

A workplace exercise intervention in China:

An outcome and process evaluation

by

Betsy Lai Woon Pun, BBA, MSc

Thesis submitted to the University of Nottingham
for the degree of Doctor of Philosophy

March 2018

Table of Contents

ABSTRACT	6
ACKNOWLEDGEMENTS.....	7
LIST OF TABLES.....	8
LIST OF FIGURES.....	10
ABBREVIATIONS	11
PREFACE.....	13
<i>Introduction of the study.....</i>	<i>13</i>
<i>Aims and focuses of this thesis</i>	<i>15</i>
<i>Structure of the thesis</i>	<i>17</i>
CHAPTER 1 BACKGROUND	21
1.1. PHYSICAL ACTIVITY DEFINITIONS	21
1.1.1. MEASURING PHYSICAL ACTIVITY	23
1.1.2. RECOMMENDED LEVELS OF PHYSICAL ACTIVITY	25
1.2. PHYSICAL ACTIVITY AND ITS EFFECTS	26
1.2.1. INDIVIDUAL LEVEL EFFECTS.....	26
1.2.1.1. <i>PHYSICAL HEALTH.....</i>	<i>26</i>
1.2.1.2. <i>PSYCHOLOGICAL, PSYCHOSOCIAL, SOCIAL HEALTH AND</i>	
<i>QUALITY OF LIFE.....</i>	<i>29</i>
1.2.2. ORGANISATIONAL LEVEL EFFECTS	30
1.2.2.1. <i>SICKNESS ABSENCE.....</i>	<i>31</i>
1.2.2.2. <i>WORK PERFORMANCE</i>	<i>32</i>
1.2.2.3. <i>JOB SATISFACTION.....</i>	<i>33</i>
1.3. PHYSICAL INACTIVITY AS A GLOBAL PUBLIC HEALTH CHALLENGE	34
1.4. STRATEGIES TO PROMOTE PHYSICAL ACTIVITY.....	36
1.5. WORKPLACE EXERCISE INTERVENTIONS.....	40
1.5.1. WORKPLACE AS A SETTING FOR HEALTH PROMOTION	40
1.5.2. WORKPLACE PHYSICAL ACTIVITY INTERVENTIONS.....	41
1.5.3. WORKPLACE EXERCISE DEFINITIONS	44
CHAPTER 2 LITERATURE REVIEW AND RATIONALE	46
2.1 LITERATURE REVIEW	46
2.1.1. ABSTRACT	47
2.1.2 METHODS	48
2.1.2.1. <i>LITERATURE SEARCH.....</i>	<i>48</i>
2.1.2.2. <i>STUDY INCLUSION AND EXCLUSION CRITERIA</i>	<i>49</i>
2.1.3. RESULTS	49
2.1.3.1. <i>SYSTEMATIC REVIEWS ON PHYSICAL ACTIVITY OUTCOMES.....</i>	<i>56</i>
2.1.3.2. <i>SYSTEMATIC REVIEWS ON WORK-RELATED OUTCOMES.....</i>	<i>64</i>

2.1.3.3. <i>EMPIRICAL STUDIES ON PHYSICAL ACTIVITY OUTCOMES</i>	72
2.1.3.4. <i>EMPIRICAL STUDIES ON SICKNESS ABSENCE LEVELS</i>	78
2.1.3.5. <i>EMPIRICAL STUDIES ON WORK PERFORMANCE</i>	89
2.1.4. DISCUSSION FROM LITERATURE REVIEW	104
2.2. CHINA AS A STUDY BASE.....	115
2.2.1. CHINESE WORKING POPULATION AND ITS HEALTH SITUATION	115
2.2.2. WORKPLACE PHYSICAL ACTIVITY INTERVENTIONS IN CHINA	117
2.2.3. HEALTH CULTURE: EAST VERSUS WEST	118
2.3. SUMMARY AND RESEARCH OBJECTIVES.....	120

CHAPTER 3 INTERVENTION DEVELOPMENT 124

3.1 BEHAVIOURAL CHANGE MODEL.....	124
3.1.1. COMMONLY USED BEHAVIOUR CHANGE MODELS.....	124
3.1.2. BEHAVIOUR CHANGE WHEEL AND CAPABILITY-OPPORTUNITY- MOTIVATION-BEHAVIOUR THEORY	129
3.1.3. COM-B ANALYSIS AND INTERVENTION FUNCTION SELECTION	130
3.1.4. SELECTING 'ACTIVE INGREDIENTS' IN THE INTERVENTION	133
3.1.5. ESTABLISHING POLICIES TO SUPPORT THE INTERVENTION DELIVERY	135
3.1.6. READINESS TO CHANGE.....	136
3.2 WORKSITE EXERCISE INTERVENTION DEVELOPMENT	138

CHAPTER 4 FEASIBILITY OF A WORKSITE EXERCISE

INTERVENTION 140

4.1. METHODS.....	140
4.1.1. DESIGN	140
4.1.2. RECRUITMENT STRATEGY	141
4.1.3. PARTICIPANTS.....	142
4.1.4. PROCEDURES.....	143
4.1.5. THE INTERVENTION PROGRAMME	144
4.1.6. THE IMPLEMENTATION OF THE INTERVENTION	146
4.1.7. MEASUREMENTS	147
4.1.7.1. <i>PHYSICAL ACTIVITY</i>	148
4.1.7.2. <i>JOB SATISFACTION</i>	148
4.1.7.3. <i>WORK PERFORMANCE (SELF-REPORT)</i>	149
4.1.7.4. <i>WORK PERFORMANCE (OBJECTIVE MEASURE)</i>	149
4.1.7.5. <i>SICKNESS ABSENCE</i>	150
4.1.7.6. <i>EXERCISE ADHERENCE</i>	150
4.1.8. PHYSICAL ACTIVITY COMPUTATION	150
4.1.9. DATA ANALYSIS	152
4.2. RESULTS	154
4.2.1. SAMPLE ANALYSIS	154
4.2.2. PHYSICAL ACTIVITY.....	156
4.2.3. WORK-RELATED OUTCOMES	158
4.3. POST-INTERVENTION FOCUS GROUPS.....	159
4.3.1. FOCUS GROUP PARTICIPANTS	159
4.3.2. FOCUS GROUP PROCEDURES	160
4.3.3. FOCUS GROUP ANALYSIS.....	163

4.3.4. FOCUS GROUP FINDINGS.....	164
4.4. DISCUSSION	170

CHAPTER 5 PILOTING INTERVENTION UNDER

RESEARCH PROCESSES 180

5.1 METHODS.....	180
5.1.1 DESIGN	180
5.1.2 PARTICIPANTS.....	181
5.1.3 MATERIALS	181
5.1.3.1 PARTICIPANT RECRUITMENT LETTER	181
5.1.3.2 ONLINE QUESTIONNAIRE SURVEY	182
5.1.3.3 FOCUS GROUP GUIDE.....	183
5.1.4. PROCEDURES	184
5.1.5. DATA ANALYSIS.....	186
5.2. RESULTS	188
5.2.1. FOCUS GROUP FINDINGS.....	188
5.2.1.1. ENABLING FACTORS	188
5.2.1.2. BARRIERS AND WAYS TO OVERCOME THEM	192
5.2.1.3. FEEDBACK ON THE SURVEY INSTRUMENT	194
5.2.2. INTERVENTION DEVELOPMENT FOR THE MAIN STUDY	194
5.3. DISCUSSION	196

CHAPTER 6 MAIN STUDY - EFFECTIVENESS OF A

WORKSITE EXERCISE INTERVENTION 205

6.1 METHODS.....	205
6.1.1. DESIGN	205
6.1.2. PARTICIPANTS.....	205
6.1.3. PROCEDURES.....	206
6.1.4. INTERVENTIONS	211
6.1.4.1. INTERVENTION GROUP.....	212
6.1.4.2. WAITLIST CONTROL GROUP.....	213
6.1.5. MEASUREMENTS	215
6.1.6. DATA ANALYSIS.....	215
6.2. RESULTS	218
6.2.1. SAMPLE ANALYSIS	218
6.2.2. PHYSICAL ACTIVITY.....	221
6.2.3. WORK-RELATED OUTCOMES	223
6.2.4. EXERCISE ADHERENCE	225
6.2.5. 12-MONTH FOLLOW UP	226
6.3. DISCUSSION	227

CHAPTER 7 PROCESS EVALUATION..... 237

7.1. METHODS.....	237
7.1.1. DESIGN	237
7.1.2. 4 DIMENSIONS OF RE-AIM FRAMEWORK	240
7.1.2.1. REACH.....	240

7.1.2.2. ADOPTION	240
7.1.2.3. IMPLEMENTATION.....	240
7.1.2.4. MAINTENANCE.....	241
7.1.3. DATA COLLECTION	244
7.1.3.1. FOCUS GROUPS WITH PARTICIPANTS AND NON-PARTICIPANTS	244
7.1.3.2. FOCUS GROUP WITH ORGANISATIONAL COMMITTEE	246
7.1.3.3. FOCUS GROUP WITH SENIOR MANAGEMENT	247
7.1.3.4. DOCUMENT REVIEW/PROJECT DOCUMENTS, FIELD NOTES AND ADMINISTRATIVE DATASETS	248
7.1.4. DATA ANALYSIS	248
7.2. RESULTS	250
7.2.1. REACH.....	250
7.2.2. ADOPTION	252
7.2.2.1. ORGANISATIONAL SUPPORT.....	252
7.2.2.2. PROGRAMME FACILITATORS	254
7.2.2.3. PROGRAMME BARRIERS.....	255
7.2.3. IMPLEMENTATION.....	257
7.2.3.1. EXERCISE ADHERENCE	258
7.2.3.2. EXERCISE ACCEPTANCE.....	259
7.2.4. MAINTENANCE.....	259
7.2.4.1. WAYS TO SUSTAIN EXERCISE BEHAVIOUR	260
7.3. DISCUSSION	261
CHAPTER 8 OVERALL DISCUSSION & CONCLUSION.....	272
8.1. SUMMARY OF STUDY FINDINGS.....	272
8.2. IMPLICATIONS	279
8.2.1. CULTURAL INSIGHTS BETWEEN EAST AND WEST	279
8.2.2. INSIGHTS ON BLUE-COLLAR AND WHITE-COLLAR WORKERS	282
8.2.3. VIABILITY OF EXERCISE BREAKS	283
8.2.4. APPLYING THEORETICAL FRAMEWORK	285
8.3. STUDY STRENGTHS AND LIMITATIONS.....	288
8.4. FUTURE RESEARCH	293
REFERENCES.....	298
APPENDIX I.....	340
APPENDIX II	345
APPENDIX III.....	346
APPENDIX IV.....	347
APPENDIX V	349
APPENDIX VI.....	351

APPENDIX VII	353
APPENDIX VIII.....	354
APPENDIX IX.....	355
APPENDIX X	356
APPENDIX XI.....	362

Abstract

The aim of this thesis was to study a worksite exercise intervention for sedentary workers in China. This involved a 10-minute Qigong exercise session twice a day. Four inter-related studies examined the development, implementation, and evaluation of this intervention. First, a feasibility study demonstrated that short exercise breaks could be integrated into the workday routine for employees with sedentary job roles. Second, a pilot study was conducted to test the intervention under research processes. Third, a waitlist controlled trial study showed increases in employees' physical activity between baseline and post-intervention for intervention (n=193) and waitlist control (n=83) participants, but no changes in work performance or sickness absence. And finally, a process evaluation using RE-AIM framework, i.e. Reach, Effectiveness, Adoption, Implementation, and Maintenance, was conducted using data from focus groups, document analysis, and exercise log reviews. In terms of reach, the exercise intervention was successfully marketed to all employees. In terms of adoption, it was considered that organisational support to implement the intervention was good. The intervention had been implemented broadly as planned. There was high exercise acceptance, but a gradual decrease in exercise adherence through the intervention period. With regard to maintenance, there was no clear management plan to sustain the programme beyond the period of study. To the author's knowledge, this research is the first to test the effectiveness of worksite exercise in China. It is recommended in future that such interventions focus further on the study of implementation and include outcomes more proximal to the intervention such as job satisfaction and work engagement.

Acknowledgements

I would firstly like to take this opportunity to thank the supervisors for this thesis, Prof Amanda Griffiths and Dr Holly Blake. Amanda and Holly provided invaluable support and guidance in the development and preparation of this thesis. I have really enjoyed working with them.

I wish to thank all the study participants who took the time and effort to participate in this study. I am also very thankful to the management and committees in the participating organisations, including Betsinda Lau, Anna Lu, and Fen Li for their assistance and commitment to the research.

Most of all, I would like to thank my family. Patrick: I would not have been able to do this without you! Your endless support and reassurance that I would be able to complete my thesis, looking after the family while I travelled frequently for work and study in the east, were much appreciated. Cliona, Bridget, and Miles: I hope that seeing me pursuing life-long learning will inspire you to keep learning. I always want you to try everything to the best of your ability and know that it's never too late to do what you love. I always count my blessings that I am the luckiest mum and wife! A special acknowledgement to my Auntie Yuen in Guangzhou and my sister, Sally, who looked after me when I travelled alone to China for this research.

Finally, this thesis is dedicated to the memory of my mentors, Prof Leung Kwok and Raymond Tsang, who were always interested in my life-long learning and constantly challenged me intellectually. They are sorely missed.

List of Tables

<i>Table 2.1</i> Systematic reviews (Total 17 articles)	51
<i>Table 2.2</i> Empirical Studies (Total 24 articles)	53
<i>Table 2.3</i> Systematic reviews on physical activity PA outcomes (9 articles)	59
<i>Table 2.4</i> Systematic reviews on work-related outcomes (10 articles).....	67
<i>Table 2.5</i> Empirical Studies on PA (6 articles).....	75
<i>Table 2.6</i> Empirical Studies on Sickness Absence (13 articles)	81
<i>Table 2.7</i> Empirical Studies on Work Performance (14 articles).....	94
<i>Figure 3.1</i> The Behaviour Change Wheel (Michie et al., 2014).....	130
<i>Table 3.1</i> Definition of selected 4 BCTs (Michie et al., 2014).....	133
<i>Table 3.2</i> Operationalisation of selected 4 BCTs	134
<i>Figure 4.1</i> Feasibility study design	140
<i>Figure 4.2</i> The work environment in factory setting.	142
<i>Figure 4.3</i> A typical exercise session in factory setting	145
<i>Figure 4.4</i> “Healthy Exercise 保健操” promotional posters	146
<i>Table 4.1</i> Samples characteristics at baseline	155
<i>Table 4.2</i> Comparison between outcomes on physical activity at baseline and post-intervention.....	156
<i>Table 4.3</i> Comparison between outcomes on physical activity (in categorical score) at baseline and at post-intervention	157

<i>Table 4.4</i> Comparison between outcomes on job satisfaction and work performance at baseline (n=72) and at post-intervention (n=38)	158
<i>Figure 5.1</i> Pilot study design	181
<i>Figure 6.1</i> Time frame of the study measurement ...	210
<i>Figure 6.2</i> Selected images on electronic consent and promotional materials for “Move It 動起來”	212
<i>Figure 6.3</i> A typical exercise session in the office setting.....	215
<i>Table 6.1</i> Sample characteristics at baseline.....	220
<i>Table 6.2</i> Comparison of physical activity levels for intervention and waitlist control group at baseline and at post-intervention	222
<i>Table 6.3</i> Comparison of physical activity levels (in categorical score) for intervention and waitlist control group at baseline and at post-intervention	223
<i>Table 6.4</i> Comparison of work performance for intervention and waitlist control group at baseline and at post-intervention	224
<i>Table 6.5</i> Comparison of sick absence for intervention and waitlist control group at baseline and at post-intervention	225
<i>Table 6.6</i> Comparison of physical activity levels for intervention and waitlist control group at baseline, post-intervention and 12 months after.....	226
<i>Table 7.1</i> Measures, data sources and data collection timeline by RE-AIM framework	243

List of Figures

<i>Figure 3.1</i> The Behaviour Change Wheel (Michie et al., 2014).....	131
<i>Figure 4.1</i> Feasibility study design	141
<i>Figure 4.2</i> The work environment in factory setting.	143
<i>Figure 4.3</i> A typical exercise session in factory setting	146
<i>Figure 4.4</i> “Healthy Exercise 保健操” promotional posters	147
<i>Figure 5.1</i> Pilot study design	182
<i>Figure 6.1</i> Time frame of the study measurement ...	211
<i>Figure 6.2</i> Selected images on electronic consent and promotional materials for “Move It 動起來”	213
<i>Figure 6.3</i> A typical exercise session in the office setting.....	216

Abbreviations

ACSM:	American College of Sports Medicine
AGM:	Assistant General Manager
AHA:	American Heart Association
AVP:	Assistant Vice Presidents
BCTs:	Behavioural change techniques
BCW:	Behaviour Change Wheel
CDC:	Centres for Disease Control and Prevention
CI:	Confidence interval
COM-B:	Capability, Opportunity, Motivation – Behaviour
CT:	Controlled trial
CVD:	Cardiovascular disease
EU:	European Commission
GPAQ:	Global Physical Activity Questionnaire
HPQ:	Health and Work Performance Questionnaire
hr:	Hours
HBM:	Health belief model
HR:	Human Resources
HRR:	Heart rate reserve
IPAQ:	International Physical Activity Questionnaire
IPAQ-L:	IPAQ long form
IPAQ-S:	IPAQ short form
IQR:	Interquartile range
IT:	Information technology
Kcal:	Kilocalories
Kilo:	Kilograms
MET:	Metabolic equivalent
M:	Mean
Mdn:	Median
min:	Minutes
NA:	Not applicable

NCD:	Non-communicable disease
NHS:	National Health Services
NIHR:	National Institute for Health Research
OECD:	Organisation for Economic Co-operation and Development
PA:	Physical activity
QC:	Quality control
RCT:	Randomised controlled trial
RE-AIM:	Reach, Effectiveness, Adoption, Implementation, Maintenance
RR:	Risk ratio
SCT:	Social cognitive theory
SD:	Standard deviation
SMEs:	Small and medium-sized enterprises
TPB:	Theory of planned behaviour
VO ₂ R:	Oxygen uptake reserve
VO ₂ max:	Maximum oxygen uptake
WAI:	Work Ability Index
WHO:	World Health Organisation
wk:	Week

Preface

Introduction of the study

Workplace physical activity interventions are increasing in popularity, with positive outcomes for employee health and wellbeing, although organisations often have real-world concerns about the approach and investment required (To, Chen, Magnussen, Costan, & To, 2013). Short exercise breaks at the workplace, incorporated within daily organisational routines, may be an economical and practically viable option (Barr-Anderson, AuYoung, Whitt-Glover, Glenn, & Yancey, 2010). This aligns with World Health Organisation (WHO) physical activity guidelines for working-age adults which recommend an accumulation of continuous 10-minute short-bouts of exercise to a minimum of 150 minutes physical activity at moderate intensity per week (WHO, 2010). Previous studies have demonstrated the feasibility of integrating exercise breaks with the work schedule as a strategy to promote worker health (Yancey, Sallis, & Bastani, 2013). This approach has rarely been studied in China.

China is the most populous country in the world with a population of 1.35 billion. Workplaces in China provide access to 74.4% of the overall population (National Bureau of Statistics of China, 2015). Research indicates the prevalence of disease associated with physical inactivity has increased dramatically in Chinese adults over recent years, with more than 200 million people suffered from hypertension and 90 million with diabetes in 2012 (Gao, Griffiths, & Chan, 2008). Developing strategies to promote physical activity is now a major health priority in China. In

addition, China has faced labour shortages in both skilled blue-collar and white-collar jobs because of increasing economic growth to both export and domestic markets (Wildau, 2015; Han & Han, 2009). Attracting and especially retaining workers, also known as the 'war for talent', has become a high priority for human resources (HR) management in China. Promoting employee well-being through corporate health initiatives may represent an important component in organisational efforts to improve employee welfare and thus labour retention (Grawitch, Gottschalk, & Munz, 2006).

There is some support for the effectiveness of workplace physical activity interventions in increasing physical activity, although interventions often have small effect sizes (Taylor, Conner, & Lawton, 2012). The relevance of physical activity interventions to work-related outcomes, such as work performance and sickness absence, is an under-researched area (Pereira, Coombes, Comans, & Johnston, 2014). Workplace physical activity interventions among Chinese workers are very sparsely investigated (Siu, Cooper, & Phillips, 2013). There is a need to study whether worksite exercise interventions might improve employees' physical activity and influence work-related outcomes in workplaces in China. In light of the preceding considerations, a comprehensive worksite exercise intervention study was designed and reported in this thesis.

Aims and focuses of this thesis

The main objective of this thesis was to examine the effects of a worksite exercise intervention on individuals (i.e. physical activity) and on work-related outcomes (i.e. work performance and sickness absence). This thesis also intends to add to a limited evidence-base on worksite exercise in China. In addition, it wishes to contribute to the workplace health literature by using a behaviour change model as a guide for intervention development and a theory-based framework to conduct process evaluation. This thesis consisted of 4 inter-related studies. The first study was a feasibility study aimed to test delivery of a worksite exercise intervention and assess potential changes in outcome measures. The study involved pre- and post-intervention comparisons of a single cohort group as well as a post-intervention focus group. Study results demonstrated the feasibility of short exercise breaks integrated into the workday routine for workers with sedentary jobs in China. Focus group findings also indicated high receptivity to the exercise intervention.

Given the affirmative results to answer the question "Can a worksite exercise intervention be delivered to employees with sedentary job roles in China?", a pilot study was used to test the study instruments and interventions among a selected group of leaders as pilot samples from the main study. Another purpose of this study was to examine enabling factors and barriers for successful delivery of an exercise intervention via focus groups. The findings indicated that worksite intervention was perceived as beneficial for health, work performance, and corporate

image. Results also showed that interruption to work and behaviour change unsustainability were identified as barriers to the intervention's success. The present study contributes ideas for tailor-made design and development of worksite exercise interventions for workers in China.

Both the feasibility and pilot studies were intended to prepare for a main study, i.e. a larger controlled trial. This study was to investigate the effects of a worksite exercise intervention on employees' physical activity and work-related outcomes. Results showed that participants in both the experimental group and waitlist control group reported higher physical activity from baseline to post-intervention, and the effect for intervention on work-related outcomes, i.e. work performance and sickness absence, was not significant. Most workplace physical activity interventions involve multiple components, such as health screening, counselling, physical exercise, and stress management training. The present study assessed the effects of worksite exercise as a single intervention component in a small office setting, and thus helps to expand the evidence base of its comparative advantage. The author believes this is the first study to test the effectiveness of a worksite exercise intervention in China.

The main study emphasised testing the effectiveness of the intervention, but the reasons why this health initiative did or did not affect significant changes in the outcome measures were not covered. To provide a comprehensive review, a process evaluation based on a RE-AIM framework (Glasgow, Vogt, & Boles, 1999) was conducted. Five dimensions of the RE-AIM framework were used: Reach;

Effectiveness; Adoption; Implementation and Maintenance. The dimension on 'Effectiveness' was examined in the main study and therefore this study focused on the other four dimensions of the RE-AIM framework. Study results demonstrated the success in reaching all workers in the participating organisation. Adoption, defined as organisational support to deliver the intervention, was good based on the post-intervention focus group findings. Implementation, i.e. intervention fidelity, was examined and results showed study interventions had been delivered broadly as planned. Results also showed that interventions were maintained moderately at organisational level. Management in the focus group did not indicate a concrete plan to maintain this corporate initiative on a long-term basis. The present study, as part of a waitlist controlled trial study, contributes to the very limited literature to report a process evaluation of a worksite exercise intervention in China.

Structure of the thesis

This thesis is structured in 8 chapters. The first chapter presents the background of this thesis with the definition of physical activity, and the ways in which it is operationalised and measured. It is followed by highlighting the significance of this study with the benefits of physical activity on individuals and organisations. Physical inactivity as a global health challenge and some common strategies to promote physical activity behaviours are reported. The last part helps to define the concept of workplace exercise from multi-cultural perspectives.

Chapter 2 describes the rationale of this work by presenting a literature review of current research on workplace exercise. At the end of the literature review, the reasons why China is chosen as a study base are presented and the research objectives are outlined. Chapter 3 introduces the most commonly used behaviour change models and why the Behaviour Change Wheel model and Capability-Opportunity-Motivation-Behaviour theory (Michie, Atkins, & West, 2014) were used in this study. Finally the study intervention design and development based on this model was presented.

Chapters 4 to 7 describe the four studies used to fulfil the research objectives, including methods, results, and discussions. Chapters four and five report a feasibility study and a pilot study respectively. Both studies aim to prepare for a larger controlled trial study. The main goal of conducting a feasibility study was to assess the feasibility in terms of appropriateness, acceptability, and workability of methods planned for a larger study (Fain, 2010). Hence, a feasibility study with the purpose of testing if a worksite exercise intervention was viable for Chinese workers in a real organisational setting was conducted and reported in chapter 4. On the other hand, the purpose of doing a pilot study was to ensure recruitment, treatment, and follow-up assessments all run smoothly. Therefore, chapter 5 describes this study and aims to test the intervention and survey instruments as well as gather feedback from the leaders via focus groups.

Chapter 6 presents the main study to test the intervention effectiveness on individual and organisational behaviour.

Study participants were mainly computer programmers. This experiment involved an experimental group (n=193) in Guangzhou and a waitlist control group (n=83) in Beijing, China. Chapter 7 describes a process evaluation of the main study based on a RE-AIM framework (Glasgow et al., 1999). Five dimensions of the RE-AIM framework were used: Reach; Effectiveness; Adoption; Implementation, and Maintenance. Each one of these dimensions provides valuable information on the factors that influenced intervention implementation. The dimension on 'Effectiveness' was presented in chapter 6. Chapter 7 describes the results on the other 4 dimensions of the RE-AIM framework.

Chapter 8 aims to summarise the study findings in a final discussion and presents an overview of the study implications, study strengths, and limitations, and provides suggestions for future research. Insight on the difference between western and eastern culture as related to workplace physical activity intervention participation is highlighted. Additionally, an insight on the difference between blue-collar workers and white-collar workers that might indicate the prevalence of Chinese cultural characteristics is also reported. Short exercise breaks as incorporated into organisational routine is concluded as a viable option for a young working population in China. Furthermore, the theoretical frameworks that were used for intervention development and process evaluation are found to be relevant and useful. The present study findings provide valuable insights on why and how Chinese employers and employees accepted and adopted this corporate health initiative.

It contributes to current workplace health research by showing major challenges associated with testing interventions in real-world organisational settings, for example, an unexpected personnel change of senior management (i.e. general manager). As a key stakeholder in the participating organisation, the general manager played a pivotal role in relation to the success of this health initiative. Moreover, study fidelity, i.e. intervention delivered as designed (Horner, Rew, & Torres, 2006) also relied on what happened during the interventions. Recommendations for future research are covered in the last part of this chapter.

Chapter 1 Background

This chapter aims to introduce the background of this thesis. In the first section, the definition of physical activity is presented, and the ways in which it is operationalised and measured is included. The second section highlights the benefits of physical activity on individuals and organisations, with the purpose of showing the significance of this study. The third section describes physical inactivity as a global health challenge, and the fourth section discusses some common strategies to promote physical activity behaviours. The last section introduces the concept of workplace exercise interventions from multi-cultural perspectives.

1.1. Physical activity definitions

The terms 'physical activity' and 'exercise' are used interchangeably in many seminal papers, albeit there are some differences in their definitions. In this thesis, physical activity covers all kinds of activity that generate energy consumption. It is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" (Caspersen, Powell, & Christerson, 1985). Exercise, on the other hand, is defined as a subset of physical activity consisting of planned, structured, and repetitive movements with the purpose of enhancing health.

Physical activity results in increased energy expenditure. The energy expenditure can be expressed as a multiple of resting metabolic rate. The Metabolic Equivalent (MET) classification has been developed based on the differences

in resting metabolic rates related to gender, age, and body composition. One MET corresponds to the mean resting oxygen intake (i.e. resting metabolic rate) in the quiet sitting position, which is roughly equivalent to 1 kcal per kilo body weight per hour, or 3.5ml oxygen per kg body weight per minute (Welk, 2002). A comprehensive list (Compendium of Physical Activities) of MET intensities has been developed for different physical activities performed (Ainsworth et al., 2011).

Physical activity can also be categorised by the purpose or domain, for example, for work, transport, leisure, domestic, sitting, or sleeping. There are 4 domains which are commonly found in health promotion literature. They are:

- Leisure Time Physical Activity
- Occupational Physical Activity
- Domestic Physical Activity
- Active Transportation Physical Activity

This thesis presents a workplace physical activity intervention in which the dose of exercise might affect outcome variables. The dose of exercise is described by the mode, frequency, duration, and intensity.

Mode is the type of activity that one performs, for example, swimming, brisk walking, cycling, running, martial arts etc.

Frequency is the amount of times an activity is performed during a specified time frame.

Duration is the total amount of time an activity is performed either continuously in one session or accumulated over a specified time in a given session.

Intensity is the rate of energy expenditure while an activity is performed.

Intensity can be described in absolute or relative terms. The common classification of the absolute intensity is light, moderate, and vigorous activity. Light physical activity is defined as requiring <3 METs; moderate physical activity as 3 - <6 METs and vigorous physical activity as ≥ 6 METs respectively (American College of Science Medicine ACSM, 2015). Relative intensity of physical activity relates to an individual's exercise capacity and therefore it varies depending on individual characteristics. Methods to quantify the relative intensity of physical activity include specifying a percentage of oxygen uptake reserve VO_{2R} , heart rate reserve HRR, oxygen consumption VO_2 , and heart rate. For example, VO_{2max} or VO_{2R} is used to express the percentage of a person's estimated maximum heart rate and it indicates the aerobic capacity of a person.

1.1.1. Measuring physical activity

Accurate and consensual operationalisation of physical activity is important because the measure is one way to assess the health status of the population. Despite the common objective to upgrade international physical activity surveillance, a recent literature review of studies in Asia-Pacific highlighted the differences within and between countries because of the variation of measures used (Macniven, Bauman, & Abouzeid, 2012). It will be useful for both research academics and practitioners to understand the optimal way to operationalise and measure physical

activity, and thus allow regional and global comparisons as well as provide the basis for effective strategies.

Physical activity as a kind of human behaviour can be measured in direct or indirect ways. Direct measures include exercise records/logs; observation; motion detectors and remote sensing systems. For example, pedometers and accelerometers are the most commonly used detectors to measure walking and running activities. Indirect ways can be 24-hour recalls, questionnaires, and heart rate monitoring. For example, the Borg scale (Borg, 1998), a self-reported measure, is commonly used in aerobics and muscle strengthening type of exercise.

The most common method used is self-reporting by questionnaires because it is relatively easy and cheap to administer. Both the International Physical Activity Questionnaire (IPAQ) and Global Physical Activity Questionnaire (GPAQ) are highly utilised in many studies. IPAQ has a long form and short form (Craig et al., 2003). The IPAQ long form IPAQ-L measures physical activity in 5 domains (work, domestic, active transportation, leisure time physical activity, and time spent sitting) whereas IPAQ short form IPAQ-S assesses the duration and intensity of physical activity in 3 dimensions: vigorous, moderate, and walking. The GPAQ measures the duration and intensity of physical activity in 3 domains: Work, transport, and leisure (Armstrong & Bull, 2006). Bull and colleagues at the WHO reported that concurrent validity estimates, including IPAQ and GPAQ, showed a moderate to strong positive relationship (range .45 - .65) (Bull, Maslin, & Armstrong, 2009). Both instruments are considered as acceptable and

valid for measuring physical activity in various settings and in many countries (e.g. Mathews, Salvo, Sarma, Thankappan, & Pratt, 2016; Mannocci et al., 2010).

1.1.2. Recommended levels of physical activity

In 2011, UK physical activity guidelines were published (Department of Health UK, 2011). Adults are recommended to do 150 minutes of moderate intensity activity in a week or 75 minutes of vigorous activities or a combination of both moderate and vigorous activities. Short bouts of 10 minutes or more can be accumulated to meet the guideline. Muscle strengthening activities (minimum two days a week) and reduction in time spent sitting were also highlighted.

The 2011 American College of Sports Medicine ACSM and American Heart Association AHA recommendations had slightly different wordings and reference indicators for time spent in physical activities. All adults aged 18 to 65 years need moderate-intensity aerobic (endurance) physical activity for a minimum of 30 minutes on five days each week or vigorous-intensity aerobic physical activity for a minimum of 20 minutes on three days each week.

The WHO's 2015 global recommendations on physical activity for health has very similar standard and aligned with the above guidelines in the UK and US. As the guidelines apply to adults in general, teenagers and people who are interested in improving physical fitness would benefit by exceeding the minimum recommended level of physical activity.

In summary, section 1 in this chapter has introduced the way in which physical activity is defined, measured, and the recommended levels provided by WHO, and reputable public health organisations in the UK and US. Section 2 will present the effects of physical activity on individuals and organisations.

1.2. Physical activity and its effects

1.2.1. Individual level effects

1.2.1.1. Physical health

There is strong evidence that physical activity has positive effects on physical health (Centres for Disease Control and Prevention, CDC, 2015). Diverse literature from the fields of epidemiology, exercise physiology, medicine, and behavioural science has continued to show compelling evidence in the past 60 years that physical activity is associated with reduced health risks, since the seminal works of Morris and colleagues in the 1950s (Morris, Heady, Raffle, & Parks, 1953) and the early works of Paffenbarger and colleagues in the 1970s (Paffenbarger, Hyde, Wing, & Hsieh, 1986). Both men and women who reported higher levels of physical activity were found to have reductions in risk of death from all causes and from specific diseases associated with physical inactivity (Fogelholm, 2010). For example, in a 24-year prospective study involving 146 pairs of healthy twin adults who had discordance for both intensity and volume of physical activity, inactive co-twins showed an increased risk of morbidity and mortality

compared with active co-twins (Waller, et al., 2010). A study result claimed that one death per year might be preventable for every 61 people among US adults who could be persuaded to walk at least 2 hours per week (Gregg, Getzoff, Caspersen, Williamson, & Narayan, 2003). In addition, an increase of energy expenditure from physical activity of 1,000-Kcal per week was associated with a mortality benefit of 20% (Myers et al., 2004).

Recent investigations have revealed even greater benefits of physical activity in improving health and preventing disease. A recent systematic review of the literature indicated that there was an inverse relation between physical activity and cardiovascular disease (CVD). A meta-analysis of prospective cohort studies from 1980 to 2010 revealed that high levels of leisure time physical activity reduced the overall risk of incident coronary heart disease and stroke by 20 to 30% (Li & Siegrist, 2012). Even short bouts of physical activity in less than 10 minutes have been found to be associated with cardiovascular health if people are encouraged to make it a regular and sustainable part of their lives (Glazer et al., 2013). Inactive women would benefit with reduced risk of CVD with as little as one hour of walking per week (Oguma & Tagawa, 2004).

In addition to the benefits on cardiovascular fitness, a review of randomised controlled trials (RCTs) concluded that physical activity reduced the incidence of type 2 diabetes in high risk persons by about 40% to 60% over 3 to 4 years (Williamson, Vinicor, Bowman, & CDC Primary Prevention Working Group, 2004). A Finnish diabetes prevention study involving 487 men and women with

impaired glucose tolerance found that individuals who had strenuous and structured leisure time physical activity were 63-65% less likely to develop diabetes (Laaksonen et al., 2005).

Several systematic reviews and meta-analytic studies have also been published with convincing epidemiological evidence that physical activity is associated with reduced risk of colon cancer (Zhang, Wu, Jiang, & Jiang, 2013; Boyle, Keegel, Bull, Heyworth, & Fristchi, 2012; Wolin, Yan, Colditz, & Lee, 2009) and breast cancer (Lahart, Metsios, Nevill, & Carmichael, 2015). Furthermore, physical activity is found to prevent osteoporosis based on evidence that it can regulate bone maintenance, strengthen muscles, improve balance and reduce the overall risk of falls and fractures (Borer, 2005). More importantly, physical activity in adolescence reduces the risk of osteoporosis in later life regardless of activity levels in adulthood (Siqueira, Facchini, Azevedo, Reichert et al., 2009).

In summary, observational studies provide convincing evidence that regular physical activity is associated with a reduced risk of premature death from any cause. In general, people who are physically active live longer and have lower morbidity (Lee et al., 2012). Furthermore, a dose-response relationship appears to exist (i.e. more activity is better than none, and more activity, up to a point, is better than less), such that greater amounts of physical activity provide additional health benefits (Sattelmair et al., 2011).

1.2.1.2. Psychological, psychosocial, social health and quality of life

A plethora of evidence has emerged linking physical activity with stress management, reduction in depressive symptoms and anxiety (Nystrom, Neely, Hassmen, & Carlbring, 2015; Chu, Koh, Moy, & Muller-Riemenschneider, 2014; Blake, Mo, Malik, & Thomas, 2009). People engaging in regular physical activity displayed more desirable health outcomes across a variety of psychological variables, for example, self-efficacy and better mood state (Pedersen et al., 2013; Penedo & Dahn, 2005). Physical activity seems to positively affect self-esteem as well as individual and social resources (McAuley et al, 2005). Physical activity may also help personal growth in qualities such as persistence, self-reliance, commitment, and motivation (Eime, Young, Harvey, Charity, & Payne, 2013). Taking part in regular exercise gives an individual a goal to aim for and they will be more likely to meet people that share a common interest. It provides an opportunity to establish friendship and develop a social network (Kaasalainen, Kasila, Villberg, Komulainen, & Poskiparta, 2013).

Enhanced quality of life is often perceived as a benefit of and motivator for physical activity by exercise professionals and researchers (Gill et al., 2013; Bite, Jeffrey, Johnson & Plotnikoff, 2007). A recent study by Anokye and his team using a sample of 5,537 adults (40-60 years old) from a representative national survey in England (Health Survey for England 2008) suggested that higher levels of physical activity are associated with better health related quality of life (Anokye et al., 2012). Another meta-analytical study found the effects of exercise interventions on the overall

quality of life (Gillison et al., 2009). However, the evidence about the relationship between domains (e.g. leisure, transport, occupational) and physical activity intensity (e.g. walking, moderate, vigorous) with specific dimensions of quality of life (e.g. physical, social, emotional) is still limited (Pucci, Reis, Rech & Hallal, 2012).

Last but not the least, the dose-response relation between exercise and psychosocial outcomes needs to be further explored (Eime et al., 2013). Existing research does not provide enough clarification of whether physical activity plays as independent or mediating variable to healthy behaviours. Future studies investigating the link between physical activity and mental health are needed for more definitive conclusions (Harvey, Hotopf, Øverland & Mykletun, 2010; Paluska & Schwenk, 2000).

This section has covered the effects of physical activity on individual physical and mental health. An important point to note is that physical activity is only one of many everyday behaviours that affect health. Other lifestyle characteristics, including nutritional habits, are also linked to some of the same aspects of health as physical activity.

1.2.2. Organisational level effects

Despite extensive literature into the effects of physical activity on health-related outcomes, not many publications appear to exist regarding the effects on work-related variables (Conn, Hafdahl, Cooper, Brown, & Lusk, 2009). An earlier review found some evidence that physical activity was related to lower absenteeism, but was

inconclusive for job satisfaction and unrelated to productivity (Proper, Koning, Van der Beek, Hildebrandt, Bosscher, & Van Mechelen, 2002). A more recent meta-analysis (Rongen, Robroek, van Lenthe, & Burdorf, 2013) revealed that workplace health promotion programmes had a small effect across work-related outcome measures (Effect size = 0.24, 95% CI = 0.14-0.34). In this section, the effects of physical activity on important organisational variables, including sickness absence, work performance, job satisfaction, and corporate image will be reviewed.

1.2.2.1. Sickness absence

The effect of physical activity on sickness absence has been investigated in numerous studies, but with conflicting results. A population-based survey was conducted in 2000-2002 among 40-60-year-old employees of Helsinki, Finland, and physical activity was found to be associated with reduced sickness absence (Lahti, Laaksonen, Lahelma, & Rahkonen, 2010). Another survey among autoworkers in Brazil indicated more evidence on the work of absenteeism as associated with physical activity at work (Fonseca, Nobre, Pronk, & Santos, 2010). While large-scale research of this kind provides considerable strength, large datasets can be costly to acquire and may not be obtainable for many researchers. Besides, other multifactorial RCTs, including physical exercise, have shown less effect on sickness absence among cleaners, construction workers, and healthcare workers (Jørgensen, Faber, Hansen, Holtermann, & Søgaard, 2011; Hengel, Blatter, van der Molen, Bongers, & van der Beek, 2013; Christensen, Overgaard, Hansen, Søgaard, & Holtermann, 2013).

Despite organisations frequently implementing workplace programmes to promote health and aiming to reduce absenteeism, the evidence to date is mixed regarding the relationship between physical activity intervention and sickness absence.

1.2.2.2. Work performance

Very few published reports address the effects of physical activity intervention on employees' productivity, partially because productivity is a complex construct to measure (Beaton et al., 2009), albeit the trend has shown increasing interests in this research area. A recent systematic review indicated that insufficient evidence was found between the effectiveness of physical activity interventions on work ability (Cloostermans, Bekkers, Uiters, & Proper, 2015). Evidence on work performance is limited and has mainly focused on physically demanding jobs. Two RCTs carried out in Denmark in recent years reported significant improvements in perceived work ability for the intervention group compared with the reference group from baseline to follow up among healthcare workers (Jakobsen et al., 2015; Andersen et al., 2015). Another RCT, also in Denmark, reported that implementation of strength training prevented deterioration of work ability among slaughterhouse workers with chronic pain exposed to forceful and repetitive tasks (Sundstrup et al., 2014). On the other hand, some exercise intervention studies in different occupational settings found little or no effect on work ability (Gram, Holtermann, Bultmann, Sjøgaard, & Søgaard, 2012; Jørgensen et al., 2011). Low adherence rates and high dropouts in the abovementioned studies

highlight the difficulties of effective implementation at the workplace. Nevertheless, to secure management support, evidence of work performance outcome is a viable way to justify the investment and demonstrate the financial benefits of intervention. The need for more research is evident.

1.2.2.3. Job satisfaction

It has been suggested that employers who provide workplace physical activity programmes are viewed as showing more concern for their employees and, as a result, enhance an employee's job satisfaction (Rhoades & Eisenberger, 2002). Employers tend to incorporate this kind of workplace initiative into part of a human resources strategy to attract and retain employees (Bachmann, 2007). A recent meta-analysis of workplace interventions showed that increasing physical activity at work might lead to increased job satisfaction (Conn et al., 2009). Moreover, significantly greater job satisfaction was found from the results in a recent questionnaire study involving a five-year workplace wellness intervention for 1,452 employees in the UK's National Health Service (Blake, Zhou, & Batt, 2013). In comparison, a recent RCT study in Denmark for laboratory technicians with 199 participants in the training group and 228 in the waitlist control group did not provide evidence for an effect of a worksite strength-training programme on job satisfaction (Roessler et al., 2013). Direct comparison of these results was not easy because the studies were in different settings, targeted different populations, and used different methodology. Job satisfaction is influenced by a diversity of contextual factors.

Studies may also demonstrate inconsistent results when the interventions are targeted toward the individual and/or toward the work environment and thus elicit different effects on job satisfaction (Brown et al., 2001).

In summary, investment in employee health by promoting workplace physical activity might generate benefits to organisations, including job satisfaction, organisation commitment, reduced sickness absence, and improved performance (Park & Steelman, 2008; Kuoppala, Lamminpaa, & Husman, 2008). Some experts suggest workplace health promotion programmes would make the company more attractive as a good employer and thus enhance its corporate image (WHO, 2016), but there is a lack of studies with scientific evidence to prove its direct relationship.

This section has covered the effects of physical activity on major organisational outcomes. Despite the potential benefits on individuals and organisations, encouraging people to make physical activity a regular and sustainable part of their lives is still a challenge. The next section will present how physical inactivity poses serious threat to global public health.

1.3. Physical inactivity as a global public health challenge

Despite strong evidence on the benefits of physical activity, the latest world figures for the levels of physical activity

have declined in the last century (Dumith, Hallah, Reis, & Kohl, 2011). The prevalence of physical inactivity in adults was 31.1%, based on the comparison data across 122 countries using International Physical Activity Questionnaire (Hallal et al., 2012). The range was 17% in South-East Asia to approximately 43% in the United States. Physical inactivity is the biggest problem in the 21st century. The prevalence of physical inactivity in all regions poses serious threat on national and international health issues. It is now one of the leading causes of death, responsible for an estimated 5.3 million globally through its effects on cardiovascular diseases, diabetes, and some cancers (Sallis & Carlson, 2015). Physical inactivity impacts on the health of millions of people in both developed and developing countries. Most of the inactivity-related deaths are in low- and middle-income countries, so it is not just a health pandemic in high-income countries. It is identified as the fourth leading risk factor of non-communicable disease, after tobacco use, unhealthy diet, and alcohol (WHO, 2015). The individual and societal health and economic costs of physical inactivity are enormous. In developed countries, it is estimated that the direct healthcare costs because of physical inactivity range from 1.5% to 3.0% of total healthcare costs and thus affects public and private healthcare systems (Oldridge, 2008). A recent study using national US data estimated that 9-11% of aggregate US health care expenditures were associated with physical inactivity (Carlson, Fulton, Pratt, Yang, & Adams, 2015).

To combat with this modifiable health risk factor, world public health organisations initiate global strategies and recommendations for effective approaches to promote

physical activity for the population. The next section presents common prevention approaches and ways to encourage behavioural change.

1.4. Strategies to promote physical activity

The WHO Global Strategy on Diet, Physical Activity and Health (2015) proposed the development of health promotion programmes focusing on physical activity. In view of the clearly established association between physical inactivity and poor health status in populations, physical activity promotion has been the target of health promotion interventions, strategy and action (Dugdill, Crone & Murphy, 2009). To translate the strategy into action, two approaches on physical activity interventions are adopted to reduce the health risk factors: Primary prevention and secondary prevention approaches. Primary prevention approach targets the population at large rather than individual risk level. Secondary prevention approach focuses on high-risk populations or those who have already developed subclinical disease (Proper & van Mechelen, 2008). In general, public health initiatives tend to prefer the primary intervention approaches because a small change at individual levels would represent a significant change in the whole population (Demaio, Nielsen, Tersbøl, Kallestrup, & Meyrowitsch, 2014).

Physical activity interventions can target behavioural change for individuals, groups, organisations, communities, environments, and policies. The interventions that target individuals and groups include individual counselling, group classes, printed materials, telephone counselling, and more

recently, websites, text messaging, and mobile apps. The United Kingdom has adopted a national public health guideline to encourage behaviour change using a variety of methods (National Institute for Health and Care Excellence, 2007). Broadly, the most commonly used interventions can be divided into 4 main categories:

- Policy
- Education or communication
- Technologies
- Resources

It is important that policy makers in both public and private sectors take steps to address the social, environmental, economic and legislative factors that affect people's health and well-being. For example, 'The Cycle to Work Scheme' was available to employees in England, legislated within the 1999 Finance Act, which introduced an annual tax exemption allowing employers to loan cycles and cyclists' safety equipment to employees as a tax-free benefit (Department for Transport, 2011).

Education approaches aim to influence behavioural change through communication campaigns, mass media and one-to-one counselling. One of the key areas for intervention is school. For example, to support the delivery of physical education in schools, the Department of Education in Northern Ireland funded the Gaelic Athletic Association and the Irish Football Association to deliver the Curriculum Sports Programme (Education and Training Inspectorate of the Department of Education, 2010). The programme was aimed to develop the physical literacy skills of pupils, as

well as teacher confidence in delivering the physical education curriculum. In 2013/2014, 577 primary schools and 39,000 pupils had attended the programme.

Technologies, such as the use of seat belts or breathalysers, are used to influence individual healthy behaviours. High tech and high touch – it would require using technologies that are relevant to target groups, as well as engage them through all kinds of social marketing media.

Attempts to promote or support behaviour change need resources. The provision of leisure centre entry, local sports club membership or training exercise professionals requires investment of time and money. Co-ordinated efforts can be achieved at different levels, ranging from local, one-to-one interactions with individuals to national campaigns. For example, the Department of Health had introduced a 'Let's Get Moving' initiative as a tool to promote physical activity in primary health care (Department of Health, 2012). It presented a systematic approach to equip health planning personnel with the knowledge to commission the intervention and support adults who were not meeting the recommended physical activity levels.

In addition to the public health guideline introduced in the United Kingdom, three approaches in promoting behavioural change are also most commonly found in current health promotion literature (US Task Force on Community Preventive Services, 2005). They are:

- Informational approaches;
- Behavioural and individually adapted approaches;

- Environmental and policy approaches.

Informational approaches make use of the communication media to promote the benefits for physical activity. For example, a social marketing mass media campaign named VERB™ Campaign in the US which ran from 2002 to 2005 (Collins & Wechsler, 2008) was deemed to be successful in promoting an active lifestyle to teenagers. Programmes using strategically placed prompts to encourage people to become physically active, for example, stair use, and were found to be more effective, although the gain was short-term (Marcus et al., 2006).

Behavioural approaches aim to influence individual behavioural change through skills practice or motivation. There is substantial evidence to support the individually tailored motivational programmes including goal setting and feedback in achieving healthy behaviours (Hillsdon, Foster, & Thorogood, 2005; Pelletier, 2009).

Environmental and policy approaches aim to provide a convenient and appealing environment for physical activity. Environmental interventions have ranged from the presence of sidewalks, parks, and trails to the design of street crossings to encourage walking for transportation. Effective interventions tend to adopt good marketing and communications strategies in addition to hardware facilities (Kahn et al., 2002).

There is growing interest among researchers to propose the environmental approaches for health promotion in settings such as the workplace. Using the workplace as a setting to

reach the mass working population has led to an expansive body of research that is dedicated to the understanding of the prevention approaches to promoting employee health (Bennie, Timperio, Dunstan, Crawford, & Salmon, 2010; Pelletier, 2009). Scheduling time for physical activity at work has been identified as one of the recommended interventions in a recent systematic review of population-based physical activity interventions for the workplace setting, in addition to comprehensive multi-behaviour programmes and fitness centres at work (Mozaffarian et al., 2012). In the next section, workplace physical activity interventions in general and workplace exercise interventions in specific will be presented.

1.5 Workplace exercise interventions

This section focuses on the concept of workplace exercise interventions: The workplace as a setting for health promotion, workplace physical activity interventions in general, and definitions of workplace exercise from multi-cultural perspectives.

1.5.1. Workplace as a setting for health promotion

The workplace has been established as one of priority settings for health promotion into the 21st century (WHO, 2016). Most of the working age population spends one-third of their lifetime in work. Therefore, it offers a convenient setting to promote individual health and well-being (Quintilliani, Sattelmair, & Sorensen, 2007). The workplace also directly influences physical, mental, economic, and social health of workers and, indirectly, the

well-being of their families and communities. Organisations not only provide existing patterns of communication and peer networks which help to facilitate employee behavioural changes, but can also develop policies to encourage employees to work and act in a healthy manner. The concept of using the workplace as a setting for health promotion is becoming increasingly important because more organisations recognise that future success in a globalising marketplace can only be achieved by a healthy, qualified, and motivated workforce (WHO, 2016).

1.5.2. Workplace physical activity interventions

Workplace physical activity intervention literature has grown substantially over the last two decades. Most of the findings in these studies suggest that support for the effects of physical activity on health outcomes is strong, but evidence supporting the effects is less robust when individual physical activity as well as work-related attitudes and behaviours are the focal outcomes. While some literature reviews demonstrate that workplace interventions have some impact for increasing individual physical activity, the evidence base for their efficacy is not overwhelmingly strong, and the effect is not sustained over time (Malik, Blake, & Suggs, 2013). Moreover, the evidence to support the effects on work-related outcomes, including sickness absence, work performance, and job satisfaction, is relatively sparse (Rongen, Robroek, van Lenthe, & Burdorf, 2013).

There are insufficient high quality research studies in this field (Proper, Singh, van Mechelen, & Chinapaw, 2011).

Most studies used self-report measures to assess the level of physical activity and some used non-validated questionnaires on work-related outcome measures, for example, job performance and absenteeism. The lack of detailed recruitment procedures and report analysis will also lead to risks of bias (Odeen et al., 2012). To encourage wider application of theory into practice, it is important for future research with good quality programmes that can be well received by the employers and employees (Marshall, 2004).

Moreover, few studies on physical activity interventions find consistent results (To, Chen, Magnussen, & To, 2013; Abraham & Graham-Rowe, 2009). These inconsistencies may reflect differences in the research design, choice of measurement tools, and the methods used to test the hypothesis. For example, Malik and colleagues (2013) revealed in their literature review that among 58 reviewed studies, there were 8 physical activity/exercise interventions, 13 counselling support interventions, and 37 health message/information interventions.

A plethora of research tends to use a diverse composite of intervention strategies and modality. Intervention modalities include multiple elements, such as walking, active travel, motivational interviewing, health checks, educational materials and led activity sessions. Compared with other sports, walking is a popular and free form of exercise that can be conveniently incorporated into everyday life. Walking at a moderate pace of 5km/hour expends sufficient energy to meet the definition of moderate intensity physical activity (Ainsworth et al.,

2000). Dugdill et al (2008) in a systematic review of physical activity intervention (across Europe, Australia, New Zealand, and Canada) found some evidence that workplace walking and workplace counselling intervention positively impacted upon physical activity behaviour (Dugdill, Brett, Hulme, McCluskey, & Long, 2008). Besides, workplace individual counselling tends to address the actual individual behaviour and meet the specific needs of the individual (Proper et al., 2003). Motivational interviewing, similar to counselling, incorporates behaviour change principles and a flexible approach to influence individual's healthy behaviour (Rollnick, Miller & Butler, 2008). A recent systematic review and meta-analysis indicated that motivational interviewing might lead to increased physical activity for people with chronic health conditions (O'Halloran et al., 2014).

The range of intervention modality is very broad and it is difficult to identify which types of interventions (e.g. counselling vs exercise intervention) or delivery formats (e.g. supervised group vs home-based) are more effective than others. Further research is needed to address the concerns raised above so that business practitioners and researchers can have a better understanding of which elements of physical activity interventions are most likely to increase efficacy within the workplace setting. Scientific-based recommendations on optimal intervention dose, including mode, intensity, frequency, and duration, will also help to facilitate effective workplace physical activity intervention development.

Previous studies in western societies have demonstrated the feasibility of integrating exercise breaks with the work schedule as a strategy to promote worker health (Yancey, Sallis, & Bastani, 2013). Evidence to assess the effect of exercise as a single intervention component will help to expand knowledge of its effectiveness at promoting workplace physical activity. The next section will introduce the definition of worksite exercise from multi-cultural perspectives.

1.5.3. Workplace exercise definitions

This section presents the concept of workplace exercise from multicultural perspectives. In the United States, “Booster Break” was proposed by a group of scholars as good company practice to improve “physical and psychological health, enhance job satisfaction and sustain or increase work productivity” (Taylor, 2005, p.462; Taylor, Horan, Pinion, & Liehr, 2014). Short exercise breaks had also been advocated by Antronette Yancey in UCLA, Los Angeles, to be integrated into organisational routines in the workplace for the benefit of employee health (Yancey, 2010). Instead of encouraging unhealthy habits such as cigarette breaks or the consumption of high fat snacks, the ‘instant recesses’ initiated by Yancey were regular 10-minute exercise breaks that incorporated music and dance into the workplace.

In the UK, a review was carried out into the literature relating to the benefits of “limbering up exercises at work” (Lock & Colford, 2005). The study referred to short, light to moderate exercises, which might include warming up

and/or stretching, performed every day and often throughout the day to loosen up or prepare the body for work. A recent study showed evidence that calisthenics led to better cardiovascular health improvements compared to standing or walking interventions (Carter, Jones, & Gladwell, 2015).

In the east, work exercise has its historical development in China. "Radio callisthenics" is a twice-daily fitness broadcast that reached its participating peak in the 1960s during the Cultural Revolution. The music and routine are set and almost every Chinese has learnt it at school (Glionna, 2010). In Japan, it is part of national culture to start every day at work with workplace gymnastics, commonly known as "radio gymnastics". Large corporations, including Toyota and Matsushita, have had well-established workplace exercise practices for many years (Fukue, 2010). A Japanese study (Watanabe, 1999) reported that conventional Japanese workplace exercise replaced with a Chinese form of exercise known as 'Qigong', found a significant reduction in low back pain from 57% to 34%. Qigong is similar to Tai Chi, which is a form of ancient Chinese martial arts aimed at improving health. This ancient approach is well recognised by Chinese and is becoming increasingly popular in Japan. Research in the worksite exercise intervention will help academics as well as practitioners to see if there is cultural relevance between the west and the east.

In the next chapter, a literature review on the effects of the workplace exercise intervention will be presented.

Chapter 2 Literature review and rationale

Chapter 2 aims to introduce the rationale of this thesis. The first section reports a literature review on the effects of the workplace exercise intervention from both systematic review-level and empirical study-level. The second section explains why China is chosen as a study base. The third section summarises the research objectives and describes how all four studies in this thesis are designed to fulfil the research objectives.

2.1 Literature review

This section describes the methods, results, and discussion of a narrative review of literature on the effects of the workplace exercise interventions on individual physical activity and major work-related outcomes, i.e. sickness absence and work performance.

A prescribed method of the systematic reviews using explicit methodology to identify, select and critically evaluate results of the studies are considered as a robust approach to increase the rigour and breath of literature reviews (Cochrane Collaboration, 2011). On the other hand, the systematic literature review approach might limit comprehensive coverage and narrative thread would be lost in the strict rule of systematic reviews (Collins & Fauser, 2005). A narrative review summarises different primary studies from which conclusions may be drawn into a holistic

interpretation contributed by the reviewers' own experience, existing theories and models (Campbell Collaboration, 2017). Results are normally of a qualitative rather than a quantitative meaning.

Hence a narrative review was used in this study because it provides a wider focus of scope for reviews and a way to comprehend the diversities and pluralities of understanding scholarly research topics (Jones, 2004). Meanwhile a structured format in presenting this literature review was adopted because this approach would benefit from applying the methodological rigour of systematic reviews, and help to improve the quality of narrative reviews (Ferrari, 2015). An infusion of the systematic review method helps to strengthen the clarity, transparency and reproducibility in the methods of reviews. The structured approach included establishing explicitly the inclusion and exclusion criteria, concentrating on specific set of studies and having objective criteria of assessing the methodological quality of the studies.

2.1.1. Abstract

The purpose of this review is to explore the effectiveness of workplace exercise interventions aimed at increasing employees' physical activity. Articles targeting workplace exercise programmes, and workplace physical activity interventions that included exercise as one of the multi-component interventions, were located through a structured database search. Information on intervention approaches, physical activity outcomes, and work-related outcomes were extracted. A total of 41 studies were identified, including 17 systematic reviews and 24 empirical

studies. The results revealed that review-level reports on the effect of workplace exercise on physical activity were inconclusive, but the empirical study-level evidence was strong. These results provide some support for the effectiveness of workplace exercise interventions on physical activity behaviours. However, workplace exercise shows little effect on sickness absence at both review-level and empirical study-level. The effect on work performance at systematic review evidence level is very limited and inconclusive at empirical study review evidence level. Future research should include more studies on work-related outcomes and on other ethnic groups.

2.1.2 Methods

2.1.2.1. *Literature search*

The research literature was accessed through an electronic database, including AMED, ASSIA, PsycINFO, PsycArticles, Medline, SportDiscuss, and Web of Science. Additional articles were identified through reference searches of recent literature review and meta-analysis. Only peer-reviewed articles and studies published from 2000-2016 were searched. This search strategy was chosen because some of the included reviews had covered articles from earlier publication dates. Moreover, most empirical studies were conducted in the recent decade. Keywords used included worksite, workplace, physical activity, exercise, intervention, employee health, fitness, well-being, performance, work ability, productivity, sick leave, and absenteeism.

2.1.2.2. Study inclusion and exclusion criteria

Key inclusion criteria were 1) workplace exercise or as one of the multi-component interventions aiming to increase physical activity; 2) intervention aimed at working adults; 3) physical activity outcome and/or, 4) work-related outcomes, i.e. work performance and sickness absence, and 5) randomised controlled trial (RCT), controlled trial (CT) and quasi-experiment for empirical study review. The author identified workplace physical activity as the inclusion criterion in the systematic reviews because no review on the effects of the worksite exercise intervention was found.

Exclusion criteria were 1) physical activity programmes at the worksite aimed at secondary preventive of specific health complaints; 2) cross-sectional studies for empirical study review; 3) physical activity interventions other than exercise classes, such as active travel or stair walking for empirical study review, because the author was interested solely on the effect of structured exercise at the workplace; 4) no access for full text.

2.1.3. Results

Forty-one papers met the inclusion criteria. They were divided into systematic reviews and empirical study reviews. Systematic reviews are exhaustive reviews of the literature using systematic search and critical evaluation from primary studies or other reviews/meta-analyses. Seventeen articles which were systematic reviews and/or meta-analyses were identified (Table 2.1).

Seven articles examined the effectiveness of workplace interventions that aimed to increase physical activity. Eight articles investigated the effectiveness associated with work-related outcomes, including sickness absence and job performance; and two papers examined the effects on both.

Table 2.1 Systematic reviews (Total 17 articles)

Author, year, country	Outcome on PA and/or work-related
Schröer et al., 2014, Germany	PA
Malik et al., 2013, United Kingdom	PA
Wong et al., 2012, Australia	PA
Osilla et al., 2012, United States	PA
Vuillemin et al., 2011 France	PA
Dugdill et al., 2008, United Kingdom	PA
Proper et al., 2003, Netherland	PA
White et al., 2016 Canada	Work-related
Pereira et al., 2015, Australia	Work-related
Odeen et al., 2013, Norway	Work-related
Rongen et al., 2013, Netherland	Work-related
Brown et al., 2011, Australia	Work-related
Kuoppala et al., 2008, Finland	Work-related
Parks & Steelman, 2008, United States	Work-related
Proper et al., 2002, Netherland	Work-related
Barr-Anderson et al., 2011, United States	PA and work-related
Conn et al., 2009, United States	PA and work-related

Abbreviations: PA – physical activity

Empirical study review is research based on actual observation or experimentation. The papers were reviewed with a narrative synthesis of findings. Twenty-four articles were identified (Table 2.2). A narrative data analysis considering study sample, interventions, comparator, length of follow-up, outcome measures, and effect was done. The methodological quality of the studies was assessed based on the recommendations from the Scottish Intercollegiate Guidelines Network (2011).

Table 2.2 Empirical Studies (Total 24 articles)

Author, year, country	Significant ↑ PA	Significant ↑ sickness absence	Significant ↑ job performance
Jakobsen et al. (2015) Denmark	NA	NA	Yes
Andersen et al. (2015)Denmark	NA	No	Yes
Mache et al. (2015) Germany	Yes	NA	NA
Sundstrup et al. (2014) Denmark	NA	NA	Yes
Ribeiro et al. (2013) Brazil	No	NA	NA
Edries et al. (2013) South Africa	No	No	NA
Strijks et al. (2013) Netherlands	NA	No	No
Palumbo et al. (2012) United States	NA	NA	Yes
Wolever et al. (2012) United States	NA	NA	No

Author, year, country	Significant ↑ PA	Significant ↑ sickness absence	Significant ↑ job performance
Gram et al. (2012) Denmark	NA	No	No
Schwarz & Hasson (2011) Sweden	NA	Yes	Yes
Amaya & Petosa (2011) United States	Yes	NA	NA
Jorgensen & et al. (2011) Denmark	NA	No	No
Tvelto & Eriksen (2009) Norway	NA	No	NA
Svensson et al. (2009) Denmark	NA	Yes	NA
Schwarz et al. (2008) Sweden	Yes	NA	NA
Blangsted et al. (2008) Denmark	NA	No	No
Galinsky et al. (2007) United States	NA	NA	No
Van Rhenen et al. (2007) Netherlands	NA	No	NA
Brox & Froystein (2005) Norway	Yes	No	NA
Nurminen et al. (2002) Finland	NA	No	Yes

Author, year, country	Significant ↑ PA	Significant ↑ sickness absence	Significant ↑ job performance
Eriksen et al. (2002) Norway	NA	No	NA
Pohjonen & Ranta (2001) Netherland	NA	NA	Yes
Smolander et al. (2000) Finland	NA	NA	No

Abbreviations: NA - Not applicable

2.1.3.1. Systematic reviews on physical activity outcomes

Seven reviews on the effectiveness of workplace physical activity interventions on physical activity behaviours and two articles aiming at exploring the impacts on physical activity and work-related outcomes were identified (Table 2.3).

One review focused on daily physical activity bouts of 10-15 minutes as primary intervention in the worksite, school, and faith-based settings (Barr-Anderson et al., 2011). Among the 11 worksite-based published articles in this review, a quarter assessed physical activity and the majority found a positive effect of the intervention on physical activity levels. The most recent article searching all systematic reviews and meta-analyses of workplace interventions from 2006 to 2012 indicated that almost all interventions achieved small but significant changes in physical activity (Schröer, Haupt, & Pieper, 2014). Proper et al. (2003) carried out the critical review of the literature qualitatively and concluded that there was a significant intervention effect on physical activity, in spite of the conclusion made on the basis of only two high quality RCT studies (Proper et al., 2003). Another paper in UK also reviewed all the papers up to April 2011 and found that 32 of the studies showed a statistically significant increase in a measure of physical activity against a control group at follow-up (Malik, Blake, & Suggs, 2013). While the findings demonstrated that workplace interventions had some impact for increasing physical activity, the evidence base for their efficacy was not overwhelmingly strong. Another

current review of all the papers from 1996 to 2007 revealed inconclusive evidence that workplace physical activity interventions had a significant effect on physical activity (Dugdill, Brettle, Hulme, McCluskey, & Long, 2008). Despite a growing evidence base that workplace physical activity interventions could positively influence physical activity behaviour, the studies were limited to mostly large companies and the public sector. Similar findings were highlighted in a US review on papers from 1969 to 2007 (Conn et al., 2009). The vast majority in the meta-analytical review were large companies with at least 750 employees. Results indicated that the physical activity mean effect size of 0.21 was larger than the effect size reported of 33 workplace studies ($r=0.17$, $d=0.35$) (from Proper et al., 2003).

Another current report on comprehensive worksite wellness programmes only covered studies in the US from 2000 to 2011 (Oscilla et al., 2012). A total of 8 out of 13 studies found improvements in physical activity (3 RCTs and 5 others). Many studies (23 out of 33) reported three or more delivery methods in one programme. The most common modality was self-help or educational materials, individual counselling, or coaching. Another review paper that covered only studies in Europe found that exercise training and active commuting appeared promising approaches to promote physical activity in the workplace (Vuillemin et al., 2011). On top of that, a current review focused on the effects of workplace physical activity interventions in men only (Wong, Gilson, Van Uffelen, & Brown, 2012) found 5 out of 13 studies with significant

increases in physical activity and concluded that the evidence on the effectiveness for men was equivocal.

To sum up from the above reports, the review-level evidence of the workplace physical activity interventions on physical activity shows inconsistency. Five reviews showed positive results (Schröer et al., 2014; Osilla et al., 2012; Barr-Anderson et al., 2011; Vuillemin et al., 2011; Proper et al., 2003). However, the conclusion from 4 other reviews (Malik et al., 2013; Dugdill et al., 2008; Conn et al., 2009; Wong et al., 2012) indicated insignificant intervention effect on physical activity behaviours. The methodological quality of most articles reviewed was weak because of poor study design including RCTs without a true control group for comparison, lack of intervention details and process data, and outcomes being assessed through non-validated self-report questionnaires. Table 2.3 shows the systematic reviews result on physical activity outcomes.

Table 2.3 Systematic reviews on physical activity PA outcomes (9 articles)

Author, year, country	Inclusion criteria	Exclusion criteria	Outcome on PA and or work-related	Results	Conclusions
Schröer et al. (2014) Germany.	Peer-reviewed systematic reviews and meta-analyses published from 2006-2012 in English or German with interventions focus on HP at work and assessed physical activity or work-related outcomes.	The intervention was not targeted at a working population.	PA	Almost all interventions achieved small but significant changes in PA. Interventions with specifically targeted goals, e.g. PA promotion based on multi-component programmes tended to be more successful.	15 reviews – 4 in USA, 3 in Australia and 8 in Europe. 2 of 4 reviews evaluating exercise interventions did not find evidence for an increased amount of PA.
Malik et al. (2013) United Kingdom.	Outcomes designed to increase energy expenditure and measure level of PA. Workplace setting. RCT, PRT or quasi-experimental. <i>Systematic review</i>	Employees with an existing health problem. Studies published in a non-English language journal.	PA	The results were inconclusive despite the studies showing some evidence that workplace PA interventions could be efficacious (32 out of 58 studies found a significant increase in PA vs. a control group). Majority of the types of intervention were health	A few studies (6 out of 58) involve an actual PA component and only 3 studies have exercise as the single component. Major limitations on study quality include PA outcome and short-term

Author, year, country	Inclusion criteria	Exclusion criteria	Outcome on PA and or work-related	Results	Conclusions
				promotion messages/information.	measurements; RCT without a true control group; multiple intervention components.
Wong et al. (2012) Australia.	RCT, quasi-experimental, CT, or pre-test-post-test design, healthy working men, workplace interventions that aimed to increase PA or improve health. <i>Systematic review</i>	Papers that combined data for men and women.	PA	5 out of 13 studies showed significant increases in PA. Evidence on workplace PA interventions for men is equivocal. These studies used multicomponent strategies.	A few studies (5 out of 13) include exercise as intervention component. The quality of the studies is generally poor. Limited to studies on men.
Osilla et al. (2012) United States.	Articles from 2000-2011 if they had a control or comparison group and evaluated outcomes of comprehensive worksite wellness programmes.	Opinion and theory articles, reviews, articles without a comparison group, non-English language and non-US articles, articles published	PA	There were 23 out of 33 studies reported 3 or more delivery methods in one programme. The most common modality was self-help or educational	Not enough evidence to show the sole effect of workplace exercise intervention. Only covered studies in US.

Author, year, country	Inclusion criteria	Exclusion criteria	Outcome on PA and or work-related	Results	Conclusions
	<i>Systematic review</i>	before 2000, and articles that focused exclusively on disease management.		materials and/or individual coaching or counselling. There were 8 out of 13 studies that found improvements in PA (3 RCT and 5 others) and 50% had follow-up <1 year.	
	English articles from 1990-2009 that studied as primary prevention the effectiveness of intervention aimed to increase physical activity of employees in the workplace and performed in Europe. <i>Systematic review</i>	Studies outside PA Europe.		Exercise training and active commuting appears promising approaches to promote physical activity or fitness in the workplace. No evidence or only inconclusive evidence for an effect on obesity.	The first to apply RE-AIM model in the context of physical activity intervention in the workplace setting. Exercise training (13 out of 33 studies, 39% with 10 aerobic fitness and muscular training. RCTs 20 out of 33 studies (61%).
Dugdill et al. (2008)	English papers from 1996-2007. Workplace	Studies took place in US or Asia. Self-	PA	Inconclusive review-level evidence that workplace PA	Dearth of evidence from independently

Author, year, country	Inclusion criteria	Exclusion criteria	Outcome on PA and or work-related	Results	Conclusions
United Kingdom.	intervention aimed at working adults to increase physical activity. Only studies from Europe, Australia, New Zealand and Canada were included. <i>Systematic review</i>	employed or unemployed adults. Dissertations.		interventions have a significance effect on PA. The volume of evidence had increased but most of the included studies were undertaken in large companies or the public sector.	assessed measurement of PA behaviour during interventions. Only 3 (out of 33) studies on workplace exercise intervention, need more evidence on the sole effect of exercise.
Proper et al. (2003) Netherlands.	English, RCT or non-RCT, 1980-2000, working population, programme aimed at enhancing levels of PA, exercise and/or fitness, outcome measures included PA, physical fitness or health. <i>Systematic review</i>	Not stated.	PA	Only 2 high quality studies demonstrated strong evidence that workplace PA programmes increased PA.	The designs of many studies were poor. Need more evidence from study of good quality.
Barr-Anderson et	Brief exercise bouts as primary intervention,	Non-English publications;	PA and news work-	Yield positive findings in PA but mixed outcomes on work-	Dearth of more research of the effect

Author, year, country	Inclusion criteria	Exclusion criteria	Outcome on PA and or work-related	Results	Conclusions
al. (2011) United States	school, worksite or faith-based; English language 1960-2010 were included. <i>Systematic review</i>	reports; non-peer-reviewed articles.	related	related performance. Many studies included brief bouts as peripheral components of more comprehensive interventions.	on work-based outcomes. All studies are on short bout exercise intervention and 12 out of 40 studies are worksite-based.
Conn et al. (2009) United States.	English papers from 1969 to 2007, primary studies of interventions to increase physical activity, aim to calculate an effect size for ≥ 3 subjects, published and unpublished studies, small-sample studies with varied designs and pre-experimental research were included. <i>Meta-analysis</i>	Chronically ill workers.	PA and work-related	PA mean effect size of 0.21 was similar to that reported by Dishman et al in 1998 (r=0.11, d=0.22). Majority were large companies (≥ 750 employees). Findings on job-related outcomes were mixed.	Dearth of evidence from SMEs and work-related outcomes. Supervised exercises were used in 27% (37 out of 138) of the studies.

Abbreviations: HP – health promotion; PRT – prospective randomised trial

2.1.3.2. Systematic reviews on work-related outcomes

Eight papers were identified regarding the effect of workplace physical activity interventions on work-related outcomes, including sickness absence and job performance. Two additional papers aimed to both increase physical activity and explore the impacts on work-related performance (Table 2.4).

A high quality synthesis of systematic reviews supporting the use of short, simple exercise for workers found consistent evidence (7 of 7) that physical activity interventions might reduce sick leave but limited positive evidence on work productivity (White, Dionne, Warje, & Koehoorn, et al., 2016). The most recent systematic review of studies from 2000-2015 regarding the impact of onsite workplace health-enhancing physical activity interventions reported consistent evidence that these programmes did not reduce levels of sick leave (Pereira, Coombes, Comans, & Johnson, 2015). Impact on worker productivity was inconsistent. Another earlier review, also in Australia, indicated similar results in that there was no association between physical activity in workplaces with absenteeism (Brown, Gilson, Burton, & Brown, 2011). In addition, two high quality reviews were from the Netherlands. One review in a meta-analytical approach on 18 RCT studies (Rongen et al., 2013) concluded that the overall effectiveness of workplace health promotion programmes was small across work-related outcome measures (Effect size=0.24, 95% CI=0.14, 0.34). In addition to studies found in Nordic countries, there were findings in other

countries, including Australia, Spain, and Brazil. Another quality review with 8 RCTs and CTs critically reviewed (Proper, Staal, Hildebrandt, van der Beek, & van Mechelen, 2002) concluded that there was a limited effect of physical activity programmes in the workplace for absenteeism, was inconclusive for job satisfaction, job stress, and employee turnover, and nil for productivity. A high quality current review from Norway (Odeen et al., 2013) focused on active workplace interventions to reduce sickness absence. Seventeen articles were included (2 with low and 15 with medium risk of bias) and nearly all the findings were from Dutch or Nordic studies. There was moderate evidence that workplace physical exercise did not reduce sickness absence.

Reviews conducted in the United States in 2009 and 2011 found mixed outcomes on work-related performance (Conn et al., 2009; Barr-Anderson et al., 2011). Although Park and Steelman (2008) concluded in their meta-analysis that participation in organisational wellness programmes were associated with decreased absenteeism and increased job satisfaction, the composition of organisational wellness programmes was wide and it is difficult to compare directly with other papers focused solely on worksite physical activity interventions. The same conclusion applies to another review conducted in Finland (Kuoppala, Lamminpaa, & Husman, 2008). Despite the result indicating moderate evidence that work health promotion lowered sickness absence (risk ratio RR, 0.78, range, 0.10 to 1.57), and exercise seemed to improve work ability (RR, 1.38, range, 1.15 to 1.66), the content of the work health promotion

can be quite diverse, including factors such as exercise, lifestyle, and ergonomics.

In summary, there is limited review-level evidence to show the effect of workplace physical activity interventions on work-related performance. Four high quality reviews showed some intervention effect on sickness absence and others found mixed outcomes. Table 2.4 shows the systematic reviews result on work-related outcomes.

Table 2.4 Systematic reviews on work-related outcomes (10 articles)

Author year country	Inclusion criteria	Exclusion criteria	Outcome on Work-related	Results	Conclusions
White et al. (2016) Canada	Only systematic reviews of interventions that occurred at the workplace and that focused on workers, with work-related outcomes. Both quantitative and qualitative literature was included, from 2000-2012.	Severe or rare physical or mental conditions, or specific occupations that would be difficult to generalise to other occupations (e.g. firefighters, police).	Work-related	Consistent evidence that PA interventions may reduce sick leave. Limited evidence on work productivity.	Simple exercise programmes (1-2 modal components) appear to provide similar benefits to those using more complex multimodal interventions.
Pereira et al. (2015) Australia	Controlled or RCTs with adults >18; onsite workplace structured HEPA programmes; during or outside of paid work time with productivity as outcome measure, from 2000-2015. <i>Systematic review</i>	Employees who were on sick leave; programmes that needed to travel offsite, or no structured programmes.	Work-related	Consistent evidence that onsite workplace HEPA programme do not reduce levels of sick leave. Inconsistent evidence of the impact on worker productivity.	The small number of studies and the lack of consistency among studies limited further analyses.
Odeen et al.	English and peer-reviewed journals,	Participants recruited	Work-	Moderate evidence	Nearly all studies were

Author year country	Inclusion criteria	Exclusion criteria	Outcome on Work-related	Results	Conclusions
(2013) Norway	employees above 18 years old, at least some part of the intervention had to have taken place at the workplace or at the initiative of the employer, quantified sickness absence and/or return to work were the only outcome measures. <i>Systematic review</i>	from clinical settings or economic claim database, qualitative reports, or estimates of future sickness absence, non-quantified reports, e.g. 'yes' or 'no' to sickness absence.	related	that graded activity reduced sickness absence. Moderate evidence that workplace physical exercise programmes did not reduce sickness absence.	Dutch or Nordic. Not enough evidence to show the sole effect of workplace exercise intervention.
Rongen et al. (2013) Netherland	Articles describe a primary preventive WHPP aimed at physical activity, nutrition, weight loss or smoking cessation, with outcomes on health, productivity at work, sickness absence or work ability, RCT, with detailed description of the study, population, intervention characteristics and outcome measures, in English. Data was required on either pre- and post-levels, levels of change per intervention and control group, or differences between intervention	Not stated	Work-related	The overall effectiveness was small across work-related outcomes measures. High quality RCTs reported lower effect sizes.	RCT (N=18) studies, in addition to Nordic, Scandinavian countries, cover other countries, including Australia, Brazil and Spain. Comprehensive review on intervention characteristics.

Author year country	Inclusion criteria	Exclusion criteria	Outcome on Work- related	Results	Conclusions
	and control.				
Brown et al. (2011) Australia	<p><i>Meta-analysis</i></p> <p>Articles included some form of PA & were conducted in workplace with job satisfaction/productivity/absenteeism as outcome measure. Both intervention and observational studies.</p> <p><i>Systematic review</i></p>	Clinical population. No association between PA & employee outcomes. Not available in hard copy or full text, not written in English.	Work-related	<p>PA & psychosocial health are positively related.</p> <p>No association between PA and absenteeism.</p>	No standard definition for presenteeism. Most studies measured absenteeism rather than productivity. Different type of PA – difficult to identify which modality is most effective. Predominantly female subjects and in US, Europe and only 1 Australian study.
Kuoppala et al. (2008) Finland	<p>Articles in 1970 to 2005 on health promotion, well-being, work ability, sick leave and disability pension.</p> <p><i>Systematic review and meta-analysis</i></p>		Work-related	<p>Moderate evidence that WHP decreased sickness absences and work ability.</p> <p>Exercise seems to increase overall well-being (RR,</p>	Not enough evidence to show the sole effect of workplace exercise intervention.

Author year country	Inclusion criteria	Exclusion criteria	Outcome on Work- related	Results	Conclusions
				1.25, range, 1.05 to 1.47) and work ability (RR, 1.38, range 1.15 to 1.66).	
Parks & Steelman (2008) United States.	Published and unpublished studies that evaluated effect of organisational wellness programmes on absenteeism and job satisfaction. <i>Meta-analysis</i>	Not stated.	Work-related	Participation in an organisational wellness programme was associated with decreased absenteeism and increased job satisfaction.	No evidence to show the sole effect of workplace exercise.
Proper et al. (2002) Netherlands.	RCT or CT, working population, worksite programme intended to increase PA or fitness and work-related outcomes, English, German and Dutch publications from 1980 to 2000. <i>Systematic review</i>	PA programmes aimed at secondary prevention of specific health complaints; comprehensive worksite HP in which PA was merely one of the many programme components.	Work-related	Limited evidence on absenteeism. Inconclusive evidence on job satisfaction and job stress. Contrasting results	Evidence on absenteeism is based on only 1 high quality RCT. Only 1 (out of 8) study involves exercise intervention. The methodological

Author year country	Inclusion criteria	Exclusion criteria	Outcome on Work-related	Results	Conclusions
Barr-Anderson et al. (2011) United States.	Brief exercise bouts as primary intervention, school, worksite or faith-based; English language 1960-2010 were included. <i>Systematic review</i>	Non-English publications; news reports; non-peer-reviewed articles.	PA and work-related.	on productivity. Yield positive findings in PA but mixed outcomes on work-related performance. Many studies included brief bouts as peripheral components	quality of the studies was poor. Nearly all worksite studies were conducted in the past decade. Dearth of more research of the effect on work-based outcomes. All studies are on short bout exercise intervention and 12 out of 40 studies are worksite-based.
Conn et al. (2009) United States.	English papers from 1969 to 2007, primary studies of interventions to increase physical activity, aim to calculate an effect size for ≥ 3 subjects, published and unpublished studies, small-sample studies with varied designs and pre-experimental research were included. <i>Meta-analysis</i>	Chronically workers.	ill PA and work-related	PA mean effect size of 0.21 was similar as reported by Dishman, 1988. Majority were big companies. Mixed Findings on job-related outcomes	Dearth of evidence from SMEs and work-related outcomes. Supervised exercise were used in 27% (37 out of 138) of the studies. Findings should be interpreted with caution.

2.1.3.3. Empirical studies on physical activity outcomes

Six articles on workplace exercise intervention programmes with physical activity as the measure outcome or one of the outcomes were identified (Table 2.5).

Study characteristics. The sample size of these studies ranged from 80 to 1,572. Four studies had 127, 129, 177, and 195 participants respectively. Two studies focused solely on female workers (Ribeiro, Martins, & Carvalho, 2013; Schwarz, Lindfors, & Lundberg, 2008) and one on blue-collar workers (Edries, Jelsmta, & Maart, 2013). The studies covered different industries, including logistics, health care, and clothing.

The mode of the workplace exercise intervention was mainly weekly exercise sessions that ranged from 1 hour to 2.5 hours. The exercise was of medium-to-high intensity. These structured exercises were aimed at enhancing cardiovascular fitness, muscle strengthening, and flexibility. A multi-component fitness programme included nutrition counselling and stress management classes in its content. Two studies offered graded exercise in the manner that duration, intensity, or repetition of the exercise would be increased progressively over time.

Two studies reported using a cognitive behaviour approach, which covered some individual goal-setting skills and behaviour change strategies (Edries et al., 2013; Amaya & Petosa, 2011). The remaining studies did not mention the

theoretical basis of the interventions. One study used pedometers to obtain objective measures while all remaining studies used self-report measures to assess the levels of physical activity. One used the Stanford Exercise Behaviours Scale, three studies reported developing their own questions to assess exercise habits, and one study did not report the outcome measure.

Effect of interventions on physical activity levels. Five studies found some improvement in physical activity behaviours following the interventions. Four of the studies showed a statistically significant increase in physical activity levels against a control group (Mache, Jensen, Linnig, Jahn, Steudtner, Ochsmann, & Preuß, 2015; Amaya & Petosa, 2011; Schwarz et al., 2008; Brox & Froystein, 2005). Mache et al. (2015) found significant improvements in physical activity especially in overweight employees. Schwarz et al. (2008) also reported that after participation in the weekly 2.5 hours of mandatory physical exercise, the group had increased its weekly physical activity from 2 to 4 hours. Brox and Froystein (2005) indicated that participants assigned to the intervention involving a weekly session of 1-hour of light exercise had increased 48% of their leisure time physical activity level. On the other hand, participants assigned to the control group only demonstrated an increase of 14%. Moreover, a pilot study in the US on an evaluation of a worksite exercise intervention showed that the treatment group reported important increases for exercise at post-test and follow-up (Amaya & Petosa, 2011). One study (Edries et al., 2013) revealed some improvements but no significant differences were found between the treatment groups. Nevertheless, a

study in Brazil (Ribeiro et al., 2013) did not find any improvements in physical activity levels.

Quality assessment. Four studies were RCTs and two were CTs. Of the 4 randomised trials, 3 were randomised at the individual level and 1 was randomised to intervention and control groups by the worksite. One study explicitly reported involving an external independent party to carry out the random allocation and concealment of treatment allocation (Brox & Froystein, 2005). Three studies clearly reported that groups were similar at baseline. Only 4 studies stated attrition rates, which were 9.2%, 17%, 30%, and 76% respectively. Two studies reported one year of follow-up after intervention; one took 6 months and two took 3 months follow-up study respectively. Table 2.5 shows the empirical reviews result on physical activity outcomes.

Table 2.5 Empirical Studies on PA (6 articles)

Author, year, country	Study (N)	sample	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ in PA
Mache et al. (2015) Germany.	Logistic company workers (1,572)		A 12-month multi-component intervention with physical activity and nutrition counselling. PA focused on body strength and exercise to ease muscle on the shoulder, back and neck. 30-60min every week/fortnight.	Controlled trial	Control group (859) had no intervention.	1 year.	Self-report PA. The regularity of PA was specified by categories: regularly (>2hr/wk); irregularly (≤1hr/wk); no or almost no.	Yes. Intervention group reported a more regular PA at follow up than at baseline ($p = .01$).
Ribeiro et al. (2013) Brazil	University hospital workers (195).	female	<ol style="list-style-type: none"> 1. Pedometer-based individual counselling (53) 2. Pedometer-based group counselling(48) 3. Aerobic training AT (47) for 3 months. AT had 24 progressive sessions from 30min, 35 to 40min on a treadmill led by experienced exercise professionals before or after work or lunch hours. 	RCT	Minimal treatment comparator (47) had booklets on information to increase physical activity.	6 months.	Objective measure of the total number of steps by pedometers.	No. Only groups using pedometers increased the total number of steps. No PA benefits for all groups at 6 months follow-up.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ in PA
Edries et al. (2013) South Africa.	Volunteer clothing manufacturing employees from 3 different companies. All blue-collar workers (80).	Employee Wellness programme comprised of a weekly 30-min health promotion talk and a 30-minute aerobic exercise class for 6 weeks. The intensity and repetitions of the exercises were gradually increased each week. Based on Cognitive Behavioural Therapy principles, participants were guided on how to set goals.	RCT	A once-off health promotion talk and various educational pamphlets.		Self-report PA was assessed by Stanford Exercise Behaviours Scale. The scale measures the amount of exercise performed during the past week.	No. There were no significant differences between the behaviour of the two groups in all 5 categories: stretching, walking, swimming, cycling and other aerobic exercise. For the experimental group, participation in all behaviours except swimming improved significantly from baseline.
Amaya & Petosa (2011) United States.	Volunteer workers as insufficient active or sedentary (127).	Worksite exercise – using a social cognitive theory, a pilot study.	Quasi-experimental separate samples pre-test post-test group design.	Comparison	1 month & 3 months post-test.	Self-report PA 7-day recall of exercise questionnaire.	Yes Intervention group reported greater increase in exercise at post-test follow-up

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ in PA
Schwarz et al. (2008) Sweden.	Volunteer health care workers (177). All female employees. 6 workplaces were paired into 3 groups for randomisation.	Physical exercise PE (62): 2.5 hours of weekly working hours were allocated to mandatory physical exercise.	RCT cluster	1. Reduced work hours WRH group (50): full-time weekly hours reduced from 40 to 37.5 hours. 2. Control group (65): no intervention.	1 year	Self-report PA was assessed by two items assessing overall PA/exercise levels and how much time spent in a week on PA/exercise.	Yes. PA increased significantly in all 3 groups. The increase in the intervention group (reduced work hours) was significantly greater than in the two comparison groups.
Brox & Froystein (2005) Norway.	Volunteer employees in nursing home for elderly (129).	The fitness programme (65) consisted of a weekly session of 1-hour light group exercise aiming to improve cardiovascular fitness, muscle strength and flexibility. In addition, classes on exercise, nutrition and stress management were covered.	RCT	Control group (64) had no intervention.		Self-report. Leisure-time PA were assessed.	Yes. Intervention group reported increase of 48% and control group reported 14% ($p < 0.01$).

2.1.3.4. Empirical studies on sickness absence levels

Thirteen articles were identified about workplace exercise intervention programmes with sickness absence as the measure outcome or one of the outcomes identified (Table 2.6).

Study characteristics. The sample size of these studies ranged from 40 to 860. Seven of the studies had samples under 250 and six of the studies had samples of more than 250. One study focused solely on female employees (Schwarz & Hasson, 2011). In addition, two organisations had mostly female workers involved in the study (>90%) whereas another two organisations had a majority of male employees (>90%). Nearly all reviewed studies (12 out of 13) were carried out in the Netherlands and Nordic countries, including Norway, Sweden, Denmark, and Finland. Half of the reviewed studies (6 out of 13) recruited participants from the health care industry and the others covered the telecom, laundry, postal office, and manufacturing industries.

The mode of the workplace exercise intervention was mainly weekly exercise sessions ranging from 30 minutes to 2.5 hours. In addition to simple stretching and aerobic exercise, some relaxation and circulation movements also aimed to reduce pain in the neck, back, and arms/shoulders. There was an Integrated Health Programme that combined physical exercise, stress management training, and ergonomic examination.

Individually-tailored exercise was also included in the intervention study for construction workers. Two studies reported using a cognitive behaviour approach, which involved education, skills acquisition, and problem-solving strategies (Edries et al., 2013; Van Rhenen et al., 2007). The remaining studies did not mention the theoretical basis of the interventions.

Eight studies used self-report measures to assess the sickness absence. Participants were asked to report the frequency and duration of sick leave in various periods, ranging from the last 30 days to a year before, during, and after the intervention. Five studies used an objective way to collect data on sickness absence, either from the company attendance records or community insurance register (Edries et al., 2013; Jorgensen et al., 2011; Van Rhenen et al., 2007; Brox & Froystein, 2005; Nurminen et al., 2002).

Effect of interventions on sickness absence. The workplace exercise intervention did not have a favourable effect on sick leave. Only 2 out of 13 studies showed significant decreased sickness absence (Schwarz & Hassan, 2011; Svensson, Strøyer, Ebbehøj, Schultz-Larsen, Marott, Mortensen, & Suadicani, 2009) and the remaining studies indicated no significant difference in the sick leave between the intervention groups and control groups (Andersen et al., 2015; Edries et al., 2013; Strijk, Proper, van Mechelen, & van der Beek, 2013; Gram, Holtermann, Bultmann, Sjøgaard, & Sjøgaard, 2012; Jørgensen, Faber, Hansen, Holtermann, & Sjøgaard, 2011; Tvelto & Eriksen, 2009; Blangsted, Sjøgaard, Hansen, Hannerz, & Sjøgaard, 2008;

van Rhenen, Blonk, Schaufeli, & van Dijk, 2007; Brox & Froystein, 2005; Nuriminen, Malmivaara, Ilmarinen, Ylostalo, et al., 2002; Eriksen et al., 2002). In fact, two studies found the number of days of sick leave increased among the study population by doing the pre- and post-study comparisons (Brox & Froystein, 2005; Tvelto & Erikson, 2009). Tvelto and Erikson reported an increase by a factor of 2.6 from the year before the intervention (mean 20, 95% CI 11-30) to a year post-intervention (mean 53, 95% CI 29-79).

Quality assessment. Twelve studies were RCTs and one was a prior RT. Of all the randomised trials, 8 were randomised at the individual level; 4 were randomised by departments/worksite and the potential participants of one prior RT were randomly assigned to one of two treatment groups, namely physical intervention or cognitive intervention. Four studies explicitly reported involving an external independent party to carry out the random allocation and concealment of treatment allocation (Strijk et al., 2013; Gram et al., 2012; Jorgensen et al., 2011; Nuriminen et al., 2002). All studies clearly reported that groups were similar at baseline on demographic or outcome variables. The use of intention-to-treat analysis was described in nine studies. Nine studies stated attrition rates, which ranged from 9.2% to 50%. Detailed reasons for the dropouts were reported in 5 studies. Six studies reported 1 year of follow up after intervention and two indicated 15 and 14 months of follow-up period respectively. The remaining studies did not provide any information about the length of follow-up. Table 2.6 shows the empirical reviews result on sickness absence outcomes.

Table 2.6 Empirical Studies on Sickness Absence (13 articles)

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ sickness absence
Andersen et al. (2015) Denmark.	Healthcare workers (54).	Tailored physical activity (TPA) supervised by physiotherapists included aerobic fitness and strength training for 50min three times a week over ten weeks during work hours.	RCT	Reference group received health guidance for 1.5 hours.		Self-report sickness absence.	No significant difference although more participants from TPA than REF reported that they had no sickness absence.
Edries et al. (2013) South Africa.	Volunteer clothing manufacturing employees from 3 different companies. All blue-collar workers (80).	Employee Wellness programme comprised of a weekly 30-minute health promotion talk and a 30-minute aerobic exercise classes for 6 weeks. The intensity and repetitions of the exercises were gradually increased each week. Based on CBT principles, participants were guided on how to set goals.	RCT	A one-off health promotion talk and various educational pamphlets.		Objective data on absenteeism was based on factory attendance registers.	No. No significant differences between the two groups. But both groups took less time off work from the beginning to the end of the study.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ sickness absence
Strijk et al. (2013) Netherlands.	Academic hospital workers aged ≥ 45 years. (730).	Vital@Work (367): Two weekly guided group sessions; one yoga and one workout + one weekly aerobic exercising + individual coach visits aimed at changing lifestyle behaviours for 6 months outside working hours.	RCT	The control group (363) received written information about a healthy lifestyle in general.	1 year.	Single-item on sick leave from the Productivity and Disease Questionnaire PRODISQ.	No. No effect was observed for sick leave.
Gram et al. (2012) Denmark.	Construction workers (67).	Individually tailored exercise group (35) 3X20 minute a week for 12 weeks to maximise oxygen uptake and muscle strength.	RCT	The control group (32) was given a 1-hour lecture on general health promotion.		Self-report by single-item: How many days of sick leave have you had in the previous 3 months?	No. No significant change from baseline to follow-up at 12 weeks.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ sickness absence
Schwarz & Hasson (2011) Sweden.	Dental health care workers (177). Volunteer female employees, 6 workplaces were paired into 3 groups for randomisation.	Physical exercise PE (62): 2.5 hours of weekly working hours were allocated to mandatory physical exercise.	RCT cluster	1. Reduced work hours WRH group (50) had weekly hours reduced from 40 to 37.5 hours. 2. Control group (n=65) had no intervention.	1 year.	Self-report sickness absence.	Yes. PE group showed significant decreased sickness absence.
Jorgensen et al. (2011) Denmark.	Cleaners (294).	Physical co-ordination training PCT (120): 20 minute a @wk intensively for 3 months and less intensive for 9 months.	RCT	1. CBT (121). 2. The control group (122) with health check only.	1 year.	Sickness absence data from the managers' records.	No. No significant difference between the groups at baseline or at follow-up.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ sickness absence
Tvelto & Eriksen (2009) Norway.	A convenience sample of nurses & nursing aids (40) in homes for old people.	Intervention group (19) participated in the Integrated Health Programme IHP for 9 months. It was composed of: (1) Physical exercise 1 hour X 3 X 1 week, (2) Health information/ stress management training 1 hour X 1 week, (3) ergonomic examination, with (2)+(3)=15 hours aimed to improve physical capacity, muscle strength and flexibility.	RCT	The control group (21) were offered the programme after the intervention was finished.		Self-report sickness absence from the year before the start of the intervention, the intervention year, and the year after the intervention were supplied by the employer.	No. No significant differences between the intervention and control groups.
Svensson et al. (2009) Denmark.	Nursing students (766).	Intervention group (389 in 20 clusters) received a multidimensional prevention programme combining physical training (48 hours), patient transfer technique (20 hours) and stress management (22 hours). Physical training had warm-up (15 minutes) with back muscle extension and flexion endurance plus expected and unexpected trunk loading and balance.	Cluster RCT	The control group (279 in 18 clusters) no intervention.	14 months.	Self-report sickness absence by a single item: How many days during the last 12 months have you been absent due to your own sickness?	Yes. The intervention group had significantly less sickness absence.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ sickness absence
Blangsted et al. (2008) Denmark	Office workers (549).	<p>1. Specific resistance training SRT (180) consisted of exercises specifically for the muscles in the shoulder and neck. 3X20minutes a @wk, supervised by an experienced instructor.</p> <p>2. All-round physical exercise APE (187) consisted of a mixture of activities including Nordic walking and running, aerobic fitness and general strength, cycling to work.</p>	RCT	The control group (182) were offered health talks.	1 year.	Self-report questionnaire in addition to the records in the personnel file.	No. No significant changes in the sick leave scores.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ sickness absence
Van Rhenen et al. (2007) Netherlands	Volunteer employees (242) working in various jobs in a telecom company.	Based on Meichenbaum's 'stress inoculation training' (SIT) as guiding principle for both interventions: (1) Cognitive focused programme comprised three stages – education; skills acquisition and problem-solving strategies; application. (2) Physical intervention sessions consisted of an introduction, a warming-up and physical exercise, relaxation and a homework assignment. Both (1) and (2) took 4 x 1 hour x 8 weeks during working hours.	Priori RT		1 year.	Objective. Sickness absence data were provided by the employer, analysed with respect to spells of sickness (frequency, incidence rate), days (length, duration), and time between intervention and first subsequent absent spell.	No. No effect. But, as compared with physical exercise, the cognitive intervention reduced the period between the intervention and the first recurrence of a sick leave period with 144 days (marginal significant).

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ sickness absence
Brox & Froystein (2005) Norway.	Volunteer employees in nursing home for elderly (129).	The fitness programme (65) consisted of a weekly session of 1-hour light group exercise aiming to improve cardiovascular fitness, muscle strength and flexibility. In addition, classes on exercise, nutrition and stress management were covered.	RCT	The control group (64) had no intervention.		Objective Sickness absence data was collected from the community insurance register.	No. No significant difference between the intervention and control groups. Sickness absence increased in both groups.
Nuriminen et al. (2002) Finland.	Volunteer laundry workers (260) in 11 production units in various Finnish cities.	Intervention Group (133) had Exercise 60 minutes a wk for 8 months + exercise prescription involved muscle strengthening, cardiovascular exercise and stretching.	RCT Individual	The control group (127) had no intervention.	15 months.	Objective. Data on sick leave was obtained from the employer.	No. No statistically significant difference between the two groups.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ sickness absence
Eriksen et al. (2002) Norway	Volunteer postal workers (860) from 29 post offices and 2 postal terminals.	(1) PE (n=189) 1hx2@weekx12weeks=24hrs, (2) IHP (n=165), (3) SMT (n=162) Both (2) + (3) had 2hx1@weekx12=24hrs PE, conducted by authorised instructors, was a standardised aerobic dancing programmes aiming to improve physical capacity, muscle strength and flexibility. It also helped to reduce pain in the neck, back and arm/shoulder by relaxation and circulation exercises. The IHP consisted of 3 components: PE, SMT, & ergonomic examination. SMT was based on cognitive-behavioural approach with role-play and video recordings	RCT	The control group (344) had no intervention.	1 year.	Self-report sick leave data was collected. Participants were asked to report the frequency and duration of sick leave during the last 30 days.	No. No significant effect of interventions. However, strong and specific positive effects were found for the particular goal areas defined for each intervention.

2.1.3.5. Empirical studies on work performance

Empirical Studies - Work Performance

Fourteen articles on workplace exercise intervention programmes with work performance as the measure outcome or one of the outcomes were identified (Table 2.7).

Study characteristics. The sample size of these studies ranged from 11 to 730. Seven studies had less than 100 participants. Five studies had sample sizes ranging from 177 to 294. Two studies had 549 and 730 participants respectively. Three of the studies focused solely on female workers (Jakobsen et al., 2015; Schwarz & Hasson, 2011; Pohjonen & Ranta, 2001), while one had a majority of female workers (>90%). One study targeted for male construction workers (Gram et al., 2012). A majority of studies (11 out of 14) were carried out in Scandinavian countries, including Denmark (n=6); Finland (n=3); Netherlands (n=1) and Sweden (n=1). The rest of the studies were implemented in the United States. Six studies recruited participants from the health care industry and the others covered a wide range of industries including laundry, slaughter house, construction, and government Inland Revenue services.

The mode of the workplace exercise intervention was weekly exercise sessions ranging from short stretching exercise breaks of 2 minutes to 2.5 hours, from once a week to five times a week. The exercise included mostly aerobic fitness, and resistance and strength training for shoulder, arm, and hand muscles. Two studies provided

individually-tailored physical training supervised by professional physiotherapists. One study focused on Tai Chi movements and two studies included yoga exercise in the interventions. Only one study reported using a cognitive behaviour approach, for example, problem-solving, self-management approach to increase physical activity. The remaining studies did not mention the theoretical basis of the interventions.

Nearly all studies (13 out of 14) used self-report measures to assess the levels of performance. Job performance was mostly self-assessed by the participants with the Work Ability Index (predominantly in Nordic countries) or Work Limitation Questionnaire (mainly in the United States). Two studies used objective measures on productivity. Dental health care employees were appraised by the number of patients treated (Schwarz & Hasson, 2011) while the data-entry operators was assessed through three electronically recorded measures provided by the service centres, including the 'duration of terminal per day', 'total documents entered per day' and 'keystrokes per hour' (Galinsky et al., 2007).

Effect of interventions on job performance. The workplace exercise intervention showed inconclusive results on job performance. Seven studies indicated a positive effect in job performance following the workplace exercise interventions (Jakobsen et al., 2015; Andersen et al., 2015; Sundstrup et al., 2014; Palumbo, Wu, McRae, Rambur, & McIntosh, 2012; Schwarz & Hasson, 2011; Nuriminen et al., 2002; Pohjonen & Ranta, 2001). Two empirical studies carried out in Denmark among healthcare workers in recent

years reported significant improvements in perceived work ability for the intervention group compared with the reference group from baseline to follow up (Jakobsen et al., 2015; Andersen et al., 2015). Another recent study in Denmark, but targeted for slaughterhouse workers (Sundstrup et al., 2014), also found significant group x time interaction with moderate effect size (Cohen's $d = -0.52$). An RCT pilot study in the United States on implementing a Tai Chi exercise intervention for older nurses aged ≥ 49 showed a 3% increase in work productivity compared to the control group (Palumbo et al., 2012). In addition, Schwarz and Hasson (2011) in Sweden found that the physical exercise intervention group showed significant increases in self-rated productivity, but the objective measure (i.e. number of patients served) did not show the same result.

Two studies in Finland found positive results in work performance because of the workplace exercise intervention. A study for laundry workers (Nurminen et al., 2002), according to a dichotomised work ability index, at 12 months, workers with 'good' or 'excellent' work ability increased more in the intervention group than in the control group, but there were no statistically significant differences between the two groups. The result suggested that using a single-component exercise intervention once a week at worksites improved the perceived work ability only slightly. Pohjonen and Ranta had the intervention group participate in 9 months of a supervised exercise intervention (Pohjonen & Ranta, 2001). Work ability was assessed at the baseline, and after 1- and 5-year periods of follow-up. The effect was significant.

Nevertheless, 7 studies (Strijk et al., 2013; Wolever et al., 2012; Gram et al., 2012; Jørgensen et al., 2011; Blangsted et al., 2008; Galinsky et al., 2007; Smolander, Blair, & Kohl, 2000) did not find evidence on intervention effects in work performance.

Quality assessment. Thirteen studies were RCTs and one was CT. Of all the randomised trials, 10 were randomised at the individual level and 3 were randomised by worksites or departments. Only 2 studies reported concealment of randomisation treatment allocation (Gram et al., 2012; Nuriminen et al., 2002). Eleven studies explicitly reported that groups were similar at baseline on demographic or outcome variables. Ten studies mentioned the use of intention-to-treat analysis. Nine studies reported attrition rates ranging from 9% to 54%.

Jørgensen and his team (2011) stated that the RCT study for the cleaners in the regions of Zealand, Denmark, suffered from a high drop-out rate (43 drop-outs from 95) and a low adherence rate resulting in a lower dose of the interventions that might be needed for attaining significant effects. The study on home care workers in the Social Services Department of the City of Helsinki, Finland, reported that 54% of the participants dropped out during the 5-year follow up period (Pohjonen & Ranta, 2001). The authors also found that in the intervention group, the distribution of the baseline values of work ability index among the dropouts was statistically different from that among those who took part in the 5-year measurements. Detailed reasons for the dropouts were reported in 4

studies (Strijk et al., 2013; Schwarz & Hasson, 2011; Jørgensen et al., 2011; Pohjonen & Ranta, 2001). The most common reasons for dropouts included change in jobs, lack of time and long-term sick leave. Seven studies reported length of follow up studies ranging from 12 months to 5 years. Table 2.7 shows the empirical reviews result on work performance outcomes.

Table 2.7 Empirical Studies on Work Performance (14 articles)

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ job performance
Jakobsen et al. (2015) Denmark	Female healthcare workers with history of self-reported work-related musculoskeletal pain in back or upper body (200).	Workplace physical exercise (WORK) during working hours for 5x10 minutes per week over 10 weeks and up to 5 group-based coaching sessions on motivation for regular physical exercise.	Cluster RCT	Home-based physical exercise (HOME) during leisure time for 5x10 minutes per week.		Self-report perceived work ability based on Work Ability Index (WAI) score.	Yes. Significant groupxtime interaction was observed ($p < 0.05$). WAI at follow up was 1.1 higher in WORK compared with HOME with a small effect size (Cohen'd-0.24).

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ job performance
Andersen et al. (2015) Denmark.	Healthcare workers (54).	Tailored physical activity (TPA) supervised by physiotherapists included aerobic fitness and strength training for 50 minutes three times a week over ten weeks during work hours.	Parallel, randomised, single-blind controlled trial.	Reference group received health guidance for 1.5 hours from a trained supervisor.		Self-report perceived work ability based on WHO-HPQ.	Yes. Significant improvement in work ability for TPA compared with REF from baseline to follow-up ($p \leq 0.01$).
Sundstrup et al. (2014) Denmark.	Slaughterhouse workers with upper limb chronic pain and work disability (66).	10 weeks of strength training for the shoulder, arm and hand muscles (3 times per week, 10 minutes per session).	RCT	Usual care control group with ergonomic training.		Self-report perceived work ability based on Work ability index (WAI) score.	Yes. Significant groupxtime interaction was observed ($p < 0.05$) with moderate effect size (Cohen'd-0.52)

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ job performance
Strijk et al. (2013) Netherlands.	Academic hospital workers aged ≥ 45 yrs. (730).	Vital@Work (367): Two weekly guided group sessions: One yoga and one workout plus one weekly aerobic exercising plus individual coach visits aimed at changing lifestyle behaviours for 6 months outside working hours.	RCT	The control group (363) received written information about a healthy lifestyle in general.	1 year.	Self-report perceived work ability based on WHO-HPQ.	No. No significant difference in productivity between the intervention and control group.
Wolever et al. (2012) United States.	National insurance carrier workers (239).	Yoga class for 12 weeks (12 hours).	RCT study	pilot 1. Mindfulness on-line. 2. Mindfulness in person 12 weeks (14 hours).		Self-report perceived work productivity based on Work Limitation Questionnaire.	No. No groupxtime interaction effect

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ job performance
Palumbo et al. (2012) United States.	Older nurses (11).	A 15-week Tai Chi class lasting for 45 minutes, once a week and practice for 10 minutes a day for 4 days a week.	RCT pilot study	The control group (5) had no intervention.		Self-report on work productivity and absenteeism based on Work Limitation Questionnaire	Yes. 3% increase in productivity. Tai Chi group had no unscheduled time off vs control group lost 49 hours.
Gram et al. (2012) Denmark.	Construction workers (67).	Individually tailored exercise group (35) 3x20minutes a week for 12 weeks to maximise oxygen uptake and muscle strength.	RCT	The control group (32) was given a 1 hour lecture on general health promotion.		Self-report perceived work ability based on Work Ability Index (WAI) score. Productivity was measured by a single question.	No. No significant change was found in work ability and productivity.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ job performance
Schwarz & Hasson (2011) Sweden	Dental health care workers (177) Volunteer female employees, 6 workplaces were paired into 3 groups for randomisation	Physical exercise PE (62): 2.5 hr. of weekly working hours were allocated to mandatory physical exercise	RCT cluster	1. Reduced work hours WRH group (50) had full-time weekly hours reduced from 40 to 37.5 hr. 2. Control group (n=65) had no intervention	1 year	Self-report productivity and objective data from the workplaces' production levels (number of patients) were examined.	Yes. Number of treated patients increased in all conditions. The RWH group showed greatest increase in this measure, PE group showed significant increase in self-rated productivity.
Jorgensen et al. (2011) Denmark.	Cleaners (294).	Physical co-ordination training PCT (120): 20 minutes a week intensively for 3 months and less intensive for 9 months.	RCT	1. CBT (121). 2. The control group (122) with health check only.	1 year	Self-report Questionnaire on work ability.	No. No difference from baseline to follow-up between the groups.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ job performance
Blangsted et al. (2008) Denmark.	Office workers (549).	Specific resistance training SRT (180) consisted of exercises for muscles in the shoulder and neck. 3 x 20minutes a week supervised by an instructor. All-round physical exercise APE (187) consisted of Nordic walking and running, aerobic fitness and general strength, cycling to work.	RCT	The control group (182) were offered health talks.	1 year.	Self-reported questionnaire in work ability index.	No. No significant difference between the types of intervention.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ job performance
Galinsky et al. (2007) United States.	Volunteer participants (51) were seasonal employees hired on a temporary basis to process income tax forms at the Cincinnati, IRS Service Centre.	(1) Rest Break Schedules: 15 minutes in the middle of first half of the shift and 15 minutes in the middle of second half plus supplementary break, 5 minute break for each hour of the shift (2) Stretching Exercises: brief stretches targeting the neck, shoulders, back, and upper extremities, and required < 2 minutes to perform.	RCT	Mixed design with stretching exercise condition as a between subject factor and rest break schedule as a within subject factor.		Objective data from three electronically recorded measures of data-entry activity were provided by the service centre. They included "duration on terminal" per day, "total documents entered per day," and "keystrokes per hour".	No significant effects of exercise condition on data entry performance occurred. Yes for data-entry speed because of the rest break schedule. Although participants spent an average of 19 fewer minutes per day entering data, their mean rate of data entry under the supplementary break schedule keystrokes/hour was significantly faster than their rate under the conventional rest break ($p < 0.0002$).

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ job performance
Nurminen et al. (2002) Finland.	Volunteer laundry workers (260) in 11 production units in various Finnish cities.	Intervention Group (133) had exercise 60 minutes a week for 8 months plus exercise prescription. The structured exercise involved muscle strengthening, cardiovascular exercise, and stretching.	RCT Individual	The control group (127) had no intervention.	15 months	Self-report work ability was assessed using 2 questionnaires. (1) Work ability index with 7 items. (2) modified version of Nordic questionnaire with 5 items.	Yes. The proportion of workers with "good" or "excellent" work ability has increased more in the intervention group than in the control group.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ job performance
Pohjonen & Ranta (2001) Finland.	Female home care workers (87) from Social Services Department of the City of Helsinki.	Supervised exercise 1 hour twice a week for 9 months. Participants were divided into 2 fitness groups based on their initial fitness level. (1) Aerobic fitness training. (2) Muscular fitness training. In addition, the programme included 2 hours orientation and motivation session; lectures on leisure time PA, weight control, nutrition.	CT	The control group (37) had no intervention. Participants received only individual feedback from the baseline fitness tests, but no instruction for training.	1 year and 5 years.	Self-report - work ability was assessed by the Work Ability Index.	Yes. In the control group the decline of the work ability index was about three times faster than in the intervention group during the 5-year period.

Author, year, country	Study sample (N)	Intervention	Study design	Comparator	Length of follow-up	Outcome measures	Significant ↑ job performance
Smolander et al. (2000) Finland	Sedentary workers (80) participated in Project Active.	(1) Structured exercise three times a week and gradually to five times a week. (2) Lifestyle once a week in groups of 10 to 13 for the first 16 weeks and then every other week. The programme used cognitive behaviour change strategies. Intervention lasted for 6 months.	RCT Individual	N/A	18 months.	Self-report - work ability was assessed by the Work Ability Index.	No. At baseline the average WAI was 44.2 +/- 4.0 Work ability remained unchanged at 6 months (44.4 +/- 3.9) and at 24 months (44.2 +/- 3.1).

2.1.4. Discussion from literature review

The aim of chapter 2 section 1 was to review the literature on workplace exercise interventions that reported on physical activity outcomes, as well as sickness absence and job performance. To the author's knowledge, this is the first literature review to provide a comprehensive overview of research pertaining to workplace exercise interventions. Results, by reviewing 17 systematic reviews and meta-analysis, suggest that at review-level, evidence of the workplace physical activity interventions on physical activity is inconclusive, and the effect across work-related outcomes is limited. On the other hand, the narrative synthesis result of 24 empirical studies indicates strong evidence of the effectiveness of workplace exercise on physical activity, very limited intervention effects on the reduced sickness absence, and inconclusive effects on improved job performance.

Intervention characteristics

Many intervention strategies used in the systematic review papers have multi-component approaches and target a range of health behaviours. Workplace exercise is often conducted as a peripheral component of more comprehensive interventions and, consequently, to evaluate the sole effect of worksite exercise as a single component in the intervention description is virtually impossible. On the other hand, reviews on the empirical studies that were focused on worksite exercise interventions produce more reliable results.

In terms of the exercise intervention mode, most were weekly exercise sessions that ranged from 30 minutes to 2.5 hours. The exercise mostly included simple aerobic steps, dancing,

and light resistance/strength training that aimed to enhance cardiovascular fitness, muscle strengthening, and flexibility. A few studies provided Tai Chi and yoga exercise or individually tailored exercise prescribed by professionals, which was comprised mainly of relaxation and circulation movements which aimed to reduce pain in the neck, back, and arms/shoulders. A key concern with the intervention characteristics was that a bulk of empirical research tends to use a diverse composite of exercise dose and modality. It is unlikely that a comparison of the intervention efficacy across studies could be reliably carried out.

Impact on physical activity levels. The review-level evidence of the workplace exercise intervention programme on physical activity outcome is inconclusive, but the evidence base for its efficacy in the empirical study reviews is strong. Despite the fact that systematic review is supposed to synthesise research done at empirical level, inconsistent results at systematic review evidence level and at the empirical study review evidence level might be because of the specificity of workplace physical activity in the inclusion criteria. The present review at the systematic review level has covered many intervention strategies using multi-component approaches, but reviews on the empirical studies were focused solely on worksite exercise interventions. Emerging evidence certainly indicates the positive intervention effect on physical activity behaviours, especially in the past decade.

Only a few published reports addressed the effects of the exercise programme on employees' physical activity and most study settings were in large organisations and the public sector. It is unclear from the reviewed studies whether

particular modes (short-bout exercise breaks or structured graded exercise; weekly or daily) or delivery formats (face-to-face vs. internet, at the workstation vs. fitness centre, individual vs. group) are more effective than others. Very few studies mentioned the use of a cognitive behavioural approach to influence people's exercise pattern. It may be that some studies practised these behavioural change strategies without referring to the theory/model explicitly in the intervention descriptions. With very limited evidence, it is difficult to show if theory-based intervention is more effective than others. Nevertheless, evidence to support the effect of workplace exercise interventions on physical activity outcomes is promising.

Impact on sickness absence. There is limited review-level evidence to show the effect of workplace exercise interventions on sickness absence. Findings from an empirical study review showed that the exercise intervention at the worksite did not have a favourable effect on sick leave. Nearly all studies indicated no significant difference in the sickness absence between the intervention groups and control groups. While one study showed a statistically significant reduction in sickness for the entire sample group, another study indicated contrasting results with the number of sick days increasing in the study population from a year before the intervention to a year post-intervention.

It is generally assumed that the absenteeism rate will drop with increased physical activity, because exercise enhances fitness and leads to improved health. In addition, healthier employees are less likely to be absent because of illness. But the assumption relates to absences because of medical

reasons. Employees might take leave away from work for more reasons than just health problems. Therefore absenteeism is a dynamic temporal behaviour, and employees attempt to derive the most benefit from their allocation of work and non-work time (Nicholson & Johns, 1985). Overall, the results of the current literature review suggest limited evidence on the effectiveness of the workplace exercise programme on sickness absence outcomes.

Impact on job performance. Review-level evidence provides little support for the effect of workplace exercise interventions on an employee's job performance. The results were nil, small, and mixed. Despite some positive results from the empirical studies review, nearly all the studies covered in the current review used self-report performance measures. In a single study, the researchers found the physical exercise intervention group showed significant increases in self-rated productivity, but the objective measure did not show the same result. These contradictory findings suggest that the perception of workers with regards to their work performance does not necessarily reflect what they actually perform. Another plausible explanation for this contradiction may be that the employees involved in the studies feel better, and this affects their experience in overall work performance.

The employment structure has changed rapidly in the modern era. Many people are employed in the service industry, providing intangible services in person or through technology. The reason why most studies on the effect of workplace intervention programme used subjective comments, rather than objective measures, to determine improvements in productivity is understandable. Firstly, it is difficult to

operationalise this outcome measure in measurable terms. It is not straightforward to assess the productivity of a service provider, for example, a receptionist or an engineer (Gummesson, 1998). Secondly, the subjective response can also reflect the employee's attitude towards their performance. Highly-rated performance might show confidence and self-esteem (Alias & Mohd Hafir, 2009; Baumeister, Campbell, Krueger, & Vohs, 2003). The essential aspect is to collect longitudinal data and find out if the result can be maintained for a long-term period.

In spite of the increasing number of published articles on work-related variables as outcome measures, predominantly in the Netherlands and Nordic countries in the past decade, evidence of workplace exercise interventions on job performance is inconclusive.

Methodological quality of studies

Workplace health literature continues to expand, but there are still insufficient high quality research studies in this field. The RCT studies, as identified in the present empirical study review, were mostly on female workers and physically demanding work. More evidence on different gender and occupations will provide stronger generalisability of the study results. It is expected that white-collar workers, performing mainly sedentary work with limited physical activities during work, show greater interest for participation in workplace health promotion programmes than blue-collar workers (Leslie, Braun, Novotny, & Mokuau, 2013).

The majority of the RCTs screened for inclusion on work-related outcomes were from Scandinavian countries. These

countries are the largest contributors to research on this area, partly because the employers and the state carry the major part of sickness absence costs. A similar situation also applies in the United States, although there is insufficient study reporting from the US. The present review of findings suggests that there is increasing interest in this research area in other parts of the world, such as Germany and South Africa. Evidence about the relevance of western workplace health initiatives on different cultures will help to explore impacts of result findings in wider application.

Nearly all the papers listed in the empirical study reviews used self-report measures. Many of them used non-validated questionnaires to assess the level of physical activity and job performance. Only five studies solicited objective data on sickness absence via company records and two studies managed to gather objective measurement on individual productivity. Not only would the results be more prone to response bias, comparisons of strategy efficacy across various interventions are deemed to be problematic (Malik et al., 2013).

Recruitment of participants is primarily on a voluntary basis. It is more likely that employees involved in the intervention studies are motivated or already quite active in physical level. For this reason, many RCT studies covered in this review included a control group with no intervention or minimal intervention for comparison with the intervention groups to minimise the statistical bias. The feasibility of assigning participants randomly into different treatment groups in the real workplace setting looks promising. A few studies involved independent parties and concealed treatment allocation. Even

so, this review found that participant characteristics in the treatment groups were not always similar at baseline. This will subsequently lead to a risk of bias in the intervention outcomes, in spite of the fact that those differences at baseline can be accounted for during statistical analysis. However, the lack of detailed recruitment procedures and report analysis makes it harder to identify the problems.

This review shows that more than half of the studies included had longitudinal intervention follow-up ranging from 1 year to 5 years. The rates of attrition reported ranged from 10% to 54%. A few studies had detailed reports on the progressive drop-out rates at different follow-up periods, with detailed reasons for the drop-outs. Although the methodological quality of the empirical studies does show some improvements, there are, equally, a volume of studies in which no reporting details on the use of randomisation process, intention-to-treat, or attrition rates have been observed. It is unclear whether some of these studies did in fact conduct proper evaluation, but failed to report in details in their publication, or there is a possibility that the findings may be subject to selection or procedural bias.

Recommendations for future research

Evidence to assess the effect of exercise as a single component will help to expand knowledge of its effectiveness and comparative advantage at promoting workplace physical activity. There is a dearth of research work on the intervention effects on physical activity outcome and work-related outcomes. The literature has grown substantially over the previous two decades, and the vast majority of studies tend to focus on physical and psychological health as the points of

interest. Research examining the relationship between workplace exercise interventions and more organisationally-based outcomes is less common. The scarcity of research in this area is somewhat surprising given that the intervention efficacy on work-related variables would be more relevant to the operational imperatives of managers than more distant health indicators, such as cardiovascular disease. Future research should include the work-related outcome variables – such as job satisfaction or performance – that have a more immediate effect on organisational functioning.

A large body of research on workplace physical activity intervention programmes are conducted in the west, where employee wellness has been made into a corporate priority, especially in Scandinavian countries. Studies on corporate health programmes in Asia, for example, in China, are very rare (e.g. Siu, Cooper, & Phillips, 2013; Yuan et al., 2009). Evidence on the relevance of western health theories on Chinese culture will contribute to promoting the health of the global working population. The cultural relevance of western studies to other ethnic groups, such as Chinese, would need further exploration.

Independently assessed measurements of physical activity behaviour during interventions, for example, exercise logs, and objective measures of PA (pedometers or accelerometers), will allow more accurate data and comparisons of strategy efficacy across different interventions. Future research should endeavour to include only valid and reliable self-report measures and, where possible, use these in conjunction with the objective measures. Greater clarity and detailed reporting are required regarding research design. Future research

should also seek to evaluate both the short-term and long-term effects of intervention.

More efforts should be made to include small- and medium-sized enterprises (SMEs) since they cover a majority of businesses and a high percentage of the working population. According to the European Commission, there were more than 23 million SMEs in the EU, representing 99% of all European business (European Commission, Enterprise and Industry, 2013). In 2006, the US Census Bureau estimated a total of 6 million firms based in the US. Of these, only 18,000, i.e. around 2%, had more than 500 employees (US Department of Commerce).

Study limitations

In this review, the articles were categorised into groups based on the author's understanding of the interventions and their content. As most workplace physical activity interventions are composed of multiple components, only clearly defined workplace exercise interventions (weekly aerobics, stretching, muscle strengthening, short exercise bouts, individual exercise prescription) were included in the empirical study review. It is difficult to compare the heterogeneous studies and the result is certainly open for further interpretation. In addition, the empirical studies included only experiments and quasi-experiments, RCTs and CTs, the review would have omitted quality studies because of different study methodologies.

Although the literature search undertaken was comprehensive, it is possible that it did not identify all published studies in this area, for example, language issues or publication bias. Although this review is not only restricted to studies written in

English, the possibility of bias because of a restriction in language may exist. Publications with significant results seem to be published more often in English than in other languages (Egger & Smith, 1998).

Conclusions

In summary, the present review results show that the effectiveness of workplace exercise interventions on physical activity outcomes is inconclusive at systematic review evidence level, but strong at empirical study review evidence level. These results might be because of the fact that the present review at systematic review level has covered many intervention strategies using multi-component approaches but reviews on empirical studies were focused solely on worksite exercise interventions that produce more reliable results. Hence, evidence to support the effect of workplace exercise interventions on physical activity outcomes is promising. Workplace exercise shows little effect on sickness absence at both review level and empirical study level. The effect on work performance at systematic review evidence level is very limited and inconclusive at empirical study review evidence level. Despite the increasing amount of research in this area, the actual number of studies, especially in countries outside Scandinavia, is very small. Future research on the effectiveness of exercise interventions at the workplace among other ethnic groups, for example, Chinese, will help to enrich the knowledge regarding cultural relevancy. Most SMEs would not have the resources to invest in comprehensive health intervention programmes, and exercise as a single intervention component might be an efficient and effective option to promote employee well-being. Future research on its sole effect with different delivery modalities will widen

knowledge surrounding programme design. To engage commitment from employers, the research area in which the effectiveness of exercise interventions at worksites with respect to work-related outcomes is conducted needs to be strengthened.

2.2. China as a study base

The second section examines why China has been chosen as a study base by looking at the Chinese working population and how promoting physical activity has become a health priority in China. Following this, the recent development of workplace physical activity intervention in China will be reviewed. The last part focuses on Chinese health culture and its beliefs around physical activity compared and contrasted with western approaches.

2.2.1. Chinese working population and its health situation

China is the most populous country in the world with a population of 1.39 billion (WHO Representative Office in China, 2014). In the past three decades, China has increased urbanisation from 20% to today's 54% (Miles, 2014), leading to rapid economic and social changes. The job market has shifted from labour intensive occupations to jobs that are more sedentary. Physical activity levels dropped significantly among most occupations (Ng, Howard, Wang, Su, & Zhang, 2014). Research indicates that the prevalence of disease associated with physical inactivity has increased dramatically in Chinese adults over recent years (Tang, Ehiri, & Long, 2013).

In 2012, overweight rates among those ≥ 18 years old was 30.1%, up 7.3% compared with 2002; of these, 90 million people, or about 7%, are obese (National Health and Family Planning Commission, China, 2015). It has been suggested that low physical activity is one of the most important factors

(Suarez, 2010). Chronic disease mortality accounts for more than 80% of the overall death toll in China (Wang, Kong, Wu, Bai, & Burton, 2005). The prevalence of diabetes has also increased significantly in recent decades and is now reaching epidemic proportions in China. The prevalence of diabetes was less than 1% in the Chinese population in 1980 (National Diabetes Research Group, China, 1981). However, in subsequent national surveys conducted in 2000, the prevalence of diabetes was 5.5% (Gu et al., 2003). A cross-sectional survey in a nationally representative sample of Chinese adults (n=98,658) in 2010 reported that the overall prevalence of diabetes was estimated to be 11.6% in the Chinese adult population (Xu et al., 2013).

A recent report published by The World Bank - 'Towards a healthy and harmonious life in China: Stemming the rising tide of NCDs' revealed the serious health challenges that China has been facing (The World Bank, 2011). The country has 230 million patients with cardiovascular diseases, including 200 million patients with hypertension, 7 million patients with stroke, and 2 million patients with myocardial infarction (Report on Cardiovascular Diseases in China, 2011). Rising rates of chronic diseases and obesity among this population have striking consequences. For example, health expenditure as a percentage of GDP was 5.6% in 2013 in China (OECD, 2014). It is estimated that cost of overweight and related disease will be almost 9% of China's GNP by 2025 (Popkin, Kim, Rusev, Du, & Zizza, 2006).

In June 2016, the Chinese government released a National Fitness Plan (2016-2020) aiming to increase physical activity and improve population fitness (The State Council, The

People's Republic of China, 2016). The plan aims to address the need to promote population-level health, which is increasingly adversely affected by the unprecedented economic development in China. Developing strategies to promote physical activity is now a major health priority in China.

2.2.2. Workplace physical activity interventions in China

The workplace in China provides access to 74.4% of the overall working population aged 15-64 (National Bureau of Statistics of China, 2013). Workplace physical activity intervention is considered an effective strategy to promote employee's health in this country (Li, Li, Li, & Wang, 2015). However, there is a dearth of evidence-based findings on the workplace interventions in China (Siu, Cooper, & Phillips, 2013). Even so, there has been a growing interest in the workplace exercise programme in China (Li et al., 2015). In August 2010, the Chinese government launched a 'Collective Workplace Exercise' campaign (Mudie, 2010). The campaign targeted all workers in state-owned industrial firms and a majority of civil servants to participate in daily 20-minute exercises, so-called radio calisthenics. However, the public response was cautious because of the historical fact that collective exercises had been a feature of China under communist rule since 1951.

China's experience for a worksite-based intervention in Capital Iron and Steel Company of Beijing (n=110,000) demonstrated that intervention in the workplace was not only effective, but also had long term impacts (1974-1998) on health

improvements (Wu et al., 2003). In addition, a single group cohort study in Gansu province (n=133) also provided evidence that a 28-month, 10-minute, twice-a-day worksite exercise intervention was feasible for office workers (Liu & He, 2008). However, there was no report on exercise modality and study procedures in this research. Despite the above reported cases, workplace physical activity promotion efforts reach a very limited number of workplaces and workers in China (Li et al., 2015). Moreover, there was a dearth of evidence on workplace interventions from good quality studies. Apart from an absence of national physical activity guidelines, there are no surveillance systems at the various level of implementation necessary to monitor physical activity trends over time, locally and nationally (Li, Liu, Zhu & Harmer 2016). Studies testing physical activity interventions with Chinese workers will provide better insights to the health research in this international setting.

2.2.3. Health culture: East versus west

Culture is a way of life. From a health point of view, it is pertinent to understand how a culture affects the attitude, behaviour, and health of an individual, a group of people, and a society as a whole. Beliefs and attitudes towards exercise differ between cultures and understanding these differences may assist in the design of exercise interventions to maximise exercise adherence and sustainable physical activity patterns (Guelfi et al., 2015).

Hofstede's cultural studies play significant role in the cross-cultural research in health psychology (Hofstede, 2011). One

of the key dimensions¹, i.e. individualism versus collectivism, portrays in particular the impact of the culture ingrained in society on the attitude and behaviour towards health among the members of the society. Collectivistic cultures, including China, Taiwan and Japan, are characterised by high inclination towards conforming to group values and norms, with emphasis on harmony and hierarchy within group. Individuals are willing to give up personal interest for the benefit of the group. Individualistic cultures, including the United States, Great Britain and the Netherlands, value personal fun, pleasure and achievement. The behaviours of the members reflect self-sufficiency and independence as well as fulfilment of self-interest, individual goals and needs. It is hoped that this conceptual model would contribute to the development of culturally appropriate health promotion interventions (Paek, Yu & Bae, 2009; Al-Bannay et al., 2013).

As early as 3000 to 1000 B.C., the classic 'Yellow Emperor of Internal Medicine' (Veith, 2002) revealed the basic principles of health culture among Chinese that human harmony with the world was the key to prevention, and that prevention was the key to longevity. Chinese people believe good health is promoted through exercise, a balanced diet, and maintaining harmony with people and nature (National Center for Complementary and Integrative Health, US Department of Health and Human Services, 2013). On the other hand, ancient Greek ideas of exercise and health have influenced

¹ Hofstede's model originally consisted of 4 dimensions, namely power distance, uncertainty avoidance, individualism vs collectivism & masculinity vs femininity. After conducting more studies, Hofstede added 2 more dimensions in his model: short-term vs long-term orientation and indulgence vs self-restraint (Hofstede, Hofstede & Minkov, 2010).

modern western culture's approach toward physical activity. Western people are more likely to think good health was inspired by great athletic achievement, which was a combination of spiritual and physical strength.

These cultural differences may influence motivation and behaviours towards physical activity. A cross-cultural comparison study between American youth (aged 12 to 16) in the United States and Chinese youth in China showed that Chinese youth participated in physical activity primarily for social affiliation and wellness, whereas American youth's motivation of participation was for competition and improving skills (Yan and McCullagh, 2004). Another study in the United States involving 15,000 college students reported that the highest motivational factor for participating in physical activity was for reasons of appearance, followed by health, enjoyment, and affiliation reasons (Kilpatrick, Hebert, & Bartholomew, 2005). Studies testing interventions with Chinese workers in China will help to shed light on the cross cultural validity of the health theories that give the present study practical and theoretical significance.

2.3. Summary and research objectives

In summary, a large body of research has provided substantial evidence on the benefits of workplace physical activity programmes on health-related outcomes. Emerging evidence constantly indicates that intervention in the workplace has some influence on physical activity behaviours. The relevance of the physical activity to work-related outcomes is an under-researched area. There is a research gap to review the effectiveness of workplace exercise interventions on individual

and organisational outcomes. This thesis aims to contribute to the limited evidence base on the worksite exercise intervention in China. It intends to contribute to the workplace health literature also by using a behaviour change model as a guide for intervention development and a theory-based framework for process evaluation. This research has 3 main objectives:

1. to examine the effect of a worksite exercise intervention on individual physical activity;
2. to investigate the effect of a worksite exercise intervention on work-related outcomes, including work performance and sickness absence;
3. to conduct a comprehensive evaluation of the implementation process of a worksite exercise utilising the RE-AIM framework.

Four inter-related studies were conducted to achieve the research objectives:

Study 1 Feasibility of a worksite exercise intervention

A feasibility study aimed to test delivery of an intervention and to assess potential changes in the outcome measures. This feasibility study was purposely designed to prepare for a larger controlled trial study. It was used to test important parameters that were needed to design the main study: The feasibility of integrating an exercise intervention into the work schedule; exercise adherence rate; response rate to questionnaires, and the follow-up rates. This study was done in a factory and the participants were blue-collar workers (n=71) with mainly sedentary job roles. It consists of two

major components: Pre- and post-intervention comparisons of a single cohort group as well as post-intervention focus groups.

Study 2 Piloting interventions under research processes

A pilot study was the trial run of a full-scale empirical study in the participating organisation. This pilot study consisted of focus groups and pilot testing an online questionnaire survey. The purpose of this study was to assess the acceptability of an exercise intervention and to examine enabling factors and barriers for successful delivery of an exercise intervention. This study also aimed to test the study instruments to ensure the questionnaire was comprehensive and appropriate, and that questions were well defined, clearly understood, and presented in a consistent manner. Participants consisted of all team leaders (n=31) in an insurance information technology (IT) firm.

Study 3 Main study: Effectiveness of a worksite exercise intervention

This study aimed to investigate the effects of a worksite exercise intervention on employees' physical activity and work-related outcomes. The study was done in an IT firm in two separate sites and the target participants were computer programmers (n=282). This study was a field quasi-experiment with repeated measures, including one intervention group and one waitlist control group.

Study 4 Process evaluation

The aim of this study was to conduct an evaluation of the implementation process of a worksite exercise intervention for IT workers. Five dimensions of the RE-AIM framework were used: Reach; Effectiveness; Adoption; Implementation, and Maintenance. Each one of these dimensions provides valuable information on the factors that influenced intervention implementation.

Chapter 3 Intervention development

This chapter presents the Behavioural Change Wheel (BCW) model (Michie et al., 2014) and how each aspect of the model informs the design and development of the intervention. To begin with, commonly used behaviour change models are briefly introduced and supporting rationale why BCW model was identified as the best fit for this study is reported. In the second section, the BCW model is explained in detail. By adhering to the model, a Capability-Opportunity-Motivation-Behaviour (COM-B) analysis helps to guide the selection of three intervention functions which are linked with relevant behavioural change techniques BCTs. Four BCTs that are chosen to operationalise the intervention functions are introduced. The next section states the reasons why the policy on communication and marketing is adopted to support the delivery of these BCTs. The last part of this chapter describes how a worksite exercise intervention is developed based on this behavioural change model.

3.1 Behavioural change model

3.1.1. Commonly used behaviour change models

The UK Medical Research Council guidance emphasises the importance of using theory in intervention design (Craig et al., 2008). A meta-analytical study also indicated that worksite physical activity interventions using theory more explicitly were more effective, producing an effect size of 0.34 (Taylor, Conner, & Lawton, 2012). Therefore this paper has adopted a theory-informed method for the design of study interventions. Several behaviour change models provide a base of

understanding the determinants of behaviour and behaviour change in health psychology and health promotion. They include:

Health belief model HBM

The HBM (Rosenstock, 1974) used two aspects of individuals' representations of health behaviour: threat perception and behavioural evaluation. Threat perception was construed as two key beliefs, perceived susceptibility to illness and anticipated severity of the consequences of illness. Behavioural evaluation also consisted two distinct sets of beliefs: the benefits of recommended health behaviour and the costs or barriers enacting the behaviour. The HBM had been broadly applied to major areas on preventive health behaviours (e.g. diet and exercise) and sick role behaviours (e.g. adherence to recommended medical regimens). However, intervention success appeared to be unrelated to HBM construct addressed challenging the utility of this model as the theoretical basis for adherence-enhancing interventions (Jones, Smith & Llewellyn, 2013). The lack of operational homogeneity had also weakened the HBM's status as a coherent psychological model (Carpenter 2010, Abraham and Sheeran, 2005).

Theory of planned behaviour TPB

TPB was an extension of the earlier theory of reasoned action (Ajzen and Fishbein, 1980). The TPB proposed that the proximal determinants of behaviour were intention to engage in that behaviour (motivation and decision to exert effort to perform the behaviour) and perceptions of control over that behaviour (a person's expectancy that performance of the behaviour was within his/her control). Intention was

determined by three sets of factors: attitudes which were the overall evaluations of the behaviour; subjective norms which represented a person's belief how others thought of his/her behaviour and perceived behavioural control if it was easy or difficult to perform that behaviour. Perceived behavioural control was judged by beliefs concerning access to resources and opportunity to perform successfully. The major criticism of this model was that it assumed that all behaviours were rational and hence failed to address the irrational determinants of human behaviour (Sheeran, Gollwitzer & Bargh, 2013; Sniehotta, Pesseau & Araújo-Soares, 2014). Besides, the contemplation of a behaviour (e.g. when filling in a TPB questionnaire) with the intentions and perceived control might not always convert to actual performance of behaviour (Ajzen and Fishbein, 2005).

Social cognitive theory SCT

In SCT (Bandura, 1986), human motivation and action were assumed to be based upon three expectancies: situation outcome, action outcome and perceived self-efficacy. Situation-outcome expectancies represented beliefs about which consequences would occur without interfering personal action (e.g. susceptibility to health threat). Action-outcome expectancy was the belief that a given behaviour would or would not lead to a given outcome (e.g. taking regular exercise will lead to a reduced risk of heart disease). An individual's belief that he or she was not capable of performing a particular behaviour, for example, doing yoga three times a week, would constitute such a self-efficacy expectancy. Although a causal ordering amongst these three types of expectancies seemed to exist, an individual might perform a particular behaviour due to emotion or curiosity. The theory

assumed that behavioural evaluation on the changes in the environment would automatically lead to an action and changes in the person, when this might not always be true (Conner and Norman, 2005).

Stages model of health behaviour

One of the earliest stage models was found by Prochaska and DiClemente (1984) in their transtheoretical model of change (TMC). TMC had been widely applied to analyse the process of change in alcoholism treatment (DiClemente and Hughes, 1990) and smoking cessation (DiClemente et al., 1991). In TMC, five stages of change were identified: pre-contemplation, contemplation, preparation, action and maintenance. An individual was likely to progress through each stage until he/she could maintain a new behaviour successfully. Whilst relative widely applied, there was limited evidence that interventions matched to individual's stage of change were more effective than unmatched interventions (Blissmer and McAuley, 2002, Bridle et al., 2005). Also, a variety of different staging algorithms had been used and the algorithms listed on Rhode Island group's website showed inconsistencies across different health behaviours. As a result, different algorithms would lead to very different study conclusions (Sutton, 2005).

Despite the above frameworks being widely used in health psychology, a number of studies found considerable overlap between the underlying constructs (Armitage and Connor, 2001; Gebhardt & Maes, 2001). For example, there were similarities between the perceived behavioural control component of the TPB and self-efficacy (Ajzen, 2002). Besides, HBM focused on the notion of health risk as measured by perceived susceptibility and perceived severity. SCT focused

on the risk perception in terms of expectancies about environmental cues. Both models put the emphasis on perceived consequences performing a health behaviour (Conner and Norman, 2005). Moreover, all the above theories assumed that people would make rational decisions when responding to health issues. The non-cognitive side of decision-making process, including emotions, cultural influence and peer pressure, had not been addressed appropriately (Bilic, 2005). The automatic and reflective systems with sociological ideas in behavioural science might be also new areas to explore for health-related behavioural change (Kelly & Barker, 2016).

Spector and Pindek (2016) in their recent literature on a content analysis of the two leading work and occupational health journals (*Journal of Occupational Health Psychology* and *Work & Stress*) from 2010 to September 2014, raised an issue whether the focus on theory was overdone (Lathem & Locke, 2007, Hambrick, 2007). The trend seemed to show that the current theory was not sufficient to explain all the phenomena the researchers might want to study. A balanced approach that allowed an explanatory and inductive method by collecting data to identify the important issues, in addition to a deductive method of testing a priori hypothesis, was advocated.

Subsequently, the BCW model (details of the BCW model is presented in section 3.1.2) was identified as the best fit for the intervention design of the studies in this thesis because it has been developed as a guide for selecting effective strategies for complex interventions in a real-world setting (Michie, Atkins, & West, 2014). The step-by-step approach

that explicitly integrates the behavioural theory with the intervention development is appropriate for applying in this organisational setting. Following an original publication in 2011, a number of studies have used the BCW model to develop the implementation of interventions and confirmed its usefulness (e.g. Alexander, Brijnath, & Mazza, 2014; Fleming, Bradley, Cullinan, & Byrne, 2014; Sinnott et al., 2015).

3.1.2. Behaviour Change Wheel and Capability-Opportunity-Motivation-Behaviour Theory

A Behaviour Change Wheel consists of three layers. The hub of the wheel uses the Capability-Opportunity-Motivation-Behaviour (COM-B) theory. This theory includes assessing the employee's capability (i.e. physical and psychological ability), opportunity (physical environment and social environment enabling the behaviour), and motivation (reflective and automatic mechanism that activate or inhibit behaviour, such as beliefs, goals, habits, and emotions) for why a behaviour is, or is not, performed. Surrounding the hub is a layer of nine intervention functions to choose from based on the particular COM-B analysis one has undertaken. The nine intervention functions include education, persuasion, incentivisation, coercion, training, restriction, environmental restructuring, modelling, and enablement. The outer layer, the rim of the wheel, identifies seven policy categories that can support the delivery of these intervention functions. These seven policy categories are: Communication/marketing, guidelines, fiscal, regulation, legislation, environmental/social planning, and service provision. The intervention functions are linked to taxonomy of 93 replicable behavioural change techniques

(BCTs) (Michie et al., 2013). Figure 3.1 shows the Behaviour Change Wheel.

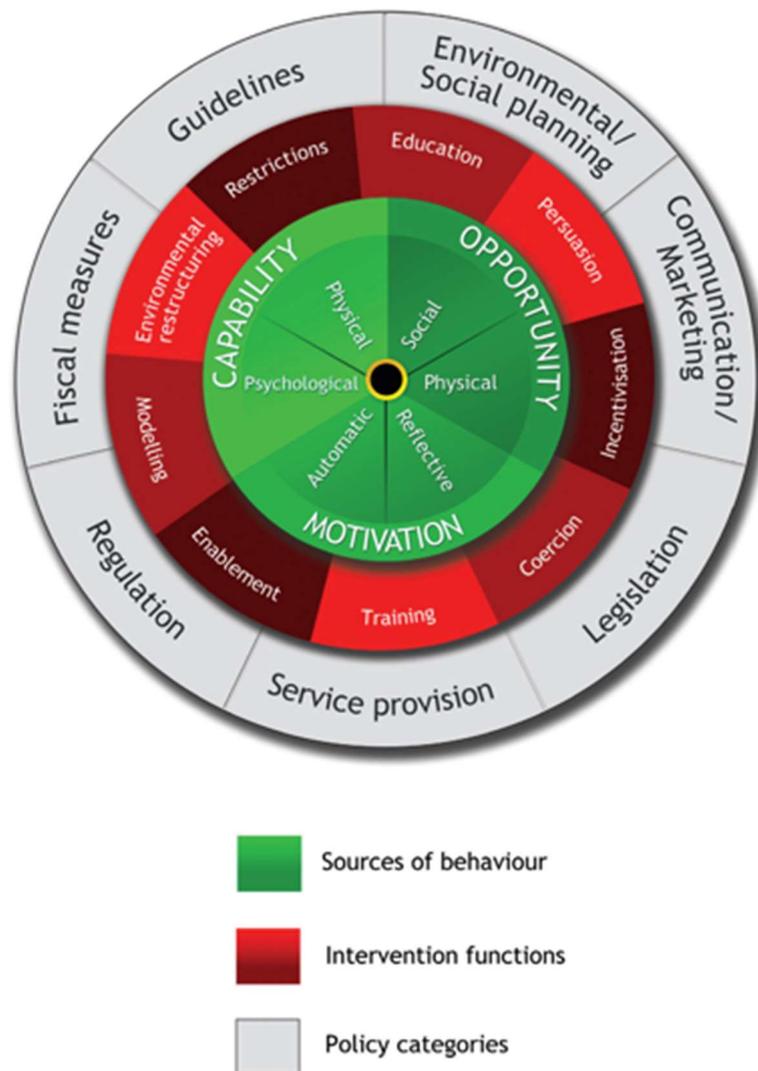


Figure 3.1 The Behaviour Change Wheel (Michie et al., 2014)

3.1.3. COM-B analysis and intervention function selection

The hub of BCW provides the guidelines to identify the sources of the behaviour that could prove fruitful targets for intervention. A workplace exercise intervention (chapter 2, section 2.1) has been identified as a possible intervention

strategy for organisations interested in promoting employee health. In accordance with the BCW model, the selection criteria in intervention designs that most likely to effect behavioural change – namely APEASE in acronym: Affordability, practicality, effectiveness, acceptability, side effects/safety, and equity – suggest that the integration of short exercise breaks within the work schedule might be an economical and practically viable choice. In terms of strategy to promote physical activity, a population-based approach to promote health and prevent disease plays a more influential role in public health and behavioural sciences (chapter 1, section 1.4). Short exercise breaks could constitute such an approach because a substantial segment of the population can be reached at the workplace. Henceforth the researcher has had a predefined idea of what the exercise intervention would be at the outset. Subsequently a literature review on the effects of worksite exercise interventions was conducted and results presented in detail in chapter 2, section 2.1.3.

Since a short bout of exercise was the focal point of study, the next step was to select appropriate intervention functions from the second layer of BCW. Three intervention functions that deemed to effect changes in Chinese workers' physical activity were selected for the studies in this paper. These intervention functions are defined as follows:

1. Modelling – A technique in which learning occurs through observation and imitation will be instilled in the intervention. Interventions are planned to be led by peers who will obtain qualification through proper training. The delivery format can be as in peer-led group sessions or video-based individual/group sessions.

2. Training – systematic instructions on the exercise routines are essential so that participants have adequate capability in participating and adhering to the intervention. To enhance training impact, written instructions and video demonstrations are included in the intervention development.

3. Enablement – To maximise receptivity of the intervention at organisational and individual levels, needs analysis study including focus groups with stakeholders, for example, senior managers, team leaders, and workers would be used. Results would provide valuable inputs to customise the interventions in the participating organisation.

These intervention functions have found to be appropriate because workers in China acquire capability, including skills and knowledge, in their jobs through similar approaches. Modelling by hands-on learning has been the major approach to training handcraft workers in China for thousands of years, in the sense of apprenticeship (Bi & Wang, 2012). Besides, formal training is considered as the prerequisite in most career acquisition and development (The World Bank, 2015). Enablement as an intervention function is important in this research because the intervention design allows the employers in the participating organisation to customise the interventions, i.e. tailor-design the BCTs. This strategy of encouraging organisations to customise and adopt BCTs to best accommodate the dynamics of the organisation is used to gain receptivity at the organisational level and maximum

recruitment and retention of participants (Hopkins, Glenn, Cole, McCarthy, & Yancey, 2012).

3.1.4. Selecting 'active ingredients' in the intervention

The 3 intervention functions selected in the preceding section represent a broad approach to effect potential behavioural change among Chinese workers, but it is also necessary to create fine-grained techniques to operationalise these functions. Behaviour change techniques (BCTs) are observable and replicable components of behaviour change interventions (Michie & Johnston, 2012). By using the link between the BCW and the taxonomy of 93 BCTs, 4 BCTs that are found to be most frequently used with this study's selected intervention functions are chosen (Colquhoun et al., 2014). They are: **code 4.1 - instructions on how to perform a behaviour, 6.1 - demonstration of the behaviour, 7.1 - prompts/cues, and 8.1 - behavioural practice/rehearsal**. The BCT code numbers are used in accordance with the code system in the BCT taxonomy version 1, (Michie et al., 2014) and the definitions of each technique are shown in table 3.1.

Table 3.1 Definition of selected 4 BCTs (Michie et al., 2014)

Code Number	Label	Definition
4.1	Instruction on how to perform a behaviour	Advise or agree on how to perform the behaviour
6.1	Demonstration of the behaviour	Provide an observable sample of the performance of the behaviour, directly in person or indirectly e.g.

		via film, pictures, for the person to aspire to or imitate.
7.1	Prompt/cues	Introduce or define environmental or social stimulus with the purpose of prompting or cueing the behaviour. The prompt or cue would normally occur at the time or place of performance.
8.1	Behavioural practice/rehearsal	Prompt practice or rehearsal of the performance of the behaviour one or more times in a context or at a time when the performance may not be necessary, in order to increase habit and skill.

The integration of each technique with the workplace exercise intervention implemented in this paper is shown in table 3.2.

Table 3.2 Operationalisation of selected 4 BCTs

Selected BCTs	Operationalisation of each BCT	Cross references
4.1 Instructions on how to perform a behaviour	Clear instructions on the worksite exercise routine with proper skills training. Exercise Champions were trained to model the exercise sequence and motivate co-workers.	Chapter 4, section 4.1.6. Chapter 5, section 5.2.2. Chapter 6, section 6.1.4.
6.1 Demonstration of the behaviour	The management in the participating organisation is responsible for nominating	Chapter 4, section 4.1.6.

	employees to be involved in the demonstration and decide on the delivery format, for example, pictures, photos, video and/or in person. The intention is to build employee ownership by engaging participants with familiar faces of their colleagues.	Chapter 6, section 6.1.4.
7.1 Prompts/cues	One participating organisation is an information technology firm. Introducing pop up screens to prompt employees from prolonged sitting and to perform the exercise routines is considered as an appropriate design that would align with its corporate culture.	Chapter 5, section 5.2.2. Chapter 6, section 6.1.4.1.
8.1 Behavioural practice/rehearsal	Integrating exercise breaks into the daily work routine will enhance behavioural practice. Both participating organisations would allow study participants to practice the exercise during break times.	Chapter 4 & Chapter 6

3.1.5. Establishing policies to support the intervention delivery

The rim of the wheel in BCW shows seven policy categories that can support the delivery of the intervention functions. Asbury and his colleagues (2008) found in their study that a

clear communication strategy is associated with the success of physical activity intervention. In addition, a participative style of managing workplace health initiative seems to allow changes to be more catered to employees' needs (Malchaire, 2006). Hence communication/marketing is chosen as the key company policy to support the delivery of the intervention. In this paper, the intervention marketing and communication policy is developed and executed by the organisational committees within the organisations. Members in the committees are selected based on their representation of employees' interests in workplace health promotion.

3.1.6. Readiness to change

Participant's state of readiness, or eagerness to change can be described as motivation to change. BCW model (Michie et al., 2014) is useful to assess the perceived readiness of participant to change behaviour because it covers the 3 core components in its hub, i.e. C for capability, O for opportunity and M for motivation. With the provision of C and O, one cannot assume that people are ready for immediate or permanent behavioural change. People are not motivated to change due to various reasons: they do not see the need to change, in other words, they do not see the benefits to change or the cost of not changing.

The public health guidelines of National Institute for Health and Care Excellence, NICE (2014) have mentioned the use of Transtheoretical Model (Prochaska and DiClemente, 1984) to help to understand the experience of behavioural change. By identifying a person's position in the change process, intervention strategy can be matched with the stage of

readiness for change. For example, in precontemplation and contemplation stages, participants can be given feedback on the health screen results, information on potential health hazards or benefits. To follow with the preparation stage, they can be supported with goal-setting skills and ways to build confidence to change. However, this model was criticised as being unable to accurately explain and predict the change, especially for complex interventions (Adams and White, 2005).

Research has shown that the way we talk to someone about change can greatly influence the motivation to change (Miller & Rollnick, 2013). If we show respect, listen actively, facilitate two-way communication, and with the combination of the above, will get people to think and embrace change easier than just telling them what to do. In the BCW model, among all BCTs in the taxonomy, motivational interviewing is commonly used to assess perceived readiness of participants to change behaviours that may be placing them at risk of developing health problems. For example, a systematic review and meta-analytical study found that motivational interviewing to increase physical activity helped people with chronic heart conditions (O'Halloran et al., 2015).

In this research, to enhance the element of M in COM-B theory and employees' readiness to increase their physical activity, direct contacts with senior management, team leaders and workers were aimed to involve them in the process before, during and after intervention. Meetings with leaders and workers respectively also provided opportunities for the researcher to listen and understand their perspectives towards corporate wellness initiatives. In addition, a pilot study was developed to gain leaders' commitment before the intervention

was introduced to all employees. Support from the leaders is often identified as an effective strategy when recruiting participants and preparing them for change (Marshall, 2004). Besides, interventions were to be tailor-designed for the two participating organisations so that employers and employees would have the ownership of this health initiative. Rapport and trust are aimed to set the right tone for getting employees' readiness to participate in the intervention and change towards healthy behaviours.

3.2 Worksite exercise intervention development

A worksite exercise intervention has been designed and developed for the study population based on the BCW model. The intervention lasted for 12 weeks and involved a peer-led, 10-minute Qigong exercise session delivered at set exercise break times during the working day. There is growing recognition that cumulative effects of short bout exercise for 10 minutes practised continuously over time can accrue health benefits. These short exercise breaks aimed to encourage the exercise uptake in alignment with the Centers for Disease Control/American College of Sports Medicine (CDC/ACSM) recommendations of at least 10-minute bouts toward an accumulation of a minimum 30 minutes nearly every day (Pate et al., 1995). A simple Qigong exercise programme was designed by a Chinese Tai Chi master with more than 20 years' experience. Since the researcher has been a Tai Chi master practitioner for 20 years, she conducted the train-the-trainer sessions and did the exercise video demonstration for the participating organisations. The movements largely involved deep abdominal breathing and simple stretching exercises. It is recognised as the most popular form of health-enhancing

physical activity in China and therefore the intervention is culturally relevant (Wang et al., 2014). Group exercise sessions can be conducted in any open space at the workplace. No equipment is required.

The Qigong exercise routines have been developed in a modular format and there are six modules that catered for different parts of the body (Appendix 1).

Module 1 Neck Exercises

Module 2 Shoulder Exercises

Module 3 Shoulder & Arm Exercises

Module 4 Wrist and Ankle Exercises

Module 5 Chest and Arms Exercises

Module 6 Full Body Movements

The following chapters (4-7) describe how this worksite exercise intervention based on the BCW model has been applied in the studies.

Chapter 4

Feasibility of a worksite exercise intervention

This study aimed to test the feasibility of integrating an exercise intervention into the work schedule in a workplace setting in China and assess potential for changes in employees' physical activity and work-related outcomes. The purpose of this feasibility study was to prepare for a main controlled trial study with larger samples (chapter 6). This chapter describes the methods, results and discussion of a feasibility study.

4.1. Methods

4.1.1. Design

This study was a single-site cohort study with pre- and post-intervention comparisons. Qualitative data was collected in post-intervention focus groups with team leaders and participants.

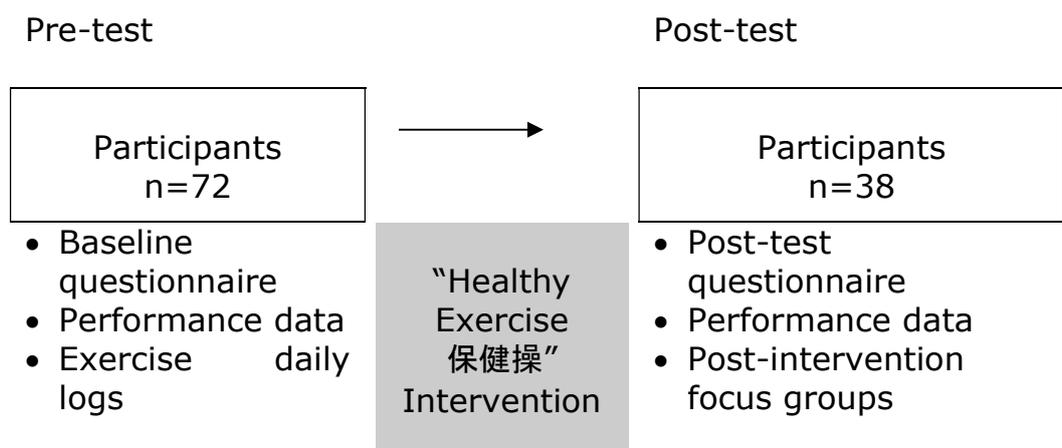


Figure 4.1 Feasibility study design

4.1.2. Recruitment strategy

To seek commitment from senior management, widely considered as one of the key success factors in workplace health promotion (DeJoy & Wilson, 2009), the researcher approached the potential participating organisation, a Swiss-owned manufacturer with a Far East head office in Hong Kong. Approval to access the factories in Shenzhen, China, was obtained in October 2011. A factory site visit was arranged and the researcher was guided by a production engineer to become familiarised with factory floors and production processes. This visit acted as a good opportunity to assess the work environment and work characteristics, both of which are prerequisites for determining the feasibility of the study (Bale, Gazmararian, & Elon, 2015).

Direct contact with senior managers or team leaders and involving them in the intervention planning process has often been identified as a helpful strategy when recruiting participants for physical activity promotion in the workplace (Marshall, 2004). Team leaders in this factory typically supervised a team ranging from five to ten workers, by monitoring daily work progress of the subordinates in the same workplace. Such leaders can 'act as model or champions for the effort, achieve buy-in and support from other levels of the organisation' (CDC: Workplace Health Promotion, page on Leadership Support, 2013). The researcher addressed the factory team leaders' meetings (n=14) and the workers' meetings (n=15) respectively to understand their general attitude towards corporate wellness initiatives. The team leaders' meeting consisted of representatives from human resources, product design, production and quality control

departments which constituted 50% of the total number of team leaders in the company. The workers were convenience samples selected from quality control departments (a fifth of total employees in these departments).

4.1.3. Participants

Participants were employed in a watch and jewellery factory in Shenzhen, China. At the time of the study, a total of 750 Chinese workers were employed, mostly young (aged 18 to 22), female (82%) blue-collar workers, with junior high school education or above. Their average monthly salary was Renminbi 2000–2200 (approximately £200-250). Management of the participating organisation designated the quality control (QC) department as the pilot intervention unit that could participate in the study (n=72). These workers spent most of the day sitting in the factory workstations and inspecting samples along the production processes from raw materials to finished products. Below are some typical pictures of the factories where employees were working.



Figure 4.2 The work environment in factory setting

4.1.4. Procedures

A 20-minute orientation and motivation briefing about the intervention was delivered to two groups of workers by their respective leaders using standardised open invitation letter prepared by the researcher (Appendix 2). The researcher gave a presentation to the same groups of workers on the purpose and content of the study. To overcome the risk of coercion (an ethical consideration), best practice in research ethical procedures was followed diligently (The British Psychological Society, 2010). The researcher explained to all workers their right of choice to participate before asking them to give consent and informed them that they could withdraw from the research at any time, without giving any reason. They were also assured of data confidentiality (Data Protection Act, 1998). After the presentation, all workers agreed to participate in the intervention, signed consent forms, and completed the baseline questionnaires. Participants were then asked to put all completed questionnaires in a collection box to preserve anonymity of those who chose not to participate. The participation rate at this baseline stage was 100%. High participation in this study might be partly attributed to cultural factors. As group conformity that fosters team harmony is highly valued by Chinese workers, participants' behaviour might be influenced by this core goal in the Chinese cultural context (Chan & Qiu, 2011).

However, prior to the intervention starting, the factory manager decided to allow only a sub-group of workers in the pilot intervention unit to receive the interventions. Therefore, the actual number of intervention participants was 40 instead

of 72. Nevertheless, similar challenges and unexpected changes have happened in other research studies where real life organisation research has been conducted (Justine, Shashivadan, & Stanton, 2016; Dunbar et al., 2015). The intervention lasted from December 1, 2012 to February 28, 2013. This length of time was found to be appropriate for short exercise interventions and was used in other successful interventions aimed at encouraging behavioural change (Barr-Anderson et al., 2011; Dishman et al., 2009).

At the end of the intervention, the researcher conducted a post-intervention survey 'in-person' with only those who received the intervention. Intervention participants were asked to complete the survey in the same procedural manner as baseline survey. The participation rate at this post-test period was also 100%, the same as at baseline.

The study was approved by the Ethics Committee of the Institute of Work, Health and Organisations, University of Nottingham, UK on October 31, 2012. (Appendix 3).

4.1.5. The intervention programme

Based on the guidance of the BCT on behavioural practice (operationalisation of this BCT was presented in Chapter 3, table 3.2), exercise breaks were integrated into the daily work routine. The intervention lasted for 12 weeks and involved a peer-led, 10-minute Qigong exercise session delivered twice a day, at the same time every day: 11.45am and 5.15pm. For reasons of health and safety, group exercise sessions were conducted in an open space at the workplace. The researcher and team leaders reminded the participants that exercises

should be done gently prior to the start of the intervention. Participants were advised to stop the exercise immediately and report to the human resources (HR) officer if they felt any discomfort during the study period. No such adverse effects were reported during the study or after. Background music for the exercise was optional: Team leaders and participants decided jointly on whether or not to have music to accompany their exercise sessions. Both teams in the jewellery and watches factory requested the HR officers to arrange the background music. (Intervention development had been presented in detail in the previous chapter 3). Photographs of a typical exercise session are provided in Figure 4.3 below.



Figure 4.3 A typical exercise session in factory setting

4.1.6. The implementation of the intervention

An organisational committee, consisting of an HR officer and team leaders, branded the intervention as the “Healthy Exercise 保健操”. Campaigns that used a clear branding and communication strategy tend to lead to better success of physical activity intervention (Asbury, Wong, Price, & Nolin, 2008). A logo and selected images were utilised on promotional posters. The key message in the communication was to encourage workers to get healthy by doing more exercise. Two examples of “Healthy Exercise 保健操” posters to market the intervention are provided in Figure 4.4 below.



Figure 4.4 “Healthy Exercise 保健操” promotional posters

Based on the BCT guidance on providing instructions on how to perform a behaviour, and demonstration of the behaviour (operationalisation of these 2 BCTs was presented in Chapter 3, table 3.2), Exercise Champions (2 team leaders and 4 workers) were recruited. They all attended a 1-hour train-the-trainer session conducted by the researcher, which included a demonstration, practice, and a paper copy of exercise

instructions to take away and keep for future reference in the workplace. They attempted to motivate co-workers and modelled the sequence of movements during each exercise break session.

4.1.7. Measurements

A paper-based questionnaire was developed for use before and after the exercise intervention. The survey items were in Chinese. Good practice as recommended for translating surveys in cross-cultural research (Hunt & Bhopal, 2004) was adopted in the translation of other survey items. Two bilingual translators (the researcher and HR manager) conducted the forward translations independently, compared the versions to identify discrepancies and agreed on the final version. An independent translator, who was blinded to the survey, back translated the items into English. The researcher compared it with the original document to check the validity of the translation. The translated survey was then pre-tested in a group of workers (n=7) from a different department who were not targeted study participants and were blinded to the study. Pre-testing was considered as a good practice and an important phase of survey research (Grimm, 2010). It helped to improve the quality of data collection design. Pre-test results led to some minor amendments on the items concerning demographic data. For example, the scale for education level was modified to fit the employees' profile appropriately.

Demographic data (gender, age, education, marital status, and length of time working for the company) were collected at baseline measurement. Self-report measures of physical

activity level, job satisfaction, work performance, and sickness absence were collected at baseline and at the end of intervention.

4.1.7.1. Physical activity

The IPAQ (International Physical Activity Questionnaire), Taiwanese short form (IPAQ Research Committee, 2005) was used as a self-report instrument for assessment of PA. Participants were asked to estimate the number of days they performed the vigorous, moderate, and walking activities (frequency) and the time (duration) spent doing these activities in the week before the assessment (i.e. last seven days recall). Output measure was total physical activity expressed as MET-min-wk⁻¹. Higher scores indicated a greater level of participation in physical activity. The IPAQ, short form, Chinese version was shown of its reliability and validity by the prior use of studies in organisations in China (e.g. Qu & Li, 2004; Macfarlane, Lee, Ho, Chan, & Chan, 2006). A recent validity study in China, of comparing IPAQ-short-Chinese version with pedometer, further confirmed its validity and found that the total domain hours per week had a statistical correlation with the criterion pedometer. The concurrent validity coefficient of physical activity of IPAQ-short-Chinese version was 0.32 (Hu et al., 2013).

4.1.7.2. Job satisfaction

To measure the difference in job satisfaction at the baseline and post-intervention, a single-item measure was used (Mangione & Quinn, 1975). The question was "All in all, how satisfied would you say you are with your job?" It was measured by a 7-point scale ranging from 1=very dissatisfied

to 7=very satisfied. A meta-analysis of single-item measures of overall job satisfaction found a corrected correlation of .72 ($SD=.05$), which was used to estimate the minimum level of reliability for a single-item measure (Wanous, Reichers, & Hudy, 1997). This single-item measure had also been recently shown with very good content validity ($M=4.59$, $SD=0.87$ on a 5-point scale with 1=poor to 5=excellent) and research utility ($M=4.47$, $SD=0.80$) by Subject Matter Expert ratings in a systematic literature review (Fisher, Matthews, & Gibbons, 2015).

4.1.7.3. Work performance (self-report)

Work performance was assessed by the items extracted from the Health and Work Performance Questionnaire (HPQ) (Kessler et al., 2004). It was composed of three items, each was measured on a 10-point scale ranging from 0=the worst performance to 10=the top performance (e.g. how would you rate your overall performance on the days you worked during the past 4 weeks?). These extracted items from HPQ related with performance outcomes have been used by many studies with good reliability and validity in the west and Asia (Lam et al., 2013; Imamura et al., 2015; Suzuki et al., 2015).

4.1.7.4. Work performance (objective measure)

Work performance was objectively measured by the amount of units that were quality checked by the workers as well as the error rate, i.e. the percentage of rejected items not meeting the required quality standard. Data was collected 4 weeks before and 4 weeks after the intervention.

4.1.7.5. Sickness absence

Sickness absence was obtained by one single item extracted from Work Ability Index (WAI) (Ilmarinen, 2007) "How many whole days have you been off work because of a health problem during the past 12 months?" It was measured on a 5-point scale ranging from none at all to 100-365 days. WAI was considered a very predictive instrument with high test-retest reliability (de Zwart, Frings-Dresen & van Duivenbooden, 2002) and also a cross-cultural stable instrument (Radkiewicz & Widerszal-Bazyl, 2005). Moreover, a number of studies on the validity of WAI had also been undertaken in China (e.g. Lin, Wang & Wang, 2006; Yang, Wang, Lan, & Wang, 2004). This single-item measure as number of days being absent because of sickness during the study periods has shown to be relevant for use in studies to estimate the effects of health promotion efforts (Hensing, 2009).

4.1.7.6. Exercise adherence

Exercise adherence is defined as the extent to which a worker acts in accordance with the advised exercise dose and exercise dosing regimen (Conraads et al., 2012). Participants kept daily records of the exercise frequency and duration on the exercise log sheets provided by the HR department. This was subsequently used to calculate exercise adherence. The adherence rate was determined by the percentage of participants who completed the intervention.

4.1.8. Physical activity computation

The physical activity variable was computed in accordance with the guidelines for data processing and analysis of the International Physical Activity Questionnaire. Continuous scores of physical activity were calculated from the questionnaire results. Given the non-normal distribution of energy expenditure in the samples, the continuous scores were presented as median MET-minutes/week rather than mean MET-minutes/week (IPAQ Research Committee, 2005).

Using the Compendium of Physical Activity (Ainsworth et al., 2000), the following values were used for the analysis of data: Walking=3.3 METs, Moderate Physical Activity=4.0 METs and Vigorous Physical Activity=8.0 METS. By means of these values, total scores were computed:

- Total physical activity MET-minutes/week = sum of walking + moderate + vigorous MET-minutes/week scores
- Walking MET-minutes = $3.3 \times \text{walking minutes} \times \text{walking days}$
- Moderate MET-minutes = $4.0 \times \text{moderate-intensity activity minutes} \times \text{moderate days}$
- Vigorous MET-minutes = $8.0 \times \text{vigorous-intensity activity minutes} \times \text{vigorous days}$

In addition, according to the guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ Research Committee, 2005), the categorical variable was converted from the continuous physical activity variable. Participants were classified into three levels of physical activity: Low, moderate and high.

Category 1 Low

This category is defined as not meeting any of the criteria for Categories 2 or 3.

Category 2 Moderate

This is a level of activity equivalent to 'half an hour of at least moderate-intensity physical activity on most days'. The pattern of activity to be classified as 'moderate' is either of the following criteria:

- 3 or more days of vigorous-intensity activity of at least 20 minutes per day OR
- 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day OR
- 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving total physical activity of at least 600 MET-minutes/week.

Category 3 High

This is the highest level of physical activity. The two criteria for classification are:

- Vigorous-intensity activity on at least 3 days achieving a minimum total physical activity of at least 1500 MET-minutes/week OR
- 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 3,000 MET-minutes/week.

4.1.9. Data analysis

Data were entered using IBM SPSS Version 22.0 and a 100% data check was conducted. Preliminary data were screened by frequency distribution, charts, and descriptive statistics. All data were normally distributed except the physical activity variable. The data of physical activity variable were log

transformed by $\log(X_i+1)$. Transforming the data is chosen to correct the problem with the non-normal distribution of scores because it would not change the relationships between variables. In other words, the relative differences between participants on physical activity levels before and after intervention stay the same (Field, 2005).

The baseline questionnaires were completed by all participants ($n=72$) and demographic data were reported at baseline. Thirty-two were withdrawn (because of the management decision described earlier) and two resigned from their jobs, leaving the post-intervention group with 38 participants. Without a unique identifier for each participant, data were therefore treated as independent and as a proportion of the population.

T-tests for unrelated data were used to test if there were any significant differences (pre-test and post-test) in physical activity level, job satisfaction, and work performance. Two-tailed tests, i.e. testing for the possibility of the relationship in both directions, were used in the analysis. Previous literature review results indicated that the effects of workplace exercise intervention on individual and work-related outcomes were inconclusive (Chapter 2, section 2.1.3.). Hence, the direction of the effect in this experiment was not predicted by the researcher. A one-tailed test provides more statistical power to detect an effect in one direction. However the advantage of adopting the one-tailed test has to be justified by the ability to explain why the effect would be expected in one particular direction (Ruxton & Neuhäuser 2010).

Finally, a chi-square test was used to analyse physical activity level changes (in categorical score) and sickness absence.

Missing data occurred because of participants' partial response to the surveys. Missing data were on participants' demographic details. The items on the exact age, education and experience of the participants had 13.5%, 6.9% and 4.2% missing data respectively. Statistical analysis was conducted on available-case analysis. All available data were maximised by an analysis-by-analysis basis. This method increases power in the analysis, but it also tends to produce standard of errors that are underestimated or overestimated (Coolican, 2009).

4.2. Results

4.2.1. Sample analysis

The sample consisted initially of 72 workers. Almost two-thirds fell within the age range of 18-32 years with 84.7% female employees. The participants' profile is similar to the study population because of matching age range and similar gender ratio. The exercise adherence rate across the 12 weeks for the intervention sessions was 90% (38 out of 40 participants attended all exercise sessions). Thirty-eight participants completed the intervention and took part in the post-test survey. Two participants resigned from work during the intervention and therefore the attrition rate was 5%. Baseline characteristics of the participants are given in Table 4.1.

Table 4.1 Samples characteristics at baseline

Variables	Number (n=72)	%
Gender		
Female	61	84.7
Male	11	15.3
Marital Status		
Single	26	36.1
Married	39	54.2
Neither of the above	7	9.7
Education		
Junior high school or below	30	41.7
Senior high school	30	41.7
College with no degree	2	2.8
University or above	5	6.9
Missing	5	6.9
Experience		
Less than 1 year	18	25.0
1 – 3 years	27	37.5
4 – 5	6	8.3
5 – 10	13	18.1
over 10	5	6.9
Missing	3	4.2
Age		
18-22	16	22.3
23-27	23	32.0
28-32	6	8.4
33-37	12	16.8
38 or above	5	7.0
Missing	10	13.5

4.2.2. Physical activity

Physical activity scores significantly increased from baseline (M=1301; SD=2733.59) to post-intervention (M=1990; SD=1040.37) with a medium effect size $r=.46$. T-test result showed the differences between means was $t(107)=-5.38$, $p<.001$.

Table 4.2 Comparison between outcomes on physical activity at baseline and post-intervention

		At baseline	At post-intervention	<i>t</i>	<i>p</i> -value, two-tailed test
Number		72	38		
Total	Mean	1301.0	1990.0	-5.38	<.001
MET-	SD	2733.59	1040.37		
minutes-	Median	660.0	1759.8		
wk ⁻¹	IQR %				
	25	0	1218.8		
	50	660.0	1759.8		
	75	1441.5	2644.5		

Abbreviations: SD- standard deviation, IQR – interquartile range

According to the guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ Research Committee, 2005), physical activity in continuous physical activity variable was converted into the categorical score. Participants were classified into three levels of physical activity: Low, moderate, and high. A chi-square analysis of the difference between pre-test and post-test results in the physical activity was significant, $\chi^2(2, N=110)=30.86, p<001$. There was a significant association between the intervention and physical activity. Results represented the fact that, based on the odds ratio, participants were 2.13 times more likely to increase physical activity from moderate to high than stay unchanged, and 34.4 times more likely to increase physical activity from low to moderate than keeping the status quo.

Table 4.3 Comparison between outcomes on physical activity (in categorical score) at baseline and at post-intervention

Physical Activity Level	Baseline n (%)	Post-intervention n (%)
High	8 (11.11%)	15 (39.47%)
Moderate	25 (34.72%)	22 (57.89%)
Low	39 (54.16%)	1 (2.63%)
Total	72 (100%)	38 (100%)

4.2.3. Work-related outcomes

Participants reported higher job satisfaction and work performance scores at follow-up than at baseline ($p < .05$), with a small effect size $r = .21$. Table 4.4 shows the comparison between outcomes on job satisfaction and work performance at baseline and post-intervention.

Participants reported higher job satisfaction scores after the intervention ($M = 5.53$, $SD = 0.92$) than at baseline ($M = 5.06$, $SD = 1.12$). The difference between means was significant, $t(108) = -2.22$.

Participants reported higher work performance scores after the intervention ($M = 8.32$, $SD = 1.25$) per participant than at baseline ($M = 7.58$, $SD = 1.80$). The differences between means was significant, $t(108) = -2.24$.

Table 4.4 Comparison between outcomes on job satisfaction and work performance at baseline ($n = 72$) and at post-intervention ($n = 38$)

	At baseline	At post-intervention	<i>t</i>	<i>df</i>	<i>p</i> -value, two-tailed test
	$M \pm SD$	$M \pm SD$			
Job satisfaction	5.1 \pm 1.1	5.5 \pm 0.9	-2.22	89.21	<.05
Work performance	7.6 \pm 1.8	8.3 \pm 1.3	-2.24	99.63	<.05

4.3. Post-intervention focus groups

Qualitative methods are often used in evaluating workplace exercise intervention to assess the quality of implementation and to provide a comprehensive understanding of factors that facilitated or hindered organisation's update of the intervention (Bredahl et al., 2015; Hammerback et al., 2015; Edmunds, Stephenson & Clow, 2011). This qualitative study was aimed to converge with the quantitative results and help in the evaluation of the feasibility study more comprehensively. Whilst the quantitative study was used to test the feasibility of the intervention and assess the potential influence on individual and organisation, the qualitative study could help the researcher to understand how and why behaviours took place.

Focus groups were used in the study because they can provide a wide range of views, perspectives, and descriptive data from the study participants (Vaterlaus & Higginbotham, 2011). In the following paragraphs, the participants, procedures, data analysis and focus group findings are reported.

4.3.1. Focus group participants

The sample consisted of four focus groups: Two groups with leaders and two groups with a convenience sample of study participants (the leaders invited those who were not occupied with work in hand to attend). Among the two focus groups with leaders, one was from the watches factory (n=4) and another one was from the jewellery factory (n=4). The focus group with leaders had 100% representation, i.e. all intervention participating leaders were involved in the focus groups. Three men and five women, aged ranging from 22 to

40 years old, had minimum 5 years' work experience with the organisation.

Two focus groups with workers (n=8,7) had participants respectively from two factories. All participants were young, female workers (participants' profiles had been presented in detail in section 4.1.3.). One reason for determining the focus group size was saturation – the point when the data collection covered a substantial range of perspectives (Rygg et al., 2010). Another pragmatic concern might determine sample size, for example, smaller groups (three-eight participants) would work best in terms of generating a rich discussion, and are easier to manage (Liamputtong, 2011).

4.3.2. Focus group procedures

Post-intervention focus groups comprising team leaders and participants were conducted in the same day as the post-test survey in March 2013. Focus groups were held in conference rooms at the factories. This meeting place was chosen because it was convenient for the study participants to walk from the workshops. It was also quiet with minimum distraction from background noise. Each meeting lasted forty-five minutes. The focus groups were conducted in Chinese.

Focus groups were conducted in semi-structured format, i.e. the researcher had a list of questions but participants were allowed to diverge and raise other issues that were not covered in the questions. This semi-structured approach is used most frequently in health care qualitative research (Gill, Stewart, Treasure & Chadwick, 2008). In an effort to determine participants' receptivity towards the intervention,

open-ended questions were asked concerning attitude of workers towards the exercise intervention and opinions on exercise modality. These questions were developed by the researcher from commonly reported effects of workplace physical activity interventions within the literature (e.g. Tucker et al., 2011; Fletcher, Behrens, & Domina, 2008). To involve the participating organisation actively in the research process and as a quality control measure, the researcher developed a focus group guide (a complete list of questions was presented in the focus group guide, Appendix 4) and had the organisational committee to review and validate it. The researcher moderated the focus groups and asked questions such as the following:

1. What would be the influential factor in your decision to participate in the "Healthy Exercise" programme?
2. To what extent did the programme meet your expectations?
3. How did the programme influence you, in person and at work? Please state specific examples.

An organisational committee member was invited to get involved in the process and support the focus groups. She helped to get participants seated in the conference room, and she distributed and collected survey questionnaires (survey study procedure had been presented in detail in section 4.1.4). During the focus groups, participants were given the opportunity to ask questions if they were unsure of the meaning of a particular question or if they needed clarification regarding specific terminology. They were encouraged to respond multiple times to each question.

The detail of participants' responses, in terms of the language and concepts they use in talking about their experiences and perspectives can be best captured by a precise audio-record of the focus groups. Therefore audio-recording would enhance the quality of the research (Braun & Clarke, 2013). But there are some exceptions. Employees in a work setting might need more information to feel comfortable, including who will get to listen to the recording and how it will be used (Krueger & Casey, 2014). Audio-recording may inhibit the participants from giving information for sensitive issues because they do not want it recorded (Muswazi & Nhamo, 2013). In this study, in consideration of the brittle employer-employee relationship and with the advice of the organisational committee, detailed recordings in note form were taken by the researcher. This form of note-taking was aimed to let the participants feel more at ease to talk freely.

To maintain as much richness and detail of the group discussion, the researcher took notes with the help of the organisational committee member who acted as an assistant moderator (she observed the group dynamics, recorded details of the participant's responses, later checked the focus group transcripts and identified speakers with demographic data). A journal was kept by the researcher to keep track of things to follow up on, such as ideas for data analysis, additional questions to ask in subsequent focus groups, things that needed to work on with regard to facilitation skills, and so on. It was useful to have an assistant in the focus groups and it is considered as a good practice (Liamputtong, 2011). Participants were thanked for their responses at the end of the focus groups.

4.3.3. Focus group analysis

The data, including the field notes and journal, in addition to the detailed records of the participants' responses by the researcher and her assistant, resulted in one document that provided the researcher with a reliable source of information for data analysis (Bowen, 2009). Data were anonymised, stored securely, and preserved both electronically and on paper. Only the researcher and her supervisors had access to it (Data Protection Act, 1988).

Thematic analysis was used in this focus group analysis. It offered a flexible approach which had been used extensively among health and wellbeing researchers (Braun & Clarke, 2014). Analytic induction was used as an exploration of and inferences about the data rather than taking a deductive approach from prior theory or research.

The researcher got familiarised with the focus group data and she translated them into English. To achieve the semantic equivalence and normative equivalence across languages, translation was focused on the meaning, not just the words of the responses (Guidelines for Translating Surveys to Cross-cultural Research, Department of Medicine, University of California San Francisco, 2007). Semantic equivalence refers to the word and sentence structure translated in English expressing the same meaning as in Chinese. Normative equivalence describes the ability of the translated text in English to address social norms in the participating organisation. For example, Chinese culture means people are less likely to share personal feelings openly; the Chinese

health concept emphasises prevention rather than the treatment of disease (Yang, Zhang, Tan, & Cheng, 2015).

By reading the data repeatedly, the researcher categorised the data and generated initial codes. Themes are phrases that summarise the manifest and latent meanings of data (Auerbach & Silverstein, 2003). Analysis of the data from the focus groups allowed the researcher to identify recurring themes. Codes were then housed under major themes. Participants' detailed responses were grouped under the thematic headings, providing a clear illustration of each theme. The dominant themes that arose out of the analysis comprised of: 1) Intervention benefits; 2) Intervention modality suitability and 3) intervention sustainability. These are presented in the focus group findings section, below.

4.3.4. Focus group findings

Three major themes were identified:

a. Intervention benefits

Focus groups reported benefits to both employees and employers. For the employees, the exercise intervention was found to be good for their physical and mental health. A majority of participants mentioned about the exercise intervention helped to reduce muscle, joint and low back pain. They felt less tensed on the heads and shoulders. Some highlighted the benefits on reduced stress; less fatigue, and improved mood states. No negative impacts on health were reported.

Qualitative data collected in these focus groups confirmed results from the questionnaires that most participants said they were more physically active in general than prior to the intervention. One participant commented:

This programme helped us build a habit of doing regular exercise two times a day. When we finished work and got back home, we had to cook and look after the kids, no time to exercise. (Female, age 38)

A few participants mentioned that they practised some exercise movements at home with the children, which indicated exercise experience at the workplace might translate to the general lifestyle.

As for the employer's benefit, the intervention was reported to create better work atmosphere and improved co-operation. Many participants found the atmosphere fun and enjoyable during the exercise breaks, despite a few participants felt *'embarrassed to exercise at the outset due to the open shopfloor layout'*. Social interaction seemed to be quite salient for these workers. Two participants commented on how much they enjoyed the social aspects of the intervention respectively:

We were all girls, we laughed and talked during exercise. (Female, age 25)

The team took good self-initiative in reminding each other to build good exercise habits and they understood the benefits to their own health. (Female, age 27)

One team leader reported that workers became more cooperative at work during the intervention period:

It was difficult to measure the impact on work performance in quantitative terms. But it had a positive influence on working atmosphere. The workers were more willing to comply with the rules. (Male, age 40)

b. Intervention modality suitability

Intervention modality as reported by focus groups included the mode, intensity and duration of this short Qigong exercise at work. It also covered the venue, timing and logistic arrangement, such as music background or video demonstration. Participants showed high receptivity on the exercise mode and intensity. Most of them reported that this Qigong exercise was '*gentle, easy to learn*', it '*covered the whole body movements*' and yet '*it didn't require much space to practice the movements*'.

Many workers reported that the sessions were short and did not interrupt their workflow. Regarding the venue arrangement, a team leader suggested:

To get everyone to practise as a group in the breakout space was good only in the initial stage when the workers were required to learn the movements. After that, workers should practise the exercise routines at their individual workstations. (male, age 38)

On the other hand, a participant gave contrasting comment on the limited space for doing the exercise:

We hit each other occasionally during some movements. It would be better with more space. (female, age 20)

Some participants suggested alternative timings from the end to the middle of shifts to disrupt prolonged sitting. Besides, most workers mentioned that they felt too hot for exercise in the afternoon because *'the air-conditioning was switched off at the end of the shifts.'* Some indicated that supporting facilities, including music and demonstration videos, were not essential. It might be partly because of limited resources to support intervention implementations in a small factory setting. An HR officer reported that:

We couldn't arrange the video player with the big TV screen and therefore the workers hadn't got the chance to watch the exercise demonstration video. We just relied on the exercise champions to lead, and occasionally on the written instructions. (male, age 28)

Another participant said:

In the first week, the sound system was running on and off. A few weeks later, the system was dead. So the leader gave verbal cues and we continued ... (female, age 22)

Accessibility was considered by many participants in the focus group to be the strength of the intervention. They reported appreciating exercise sessions that were available during working hours and in their place of work. One

participant reported that *'all workers joined the exercise every day except two who were the only men in our team'*, which indicated a high exercise adherence rate.

c. Intervention sustainability

To sustain healthy behavioural change, both employer and employee have their role to play. Focus groups showed mixed findings from the participants. In general the feedback was positive towards this health initiative. However, there was scepticism towards the long-term commitment from the management.

This worksite intervention was initiated by senior management and implemented by the HR department in this factory setting. Many participants mentioned positive perceptions towards management for providing this health initiative in a *'humanistic approach, showing genuine care on employee well-being.'* The intervention was described as a *'good initiative to promote employee health'*. Some participants expressed that having the worksite exercise was a *'common interest that we were all endeavouring to do'*.

Participants' enthusiasm as demonstrated by the animated discussion about adding variety to the exercise routines was a factor associated with feasibility in this worksite intervention. Some suggested *'to add new elements to the exercise routines every six months, especially on the waist and lower back'* and *'to sustain this initiative, the company needed to train up more exercise champions. They should have a strong sense of rhythm, be keen to exercise and willing to lead this worksite practice voluntarily.'* One even

suggested having *'different sets of exercise routines for morning and afternoon sessions.'*

During the study process, any missing communication on the nature of the pilot study might have led to the issue of lacking organisation alignment raised by a few participants; and yet it might also indicate their expectation on involving all factory workers in the exercise intervention.

Our workplace was compartmentalised by glass panels. The exercise sessions were transparent and some colleagues of other departments, especially 'packing' department workers, would stop their work and follow our exercise movements... there seemed to be a lack of consistency within the organisation. (Female, age 29)

Despite most participants proposing that they should continue with this health initiative long-term, one team leader expressed doubt about company long-term commitment.

The programme sustainability would depend on the management's point of view, on working hours, employee health, and the working atmosphere... Resource allocation was important. This pilot study was steered by Amy (HR officer) under senior management's approval and support. Generally speaking,... it depends on what the company's direction would be. (Male, age 40)

The focus group findings supported the intervention and quantitative data collected. The focus groups demonstrated

the feasibility of integrating worksite exercise into organisational daily routine.

4.4. Discussion

To the author's knowledge, this study is the first to demonstrate the feasibility of incorporating Qigong exercise breaks into daily work routines for workers performing sedentary job roles in China. Evaluation suggested that integrating short Qigong exercise breaks into daily work schedules is highly feasible and perceived positively by participants. Employees reported higher physical activity from baseline to post-intervention measurement. The potential influence of this worksite intervention on physical activity behaviour is consistent with findings of interventions delivered in the western world (e.g. Schwarz, Lindfors, & Lundberg, 2008; Merrill, Anderson, & Thygeson, 2011). Schwarz et al. (2008) reported after participation in the weekly 2.5 hours of mandatory physical exercise that the intervention group showed a significant increase in weekly physical activity compared with a control group. Merrill et al. (2011) also found significant improvements in the frequency of exercise among study participants with the effect of a worksite wellness programme.

Study participants reported higher job satisfaction after the intervention, which supports evaluations of previous workplace wellness programmes. Blake et al. (2013) found significantly greater job satisfaction and organisational commitment following a five-year intervention in the National Health Services (NHS) in the UK (Blake, Zhou, & Batt, 2013). Another study in Asia showed similar results. Frequent exercise leading to a higher level of job satisfaction was

found among hotel workers in South Korea (Magnini, Lee, & Kim, 2011). Previous studies also showed that perceptions of a health-oriented work environment were related to job satisfaction, commitment, and morale (e.g. DeJoy, Wilson, Vandenberg, Richardson, & McGrath, 2004; Lowe, Schellenberg, & Shannon, 2003).

In the present study, employees reported increases in work performance, but this is not confirmed by objective measures, a finding reported previously in Sweden on dental health care workers (Schwarz & Hasson, 2011). One plausible explanation is that participants might appreciate the provision of corporate health initiatives which may enhance their self-reported scores. In fact, when workers take more breaks, it can be expected that productivity will decrease, as their working time is shorter, on average by 20 minutes less per day. However, the results of this study and comparable results from other studies (Dishman et al., 2009; Galinsky, Swanson, Hurrell, & Schleifer, 2000; Dababneh, Swanson, & Shell, 2001) suggests that the assumption appears to be a misunderstanding, as no negative effects on productivity were found. According to the human resources manager of the participating organisation, a seasonal product mix at the production lines will also affect the actual number of outputs performed by the workers. The focus group provided evidence that the exercise intervention did not seem to interrupt workflow.

The present study did not show any improvement in sickness absence rates, which is comparable to other studies in Nordic countries (Blangsted et al., 2008; Nurminen et al., 2002). However, the findings are based on a small sample, and the

workers in this study had a low sickness absence rate at baseline. More than 97% of study participants took no sick absence or less than 9 sick days in a year. Findings might be explained by a 'ceiling effect', i.e. a large concentration of participants scored at, or near, a distinct upper limit (Wang, Zhang, McArdle, & Salthouse, 2009). China, unlike many Nordic countries, such as Sweden and Norway, does not seem to have a high prevalence of sickness absence among the working population (Selander & Buys, 2010; Krane et al., 2014).

The discrepancies might be caused by differences in culture and individual or job characteristics of the study population. A recent study for blue-collar workers (n=2,737) recruited from 13 companies in one of the most populous provinces of China (Henan) indicated that a large percentage (84.5%) of Chinese workers did not take sick leave after reporting musculoskeletal disease during the preceding year (Yu et al., 2015). Another plausible reason is that this study population received no pay for sickness absence which may have discouraged them from taking time away from work irrespective of the availability of the intervention. The lack of sickness benefits was found to have a major impact on the use of sickness absence by blue-collar workers with low salaries as these employees were most vulnerable to loss of income (Aaviksoo & Kiivet, 2014). More work in future studies is needed on this outcome measure by at least comparing self-reported data with company records (van Poppel, deVet, Koes, Smid, & Bouter, 2002).

Study strengths

Results showed that the exercise adherence rate was 90% and the attrition rate was 5%. Compared with other similar

studies, the adherence rate ranged from 31% to 86% (Pedersen, Andersen, Jorgensen, Søgaard, & Sjøgaard, 2013) and the attrition rate varied from 9.2% to 10% (Malik, Blake, & Suggs, 2013). It is not only these exceptionally high adherence rates and low attrition rates that help strengthen the study's internal validity, they also indicate the potential for its implementation in a small factory setting. Low adherence and high dropout rates are common in exercise research, although it should be noted that Chinese culture, especially blue-collar workers, tend to put considerable reverence for authority in the Chinese organisational setting (Chan & Qiu, 2011). Regarding this intervention design, the opportunity to exercise during breaks is mandatory but participation is voluntary. Interventions that encourage participants to take exercise breaks and rely less on individual initiatives to be active may have a greater public health impact (Yancey et al., 2004). This result is particularly encouraging since all exercise sessions were peer-led with minimum external influence from the researcher. The exercise modality, including the exercise mode, frequency, and duration were well received by the participants based on the evaluation through the focus groups. Above all, these results provide useful data that allow for better understanding of the potential influence of an exercise intervention in China which currently has a limited evidence-base.

IPAQ measured physical activity in all domains and the findings indicated improvement both in the workplace and outside, i.e. spillover effect (Taylor, 2005; Taylor et al., 2010). Spillover effect is a positive association between activities done in and out of work, whereby doing physical

activity during work makes one more likely to also do physical activity outside work. Meanwhile, there is a contrasting theory known as 'compensation effect' suggesting that doing physical activity during work makes one less likely to do physical activity outside work (Del Duca et al., 2013). Support for both theories has been mixed because of variation in study design, population, and measures. A recent study using objective measurement found strong positive associations between weekly physical activity during work and outside work, especially among women (Jaka, Haapala, Wolfson, & French, 2015). In the present study, both quantitative and qualitative data show the potential of moving predominantly sedentary workers to have an exercise experience that might translate to the lifestyle outside the workplace. However, the findings are exploratory and need to be tested in a rigorously designed randomised trial with longer-term follow-up to investigate whether any potential behavioural changes are sustained over time.

Leading by example is perceived as the best way for management to demonstrate its support in building a positive workplace health promotion climate (Della et al., 2010). In this study, the commitment of on-site team leaders was manifested in role modelling by participation in group exercise sessions. Qualitative study results indicated that employees appreciated management for allowing them to take frequent group exercise during paid hours. Accessibility, management support, and social interaction are factors associated with feasibility in this intervention. Group activity facilitated by co-workers seems to encourage social support and camaraderie (Taylor, 2005).

Another thought-provoking finding was the type of beneficial outcomes participants reported obtaining from this exercise experience. Traditionally, work breaks practice emanates from an avoidance mindset devoted to combating work-related stress and inactivity from prolonged sitting (Tucker et al., 2011). This intervention approach provided a unique focus on peer-led and structured group Qigong exercise breaks during each workday. Participants found it fun and enjoyable. This engagement mindset (Csikszentmihalyi, 2008; Taylor, 2005) is quite evident in the theme identified in the focus group. Additional research can assess further the influence of social support for this intervention or the extent to which this intervention has without a mandatory group context. To follow-up with behavioural change sustainability of this exercise intervention, the researcher discussed the issue with the HR manager in the participating organisation two months after the intervention. The organisation planned to cascade the "Healthy Exercise" initiative to all departments, including employees in the general office and production line (n=129) in the watches factory.

Methodological limitations

This study focused on pre- and post-intervention comparison in a single-site cohort group to test delivery of a worksite intervention. For this reason, this study has only one experimental group which limits generalisation of the results. It purposefully employed a small sample size to test the methodology, which in turn is the major limitation. Participants were mostly female workers. Future studies would need to include both men and women to understand any gender differences. Despite the above, participants were

all young blue-collar workers that make up the majority of China's industrial workforce (Kynge, 2013). Participants' profile in this study is similar to China's economically active population range in the manufacturing industry (Ministry of Human Resources and Social Security of China, 2015). The limited research in this international setting means that the findings provide important insights for the development of future trials in this setting. This intervention lasted for three months. Despite the positive results from evaluation, studies with longer periods of intervention and post-test data of six months or a year after would provide more comprehensive results on the impact of this work health initiative (Malik et al., 2013).

Methodological challenges associated with testing interventions in real-world organisational settings are not uncommon. Justine and his team (2016), in a Mobile Telehealth, study emphasised the influence of contextual factors on the conduct of the study, including the number of study participants recruited. Another study stated challenges of diabetes prevention in the real world: Programme drift denotes deviation from protocol resulting in a reduced effect from lower intervention dose and intensity experienced by participants (Dunbar, Hernan, Vartianen, & Laatikainen et al., 2015).

In the present study, it was learned that research in China requires ample time for gaining entry to the participating organisation because priorities are different between research and real-life commercial application (Glasgow, Lichtenstein, & Marcus, 2003). Having an organisational committee to be responsible for the communication was adopted in the study

approach. In spite of vigorous efforts to maintain regular communication with the committee through emails, telephone calls, and regular factory visits, the researcher found it a challenge to administer study procedures with fidelity, i.e. intervention delivered as designed (Horner, Rew, & Torres, 2006).

Upon completion of baseline data collection, the factory manager decided to designate only a sub-group of the intervention unit, i.e. QC department to receive the intervention. Without a unique identifier for each participant, the researcher could not identify repeated measurement data from the pre- and post-intervention participants. Data were therefore treated as being from independent samples and as a proportion of the population. This approach is most likely to be overestimating the sampling error (Coolican, 2009). As a result of the quantitative methodology used, knowledge of an intervention effect is insufficient and significant difference is not fully warranted. However, a qualitative approach and a focus group could improve this aspect. According to the comments of the majority of the participants, the exercise intervention was well received. The findings thus need to be replicated in a controlled trial with a larger sample.

The study used mainly self-report measures and the results would be prone to response bias. Independently assessed measurements will allow more accurate data and comparisons of strategy efficacy across different interventions. Nevertheless, there is evidence to show that the use of pedometers or accelerometers may serve as intervention in themselves and thus contaminate the intervention results (Bravata et al., 2007; Pal, Cheng, Egger,

Binns, & Donovan, 2009). This research endeavoured to include only valid and reliable self-report measures. Moreover, objective measures in conjunction with subjective data on work performance were solicited. Although this is a single-site cohort study, and findings are yet to be tested in a large scale controlled trial, the limited research in this international setting means that the findings provide important insights for the development of future trials in this setting.

Practical implications

The significance of this feasibility study is that it has acted as a pilot test on the study procedures, instruments, and measures for exploring the potential influence on individual and organisational outcomes. An area for implementation review would be alternative timings of the breaks from the end to the middle of the shifts to disrupt prolonged sitting as suggested by some focus group participants. This feedback coincides with the focus on the deleterious effects of prolonged sitting at work in the current systematic review (van Uffelen et al., 2010). Prolonged sitting time is found to be associated with chronic diseases including cardiovascular disease and diabetes (Owen, Bauman, & Brown, 2009). On the contrary, breaks in prolonged sitting time have been correlated with beneficial metabolic profiles among adults, suggesting frequent breaks in sedentary behaviour may explain lower health risk (Pronk, Katz, Lowry, & Payfer, 2012). Therefore researchers and practitioners should consider using the breaks schedule at work as a strategy to encourage employees' change in sedentary behaviour.

Regarding study instruments, missing data on participants' age were higher than other personal demographic data. Chinese workers, especially females, might be more conservative in disclosing their exact age (Chew, Tan & Ooi, 2011). This measure item will warrant cautious use in future trials among Chinese workers.

Promoting employee physical activity and fitness may represent one component in organisational efforts to improve labour welfare and employer-employee relationships (Grawitch, Gottschalk, & Munz, 2006). Recent media coverage on the strike in Honda, the Japanese carmaker's transmission plant in Foshan, has reflected the labour trend in China (Gabbatt, 2012). Workplace health promotion by introducing exercise breaks would provide an efficient means to attend to employees' psychological and physical well-being.

Conclusion

In conclusion, this study demonstrates the feasibility of brief bouts of group Qigong exercise integrated within workday routines for workers with sedentary jobs in China. The intervention succeeded in getting the majority of workers to take regular and sustained exercise breaks over a three-month period and helped them to become more active both within and outside work. Employees perceived greater support from management and they reciprocated with positive affect towards their job. This study highlights the complexities of conducting a worksite exercise intervention in real-world settings, and contributes to a limited evidence-base on worksite exercise in China. Findings need to be tested in a large-scale randomised controlled trial.

Chapter 5

Piloting intervention under research processes

The purpose of this study was to prepare for a main controlled trial study (chapter 6). This study aimed to examine enabling factors and barriers for successful delivery of a worksite exercise intervention, pilot test the study instruments and the short Qigong exercise, as well as to solicit inputs to tailor-design the BCTs for intervention development. This chapter describes the methods, results, and discussion of a pilot study.

5.1 Methods

5.1.1 Design

Focus groups consisting of selected group of team leaders as pilot samples from the main study were used in this pilot study. A qualitative approach was adopted because this method is commonly used in healthcare research to capture participants' experience, views, and beliefs (Gill et al., 2008). To ensure the components of the main study could all work together smoothly in the same organisation, this focus group aimed to capture the experiences of team leaders who participated in pilot testing the study instruments and the exercise intervention (National Institute for Health Research (NIHR), 2016). It was also designed to identify enabling factors and barriers for successful delivery of the intervention.

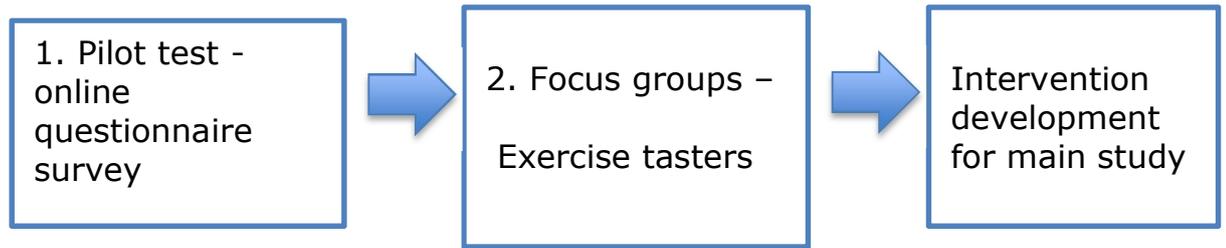


Figure 5.1 Pilot study design

5.1.2 Participants

Participants consisted of 31 team leaders (17 women and 14 men aged between 29-45 and who were majority Chinese with one Canadian). All had university education, two-thirds (74%) had more than 5 years' experience in the firm, and 84% were married. They were recruited from an insurance information technology firm in Guangzhou, China. All team leaders, including assistant general manager (AGM), assistant vice presidents (AVP), managers, assistant managers, and supervisors were eligible to participate. More than 90% of them were responsible for computer programme design and development. Team leaders in this Guangzhou worksite were invited as pilot study participants because employees in the organisation were the targeted population in the main study.

5.1.3 Materials

5.1.3.1 Participant recruitment letter

In this participating organisation, a steering committee (general manager, assistant general manager and HR manager) and an organisational committee (2 team leaders and 2 HR officers) were set up to be responsible for developing and implementing company policy on intervention marketing and communication. The steering committee sent out a

standardised open invitation letter (Appendix 5) and invited all team leaders to participate in the research via company emails. Team leaders were told explicitly in the letter that their participation was voluntary and they could withdraw from the study at any time, without giving any reason.

5.1.3.2 Online questionnaire survey

Wright (2005) conducted a review on internet-based surveys and concluded that online surveys incurred less cost in design and development. Online questionnaire surveys also allow design flexibility and real-time access for respondents to input data. Data can be automatically stored electronically, and analysis can be streamlined. On the other hand, respondents to online surveys need to have internet access. Moreover, many employees are swamped with junk mail and might easily delete messages regarding the survey.

In the early stage of intervention development in this participating organisation, senior management had already decided to have an internet-based questionnaire survey for the study because of the company's nature as an IT firm, and the online survey would align with its corporate norms for communicating with employees. Moreover, an online questionnaire survey was found to be appropriate for the pilot study and the larger controlled trial study in this organisation because it was convenient for the UK-based researcher to collect data from participants in China. All employees in the participating organisation had internet access at their workplace. To minimise on-line survey limitations, the researcher's contact email address was given to the respondents in case they had queries about the questionnaire.

Follow-up reminder emails to non-respondents were incorporated into the procedures if participants did not read the invitation for completing the survey for whatever reasons (Kropf, Neumann, Becker, & Maaz, 2015).

5.1.3.3 Focus group guide

A focus group guide (Appendix 6) was developed with the objective of developing a comprehensive picture of the factors impacting employee participation in the worksite exercise intervention. The researcher started by brainstorming a list of questions relating to the areas she was interested and some were adapted from previous literature referring to barriers and facilitators in workplace physical activity intervention (Mayer, Nuzzo, & Dagenais, 2013; Fletcher et al., 2008). Questions were organised so that they would flow logically. Early questions were more general and less sensitive than later questions (a complete list of questions was presented in the focus group guide, Appendix 6). The organisational committee involved actively in the study process by reviewing and validating the focus group guide. The researcher moderated the focus groups and asked questions such as the following:

1. Explain what are the best ways to promote employee health and well-being?
2. What are the benefits of integrating Qigong exercise breaks into work routine?
3. Describe your major concerns about this idea of a worksite exercise initiative?
4. What are your opinions on the exercise movements based on your experience in this taster session?

5.1.4. Procedures

When ethical approval (Appendix 7) was obtained from the Ethics Committee of the Institute of Work, Health and Organisations, University of Nottingham, UK, the study started in July 2012. Upon receipt of the invitation letter from the HR manager, team leaders were asked to confirm their participation interests to the organisational committee who would then follow up by sending out participant consent information sheets through intranet webpage. Team leaders responded on-line by clicking on a 'yes' button in the system to indicate their consents. All leaders (n=31) agreed to participate in the study, the participation rate was therefore 100%. High participation in this study might be attributed to the research commitment demonstrated by senior management. Senior management support is recognised as a critical success factor in workplace physical activity intervention (DeJoy & Wilson, 2009). In addition, this study required minimal commitment from potential participants, i.e. to attend a 1-hour meeting and to be free to choose the most convenient time slot from 4 predetermined focus groups.

The participants' company email list was given by the HR department to the researcher upon receipt of their consent. Each participant was assigned a unique identifier and the first part of this study regarding the online survey commenced. A questionnaire on-line via Survey Monkey was developed for use in this study. Participants were asked to complete an on-line survey questionnaire. Self-report measures of physical activity level, job satisfaction, work performance, and sickness absence were collected as a means to test the survey instrument and the study process in data collection. The

questionnaire was in English. Details of all measures have been covered previously in chapter 4, section 4.1.7, as this instrument was tested simultaneously in a feasibility study. Pilot survey data were used to clarify the design of the survey instrument and were not included in the final analysis of this study. Moreover, this pilot study will resemble the main study in many respects, including an assessment of the outcomes. Study participants will be invited again to participate in the main study.

Participants were invited to attend one of the focus groups with exercise taster sessions (Total=4 sessions). The study was conducted in a training room at the participants' workplace. Prior to the start of the study, risk assessment of the venue and facilities was conducted jointly by the researcher and an organisational committee member for safety reasons. The room was confirmed to be suitable for the study. Each meeting lasted for an hour. The researcher gave a 10-minute welcoming and orientation briefing about the purpose and content of the study to all participants. Team leaders were reminded again that participation was voluntary and they could withdraw at any time. As a taster session, the researcher led the groups to practice a full version of Qigong worksite exercise. Intervention exercises have been covered in detail previously (chapter 3, section 3.2). Participants were advised to stop the exercise immediately and report to the researcher if they felt any discomfort. No such adverse effects were reported during the study.

Participants were divided into 4 groups (n=7,7,8,9). The group size was deemed to be appropriate for discussion and sharing (Bloor, Frankland, Thomas, & Robson, 2000). Circle seating

was arranged to aim for optimal discussion among group participants (Hennink, Hunter, & Bailey, 2011). During the focus groups, participants were given the opportunity to ask questions if they needed clarification regarding specific terminology. They were encouraged to respond freely to each question. Feedback on the survey questionnaire was also collected. Participants were thanked for their responses at the end of the focus groups.

Audio-recording was used in the focus groups because the detail of participants' responses, and the language they used in talking about their experiences and perspectives could be precisely captured. Permission to voice-record the focus groups was sought from each participant via a consent form as well as before the focus group started. In cases where any participant was not comfortable with recording, detailed note taking would be undertaken by the researcher. No such case was reported in any of the study groups. Three groups were conducted in Cantonese and Mandarin while one group was in English because of a non-Chinese speaking participant. The researcher, who was fluent in Cantonese, Mandarin, and English, moderated all focus groups and maintained discussion with consistent procedure despite language differences.

5.1.5. Data analysis

In this pilot study, thematic analysis (Braun & Clarke, 2013) was used to identify themes and patterns of meaning across a focus group dataset. The researcher adopted a deductive approach in the focus group analysis. She aimed to generate an analysis from top (existing theoretical concepts) to bottom (the data); and therefore the analysis was shaped to some

extent by the researcher's theoretical interest in the topic based on previous research.

Braun & Clarke's six phases of thematic analysis (2006) were used in this study. To begin with, the researcher listened to the focus group audio recordings repeatedly, transcribed all data verbatim in Chinese and then translated into English. Translation was focused on 'conceptual equivalence' which refers to a term used in Chinese that has a comparable meaning when translated into English (Tsai et al., 2004). Conceptual equivalence also needs to address social norms in the participating organisation into the English transcribed text. For example, the Chinese health concept emphasises prevention, or the idea of Qi in Qigong exercise as an energy booster (Yang, Zhang, Tan, & Cheng, 2015).

To minimise potential effects on the quality of the data of a single person translating, an independent translator fluent in English, Cantonese, and Mandarin helped to validate the transcripts through repeated listening to all focus group recordings. In the event of any disagreement, the researcher and translator would exchange views, discuss the implications, and agree on the best translation. Some minor changes were made to develop a final version of the transcripts. For example, a leader emphasized the importance to build a proper mindset among workers. The researcher and translator spent some time to discuss and agree on the best way to interpret the meaning of a proper mindset from the participant's perspective: long hours did not necessarily mean high performance.

The transcripts, in addition to the field notes, provided the researcher with a full dataset for analysis. The researcher generated initial codes to the data systematically and collated data relevant to each code. Important recurring themes were identified and relevant data were extracted to display the relationship. The process of refining the themes was thoroughly documented until the most important themes in explaining the enabling factors and barriers were decided. A thematic map was developed showing the main themes and the coded extracts. Participants' quotations were then used to illustrate the themes. In order to keep the data anonymous, verbatim quotes were used with demographic information on only gender and general job title. Raw data, including audiotapes, written records, transcribed focus groups, and notes were stored securely (Data Protection Act, 1998).

5.2. Results

5.2.1. Focus group findings

The focus groups indicated team leaders' high receptivity to the exercise intervention and appropriateness of the selected study instruments. Two over-arching themes, section 5.2.1.1.: Enabling factors and 5.2.1.2.: Barriers and ways to overcome them, were derived from the data and their respective sub-themes are reported below.

5.2.1.1. Enabling Factors

All participants responded actively in the discussion on ways to promote employee health and well-being. Five enabling factors from the focus group data that would have impacts on employee participation were identified. These factors are listed

below in declining level of importance as highlighted in the focus groups. They were:

a) *Leading by example*

Leading by example was reported by a majority of participants as the most important enabling factor for the success of a worksite exercise intervention. To demonstrate management support, a few participants proposed the idea of having the AGM as a showcase model. *'Marson (AGM) should act as a symbol of management commitment. He will be a good showcase in the promotional video or poster.'* (Administration manager, female). In this organisation, the AGM was a local ethnic Chinese whereas the GM was a Hong Kong-born Australian Chinese. The AGM seemed to get along well with and was respected by team leaders.

The idea of 'Exercise Champion' was also raised in the focus groups. In addition to the AGM, representatives from various departments could act as role models and lead the exercise. A participant recommended *'to invite some physically active workers to act as exercise champions. They may agree to act as ambassadors to promote company health culture.'* (System analyst, female)

b) *Intervention marketing*

Intervention marketing and communication was reported as a second major enabling factor by many leaders. Participants' receptivity to the study intervention could be shown by their enthusiasm in sharing ideas on ways how to market and communicate this health initiative to the whole workforce.

The importance of bringing employees' awareness and interest was highlighted in the group discussion. *'We can package the programme as a 5- to 10-minute exercise, simple and fun to do.'* Some suggested using appealing visual aids to get attention from general staff. *'We can choose popular songs and music to go along with the exercise sessions to make it more appealing to young workers.'* (Data security service manager, female)

Many participants mentioned making use of internal multi-media such as pop-up screens and company intranet.

How about making good use of the poster stands in the corridors and staff pantry? We should put exercise promotions on i-share; i-know and i-movie (company intranet systems) that all workers can get access to. (Customer service manager, male)

c) Intervention benefits

Many participants perceived exercise positively and shared their views on the benefits of this Qigong exercise on employees' physical and mental health including muscle relaxation, stress reduction, and improved working mood. Two participants reported the benefits respectively as follows:

It helps with neck and muscle pain which seems to be common among our colleagues. (System analyst, female)

Exercise makes me feel good...more positive and energised. (Data security service manager, male)

In addition to perceived benefits to health, the researcher also found that focus group participants reported benefits to the organisation in terms of improved work performance and corporate image. A senior manager had specifically mentioned the reason why he was interested in this corporate health initiative as it would help with employees' work efficiency.

A lot of time that a programmer takes to debug a problem can be saved if he can plan and think through carefully; in simpler terms, it means to get things done right in the first place. (Senior executive, male)

Some participants reported the idea of this health initiative aligned with corporate values and that the organisation cared for the people. *'Staff would feel that we care for their well-being. It might help with stronger sense of belonging... staff retention perhaps.'* (Senior system analyst, female)

Attracting and retaining skilled workers seems to be quite salient in the IT industry in China.

d) Intervention modality

Almost all participants reported positively about the exercise modality which included exercise mode, duration, intensity, and frequency. For those who had worked in the company for more than five years, they reported previous experience in this kind of exercise practice. *'Before the company's major restructuring in 2008, it used to be under Japanese management. Every morning the GM would lead us to do morning exercise.'* (HR manager, female)

Participants' receptivity to the exercise modality was indicated also by many leaders' requests to have more varieties in the exercise routine movements, even though '*full-body movements might be restricted by limited work space*'. A female manager requested to have movements catered for the lower body below the waist because '*we sit down and work for long hours; exercise will help with our blood circulation, hopefully get my hip and legs slimmer too.*' (Solution architecture manager, female).

e) Health culture

A positive company health culture was mentioned by a few senior managers as an important factor that influenced employees' healthy behaviours. Health culture was interpreted as showing 'caring' by the organisation on the employee well-being. It might also reflect the corporate values and management commitment in promoting employee health. Despite the concept was raised specifically, no further discussion was initiated on ways to develop the company health culture.

5.2.1.2. Barriers and ways to overcome them

In contrast to overwhelming responses on the enabling factors, focus group participants reported less barriers to the success of this intervention. Three major barriers in the data were identified as follows:

a) Interruption of work flow

Although a majority of participants did not express many opinions of the barriers for the exercise intervention, one leader reported her major concern regarding potential interruption of the workflow. Considering most employees were programmers that would be required to communicate with customers over the phone, regular prompts on the desktop screens might *'disrupt an employee's chain of thought'* and *'interrupt telephone conversations with overseas clients.'* (System support manager, female)

b) Impact on the work mood

Another barrier identified in this study would be an interruption of the work mood. A leader stated that the *'employee might feel too relaxed over the exercise breaks and find it difficult to resume back to work mode swiftly.'* (System support manager, female)

Meanwhile, some participants were eager to suggest ways to overcome these potential barriers. One leader emphasised the importance to *'build a proper mindset among workers that long hours do not necessarily mean high performance.'* (Business account manager, female)

Another leader suggested that it would be an idea to *'assign exercise champions an extra role to invite participants to get back to work swiftly when the exercise routine is over.'* (Senior system analyst, male) A few participants reported the possibility of keeping exercise break times flexible which might require more of individual initiative on exercise adherence.

c) Fail to sustain behavioural change

It is a common challenge in workplace health promotion to sustain the healthy behaviours in the long-term (Jordan, Holden, Mason, & Foster, 2010). The researcher noticed some doubts in the focus groups regarding employees' sustainability in the exercise uptake through this initiative. A long-serving leader emphasised that it was important to remind target participants to be patient in building good habits in regular exercise because *'people tend to get excited for a short while due to novel ideas. They need to have patience and persistence by simply doing it every day.'* (System support manager, male)

5.2.1.3. Feedback on the survey instrument

Regarding the feedback on the survey questionnaire, many participants found the question that asked for their age to be inappropriate. Some leaders suggested that survey questionnaire for the workforce should be in both English and Chinese. To align with the company image, all leaders agreed that survey questionnaires should be completed on-line.

5.2.2. Intervention development for the main study

The intervention development in this paper was guided by the Behaviour Change Wheel (BCW) model and Capability-Opportunity-Motivation-Behaviour (COM-B) theory (Abraham & Michie, 2008). Behavioural change techniques (BCTs) based on this framework helped to inform the design of the intervention and formed the core 'active ingredients' in the intervention's development (details were presented in chapter 3, section 3.1.3). With the findings and recommendations

gathered in the pilot study, these BCTs were further developed to meet the needs of the study population in the larger trial study, i.e. chapter 6.

1. The first BCT was to provide instructions with the exercise demonstration. A series of intervention promotional videos were to be produced in-house by an organisational committee. On top of a statutory video showing the full version of the exercise routine demonstrated by the researcher, a series of videos based on exercise module sequence, such as module one on neck exercises and module two on shoulder exercises, would be demonstrated by team leaders, including AGM, managers, and supervisors respectively. This role modelling demonstration by leaders was aimed to encourage employees in exercise participation and adherence (Hodges & Franks, 2002; Crawford et al., 2004). All employees would have access to these videos on their intranet systems.

2. The second BCT was to provide prompt practice. An intervention icon in each employee's desktop computer screen was scheduled to pop up twice a day, at the same time every day: 10.50am and 3.50pm. It acted as a prompt signal to interrupt employees from prolonged sitting and perform the exercise routine (Evans et al., 2012).

3. The third BCT was to plan social support. Team leaders were nominated by the organisational committee to act as role models and motivate their members to do exercise as groups. Workplace exercise would also be incorporated into team competitions at some company events, including the sports day and annual dinner.

5.3. Discussion

This study captures the experiences of team leaders through taster sessions and examines enabling factors and barriers for successful delivery of a worksite exercise intervention for workers doing predominantly sedentary jobs in China. It also demonstrates appropriateness of the selected study instruments and high receptivity of a worksite exercise intervention by participants, thus encouraging replication with a larger sample in the organisation.

Enabling factors for the success of intervention

Study findings show that the success of worksite exercise interventions might be potentially enabled by five major factors. Engaging well-respected leaders as role-models would encourage employees to participate. The way the intervention was promoted and communicated in the organisation might be an influential factor. Moreover, the exercise intervention was perceived as beneficial to both employees and employers. Employees would enjoy better physical and mental health. Employers might benefit from improved work performance and corporate image. A 10-minute Qigong exercise modality was considered as appropriate and well-received by the team leaders. Finally, a positive company health culture would also have positive impacts on the intervention.

Participants emphasised managers leading by example as a critical factor for employee participation in worksite exercise. In this study, management commitment was manifested by having the GM and AGM involved in the steering committee of

a joint employee-management organisational committee set up for this intervention. Their image of showing support will be further enhanced if the AGM participates in the exercise promotional video or poster. Previous studies suggest that senior management's active engagement with internal marketing would make the intervention more appealing to the employees (Hodges & Franks, 2002; Crawford et al., 2004).

Some participants suggested having the exercise in small groups facilitated by co-workers who were either physically active or nominated as representatives. These 'exercise champions' might engender social support and camaraderie as mentioned in previous workplace health promotion literature (Taylor, 2005). Above all, participants' enthusiasm as demonstrated by the animated discussion and various ideas generated for communication are factors associated with receptivity of this worksite intervention.

Participants reported that the benefits of worksite exercise were not only on health, but also on work performance and corporate image. A majority of participants highlighted the benefits of exercise on muscle pain reduction, particularly on the neck and shoulders. Previous studies provide convincing evidence that long hours with computer works would lead to musculoskeletal discomfort (IJmker et al., 2007; Green, 2008). Exercise was found to be effective for patients with neck pain and its associated disorders (Hurtwitz et al., 2008). The benefit of this worksite exercise intervention was perceived to be a potential strategy to prevent and relieve MSDs among this working population.

Study findings indicated that worksite exercise breaks might help with job performance. Some studies indicated that exercise helps with concentration and thus cognitive functioning (Hillman, Erickson & Kramer, 2008; Hogan, Mata, & Carstensen, 2013). Demand on cognitive thinking in software design is deemed to be high for computer programmers (Robins, Rountree, & Rountree, 2003). The perceived benefit on job performance was reported in the focus group that triggered top management's interest and support in the intervention. Exercise breaks are therefore perceived as a good coping strategy with job demands and thus improve efficiency. Mills and his colleagues found that being part of a company's multi-component fitness programme increased self-reported productivity levels compared with a control group (Mills, Kessler, Cooper, & Sullican, 2007). Other articles however indicate contrasting results. Reviews conducted in the United States in 2009 and 2011 found mixed outcomes on work performance (Conn et al., 2009; Barr-Anderson et al., 2011). An RCT study for hospital workers in the Netherlands who participated in a Vital@Work programme with guided group sessions of yoga, aerobic exercise, and individual coaching did not show a significant difference in perceived work ability (Strijk et al., 2013). These inconsistent results might be because of different study designs and intervention components, and thus point to a need for more research to assess the effect on work performance. This finding indicates the potential influence in the changes of work performance and confirms to the researcher the need to employ this outcome measure in the main trial.

This study also reported potential benefit of worksite intervention on corporate image. Workplace physical activity promotion is often portrayed to employers as a means of supporting organisational aspirations to corporate social responsibility (Leone et al., 2015) and organisational justice (Kivimaki et al., 2003). Corporate image is a multi-dimensional variable and study reviews often recommend that researchers use open methods for exploratory analysis (Gürses & Kiliç, 2013). These qualitative findings help to inform the design of the main study that quantitative outcomes should be supported by complementary qualitative assessment.

The study result suggested high receptivity on the exercise modality among most participants, especially those who had experience in similar exercise practice within the organisation. The company used to be under Japanese management and it was part of the company culture to start every day at work with workplace gymnastics. In this study, participants found the Qigong exercise good for their mental and physical health. Some leaders requested more varieties in relation to the exercise routines which demonstrated their interest in the intervention. Evaluation on the exercise modality indicates to a great extent that this intervention will run smoothly in the main study.

It was encouraging that some leaders reported that a positive company health culture was an important enabling factor. Organisational health culture is described by Robbins and Coulter (2005) as the shared values, beliefs, or perceptions held by employees within an organisation and a positive culture will more likely have impact on employees' healthy

behaviours (Davies, 2002). Recent qualitative study results also indicated that major motivation to physical exercise at the workplace was the internal working culture and the interaction between management, employees, and the intervention (Bredahl, Særvoll, Kirkeluud, Sjøgaard, & Andersen, 2015). These findings contribute to the design and development of the main study that would cater to this working population in China.

Barriers and ways to overcome them

This study identified three potential barriers to the success of intervention: Interruption of workflow, distraction of work mood, and lack of persistence to sustain behavioural change. Previous studies suggest that simply advising people to participate in more exercise is ineffective (Hillsdon, Thorogood, White, & Foster, 2002). Periodic prompts can be an effective means to interrupt people from prolonged sitting (Evans et al., 2012). To address managers' concern on potential interruption to workflow and work mood, an exercise intervention and opportunity can be offered to the workforce, but participation is voluntary (Hopkins, Glenn, Cole, McCarthy, & Yancey, 2012). To minimise distraction of workflow, the 'architecture of choice' in the main study would allow workers to choose not to participate; or to participate in a group/individually at the workstations. This choice of implementation proved to be feasible in previous field studies (e.g. Hopkins et al., 2012; Blangsted, Sjøgaard, Hansen, Hannerz, & Sjøgaard, 2008).

This study result provides evidence that team leaders were aware of the common challenges in adherence and sustainability for this health initiative. The need to remind

target participants to be patient in building exercise habits was raised by a few leaders. Occupational health would require a collaborative effort between employer and employee. Hence employee well-being will be enhanced by mutual commitment of employer and employee (Kossek, Ozeki, & Kosier, 2001). This study result contributes to the idea of a longitudinal study design for the next stage of the main study to test if the effect on physical activity can be sustained.

Study limitations

This study was conducted in focus groups. The nature of this qualitative data collection method should be noted and thus data cannot be generalised and should not be interpreted as a representation of other settings (Fletcher et al., 2008). Semi-structured focus groups allow different opinions and views to be reflected and discussions can result in further articulation of thoughts and ideas (Kreuger & Casey, 2009). However, response bias would be caused by social desirability which might affect participants' responses to be viewed favourably by others (van de Mortel, 2008). Individual interviews might be a better option, but it will be more costly and time-consuming. The researcher as group discussion moderator has more than 20 years of work experience with different industries. A relaxed and open atmosphere was created where each participant would feel comfortable in expressing different views. In focus groups, consensus is not the goal; rather, the aim was to gather a variety of experiences (Garmy, Berg, & Clausson, 2015). Participants consisted of only team leaders. They represented managerial views and that might be different from the perspectives of general staff (Sánchez-Vidal, Cegarra-Leiva, & Cegarra, 2012). Including general workers in the pilot study would have a wider sampling coverage from the

organisation. Nevertheless, the present study wanted to capture team leaders' experience and thus commitment to the study so that the delivery of a worksite exercise intervention could be tested. The subsequent main study would cater for the whole workforce in the same organisation, including both leaders and general workers.

The same researcher who conducted and transcribed the focus groups, translated the transcripts and presented the result based on thematic analysis; therefore, potential bias could not be neglected. The concept of reflexivity was vital for the researcher to reflect on, learn from, and move beyond the presumptions and inadvertent 'biases' in her research (Braun & Clarke, 2013). To counter this, the researcher undertook critical reflection, both before and during the research process. She had insider status that shared some group identity with study participants (e.g. a chinese researcher conducting research on chinese workers). At the same time, she had outsider status when her identity was different (e.g. a postgraduate researcher from a UK university). From this perspective, subjectivity and bias are taken into consideration (Sutton & Austin, 2015). As a result, planning and organisation of the meetings was carefully done and documentations were properly kept, including transcripts, recordings, and field notes (Maxwell, 2005). Despite all focus group recordings and transcripts being validated by an independent translator, when data was analysed, caution was given in generalised findings.

Study significance

This study has acted as a good pilot test of the survey instruments and measures. The exercise modality, including

the exercise mode and duration, was well received by the participants based on the evaluation through focus groups. This form of Qigong exercise was accepted as beneficial for relaxation and reducing muscle pain. Moreover, the present study provided a good opportunity for the researcher to have a better understanding of the study population and organisational culture, both of which are prerequisites in leading to the successful delivery of the main study in the same organisation (Robbins & Coutler, 2005). Moreover, by involving team leaders in this preliminary stage of study, and incorporating their ideas in the intervention, development, and communication, the researcher aimed to secure their commitment prior to the main study. In this IT firm, a leader normally supervised a team ranging from 5 to 15 workers in the same workplace. Leadership support has often been considered as one of the key success factors in workplace physical activity intervention (CDC, 2013). Commitment from team leaders might help with recruiting participants and sustaining behavioural change in the main study.

Conclusions

This pilot study succeeded in getting all team leaders to take part in exercise taster sessions and focus groups. The key processes of the main study were pilot tested, including on-line data collection, outcome assessment, and intervention component. Evaluation showed that on-line questionnaire surveys were appropriate. Short Qigong exercise was considered as a proper component in this intervention. This worksite intervention was perceived as beneficial for health, work performance, and corporate image. Study findings suggested engaging leaders as role-models, intervention marketing, and a positive health culture were reported as

potential facilitators whereas interruption to work and behavioural change unsustainability were reported as potential barriers to the success of intervention delivery. Most important of all, the present study contributes ideas for tailor-making the exercise intervention design and development for workers performing sedentary jobs in China that would aim to encourage employees to participate and become more physically active.

Chapter 6

Main study - Effectiveness of a worksite exercise intervention

Two previous studies (feasibility study: chapter 4 and pilot study: chapter 5) have demonstrated the feasibility of integrating exercise breaks into the work schedule as a strategy to promote worker health in China. This main study aimed to investigate the effects of a worksite exercise intervention for Chinese workers doing sedentary jobs on employees' physical activity and work-related outcomes. This chapter describes the methods, results, and discussion of a main study.

6.1 Methods

6.1.1. Design

This study was a field quasi-experiment with repeated measures: 2 (tests: Before and after intervention) X 3 (outcomes: Physical activity, work performance, and sickness absence). A waitlist controlled trial study was performed, including one intervention group and one waitlist control group. Questionnaires were collected at baseline, after three months and at 12-month follow-up.

6.1.2. Participants

Participants were recruited from an insurance information technology service firm with sites in Guangzhou and Beijing, China. At the time of the study, a total of 690 workers were employed. They were predominantly local Chinese with more

than 80% university graduates aged from 25 to 40. About 75% of them worked as IT programmers and they were required to communicate with clients in English. Another 25% were data input operators and administrative staff.

Study locations were assigned by the management of the participating organisation: Guangzhou as intervention group and Beijing as waitlist control group. The study population in these two cities was chosen because their profile was similar to the economically active working population in big urban cities in China (National Bureau of Statistics of China, 2015) so that future studies could be replicated in similar settings. To minimise potential site biases, worksites were matched in the same organisation, sharing exactly the same tasks, work methods, and procedures, and were under the management of the same head office. This study's sites matching approach had been successfully used in previous studies with the objective of keeping the study population homogeneous (e.g. Van den Heuvel, de Looze, Hildebrandt, & Thé KH Affiliation, 2003; Dishman, DeJoy, Wilson, & Vandenberg, 2009).

6.1.3. Procedures

The study was approved by the Ethics Committee, Institute of Work, Health and Organisations, University of Nottingham (Appendix 8). To begin the intervention recruitment process, the HR department sent out a standardised open invitation letter (Appendix 9) to all employees in the two study sites and invited them to participate in this health initiative via the company intranet webpage. Employees were required to confirm their interests by using a dichotomous 'yes' or 'no' response option through the webpage. The organisational

committee (committee formation was reported previously in the pilot study, chapter 5, section 5.1.3.) followed up by distributing participant consent information sheets to all potential participants through a specific company intranet webpage designed solely for this intervention. Potential participants were informed that their participation was voluntary and that they might withdraw from the research at any time. Meanwhile, they had to confirm their consents by clicking on a 'yes' button through the intranet system. At this stage, the HR officer transferred a participant's list with their names and company emails to the researcher. Each participant was assigned a unique identifier and was treated confidentially in all analysis by the researcher (Data Protection Act, 1998).

To demonstrate senior management commitment in this study, the general manager and HR manager conducted a 30-minute orientation and motivation briefing session to all team leaders, face-to-face in the intervention site (n=31) where their offices were located, and through video in the waitlist control group study site (n=25) before the interventions began, using standardised materials as covered in the open invitation letter. Baseline data were collected through on-line survey questionnaires in March 2013. The number of employees who participated in the baseline study was 276. The participation rate was 40% of the total population. According to a recent literature review, the average participation rate of workplace physical activity intervention programmes was 33% (Robroek, van Lenthe, van Empelen, & Burdorf, 2009). This study had an above average participation rate.

Interventions were from April to June 2013 for the intervention group and from August to October 2013 for the

waitlist control group. This length of time has been found to be appropriate for short exercise interventions based on the feasibility study results (chapter 5) and has been used in other successful interventions aimed at encouraging behavioural change (Barr-Anderson et al., 2011; Dishman et al., 2009). The time lag between the two experimental groups receiving interventions was chosen because studies with similar designs often arranged the waitlist control groups to start interventions once the experimental groups had completed the follow-up assessments (e.g. Hall, Maher, Latimer, Ferreira, & Lam, 2009; MacMillan et al., 2011). Participants were reminded that exercises should be done gently and smoothly in the consent forms, as well as by their respective team leaders in the exercise sessions. They were advised to stop the exercise immediately and report to the HR officer if they felt any discomfort during the study period. No such adverse effects were reported during the study or after.

The post-intervention survey for both experimental groups was in July 2013. The percentage loss to post-intervention follow-up was 26% at the intervention site and 12% at the waitlist control site. Compared with other similar studies, the attrition rate varied from 9.2% to 10% (Malik et al., 2013), this study has a high attrition rate. The researcher tried to minimise the percentage loss for the on-line questionnaire surveys in the present study by sending out reminder emails to all non-respondents 2 weeks and 4 weeks after baseline and post-intervention data collection starting. These reminder emails were considered as good practice to increase the response rate because participants might not have received the earlier emails or delayed responses because of a number of reasons (Kropf, Neumann, Becker, & Maaz, 2015; Pit, Vo, &

Pyakurel, 2014). For example, participants might have considered the researcher's emails as junk mails and deleted them before reading.

In addition to pre- and post-intervention comparisons, a longitudinal study was conducted 12 months after baseline measurement. A previous literature review suggests that the length of follow-up study should be maintained 6 to 12 months after the end of intervention to assess the effect stability (Malik et al., 2013). The post-intervention data of 12 months were collected in this study because it would provide a more comprehensive result on the long-term sustainability of this health initiative. The schedule of the assessment is schematically represented below in Figure 6.1.

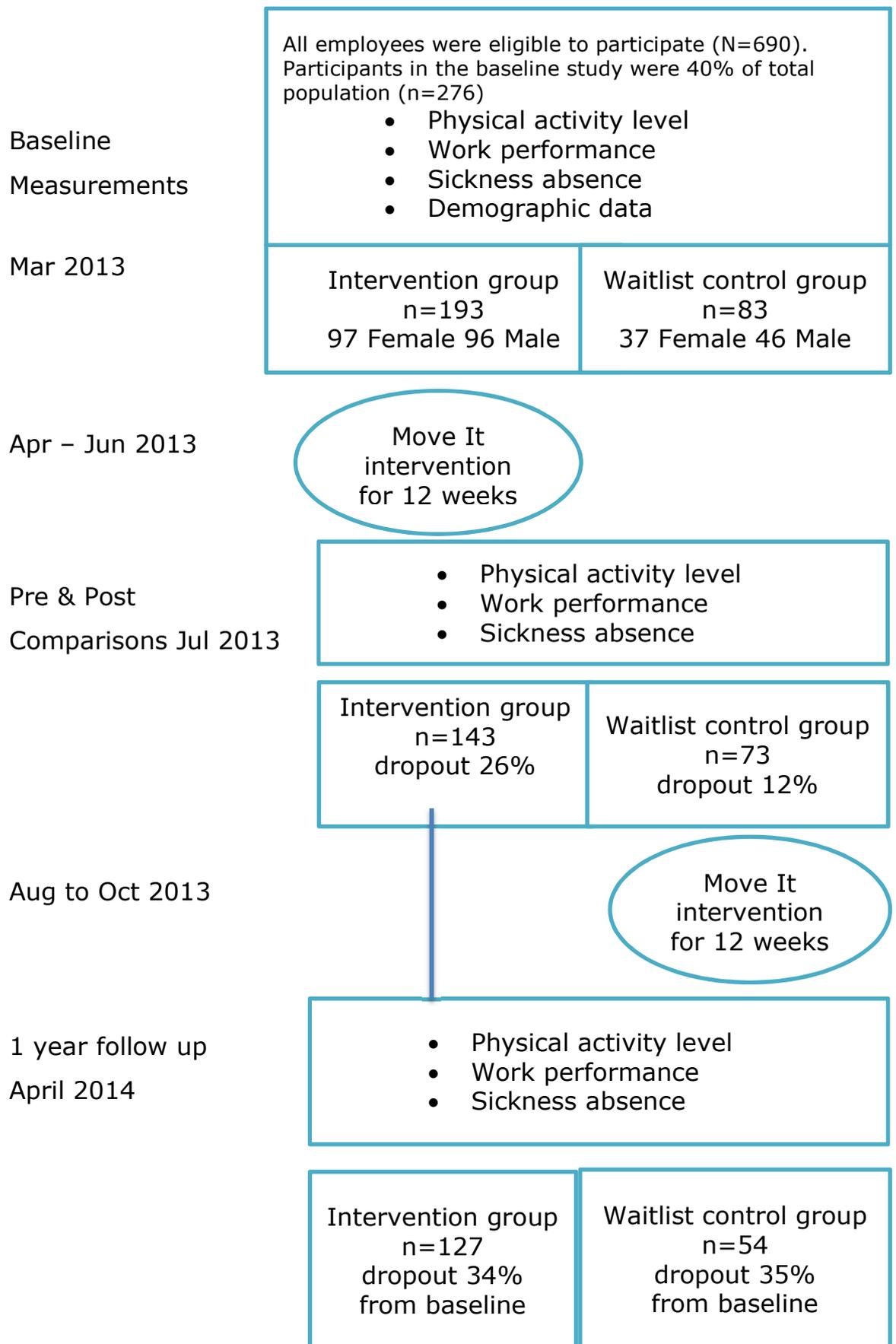


Figure 6.1 Time frame of the study measurement

6.1.4. Interventions

The interventions involved a 10-minute Qigong exercise session delivered at set exercise break times for 12 weeks (intervention development had been presented in detail in chapter 3, section 3.2) The organisational committee of this participating organisation branded the intervention as “Move It 動起來”. To align with a clear branding and communication strategy which seems to lead to better success in workplace physical activity intervention campaigns (e.g. Asbury et al., 2008), a visual logo and selected images were utilised on promotional posters. Since the participating organisation was an IT firm with skills and resources to produce appealing visual aids in multi-media, a dedicated webpage and promotional videos were developed by the organisational committee for the interventions. Examples of visual layouts for electronic consent, promotional videos, and pop-up windows in participants’ desktop computers are provided in Figure 6.2.

Team leaders (n=31 in intervention group; n=25 in waitlist control group) were nominated by an organisational committee to motivate co-workers and modelled the sequence of movements during each exercise break session. They attended a 1-hour train-the-trainer session conducted by the researcher in the training room at their office building prior to the intervention starting. Moreover, the pilot study results helped to inform how the intervention can be tailor-designed for this study population. The first BCT, i.e. to provide instructions with the exercise demonstration, was incorporated into this intervention development (operationalisation of this BCT was presented in Chapter 3, table 3.2. & Chapter 5, section 5.2.2.) The researcher video-recorded a demonstration

of this exercise routine, which was a total of six episodes based on exercise module sequence (this sequence was presented previously in chapter 3, section 3.2.) and the organisational committee downloaded the videos via the company intranet. The videos lasted for 10 minutes and all employees had access to them during the intervention period.

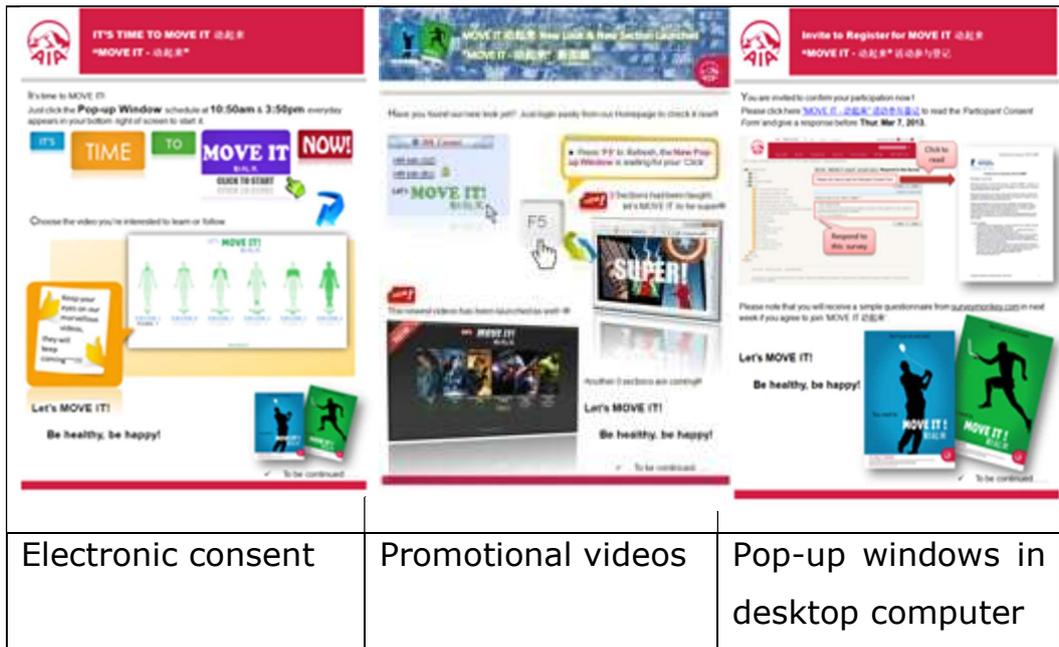


Figure 6.2 Selected images on electronic consent and promotional materials for “Move It 动起来”

6.1.4.1. Intervention group

The second BCT, i.e. to provide prompt practice, was developed to meet the needs of this study population (operationalisation of this BCT was presented in Chapter 3, table 3.2. & Chapter 5, section 5.2.2.). A “Move It” icon in each employee’ desktop computer screen was scheduled to pop up twice a day, at the same time every day: 10.50am and 3.50pm. It acted as a prompt signal to interrupt employees from prolonged sitting and perform the exercise routines.

Intervention design needs to take into consideration the job nature of the study participants (Bale, Gazmararian, & Elon, 2015). Since 75% of the study population were computer programmers and worked on project management, they were frequently involved in conference calls with clients. The intervention design allowed them to choose to participate in a group or individually at the workstations. They might do the exercise routines led by their respective team leaders. Moreover, a computer-based system was designed by the organisational committee to record individuals' exercise adherence automatically once they clicked on the screen icon. This interactive system provided useful data for analysing participants' adherence rate.

Team leaders in the intervention site, including the assistant general manager, managers, and supervisors acted as demonstrators in the exercise promotional videos. The videos included six episodes of exercise, each lasting for two minutes. These promotional videos were downloaded in the company intranet by sequence, one episode every two weeks and therefore six episodes for 12 weeks throughout the intervention period. This idea of getting team leaders involved in intervention promotion was generated by pilot study focus groups. This intervention item was developed based on the third BCT, i.e. to plan social support (operationalisation of this BCT was presented in Chapter 5, section 5.2.2.). All employees in the intervention site had access to these videos on their intranet "Move It" webpage.

6.1.4.2. Waitlist control group

Participants in the waitlist control group received the exercise intervention once the intervention group had completed. It served the purpose of providing an untreated comparison for the active treatment group, while at the same time allowing the waitlisted participants an opportunity to obtain the intervention (e.g. Brown, Barton, Pretty, & Gladwell, 2012; Hall et al., 2009). A tailor-made set of exercise promotional videos was produced by the organisational committee for the waitlist control group. To align with the same rationale behind this intervention development, the videos involved team leaders from the waitlist control site in the exercise demonstration and the intention was to engage participants with familiar faces of their own management team. The waitlist control group started the intervention when both sites finished the post-intervention questionnaire survey.

Photographs of a typical exercise session in the office setting are provided in Figure 6.3 below.





Figure 6.3 A typical exercise session in the office setting

6.1.5. Measurements

Participants were asked to complete an on-line survey questionnaire (Appendix 10) via Survey Monkey. Demographic data (gender, age, marital status, and length of time working for the company) were collected at baseline measurement. Standard self-report measures of physical activity level, work performance, and sickness absence were collected at baseline, at the end of intervention, and a year after the baseline (All measures were presented in detail in chapter 4 section 4.1.7). All survey items were in Chinese and English. The English version of the survey instrument had been tested previously in the pilot study for the same organisation (chapter 5) and the Chinese version in the feasibility study (chapter 4).

6.1.6. Data analysis

Data were entered using IBM SPSS Version 22.0 and 100% data check was conducted. Preliminary data, including the outcome variables and demographic background variables, were screened by frequency distribution, charts, and descriptive statistics. A *Kolmogorov-Smirnov* test was applied

to confirm whether the data were normal. The outcome variables, including physical activity and work performance, were not in normal distribution. The data were log transformed by $\log(X_i+1)$ so that the right tails of the distribution and positive skews were reduced. Transforming the data was chosen to correct the problem with the non-normal distribution of scores because it would not change the relationships between variables. In other words, the relative differences between participants before and after intervention stay the same (Field, 2005). As a result of the log transformation of the data, the analysis was carried out on the rankings. High scores were represented by larger ranks and low scores represented by small ranks.

The 12-month follow up survey data were not included in the pre- and post-intervention comparison between the two experimental groups. This study design was a waitlist controlled trial with repeated measures and not a waitlist cross-over. A cross-over design is repeated measurement design that the study participants cross over from one treatment to another and serve as their own controls during the study period (Piantadosi, 2005). In this real-world organisational setting, when the waitlist controlled group started the intervention, it was virtually impossible to take out the treatment from the intervention group. Despite the above limitation, the longitudinal data on the physical activity level were reported at the end of the results section for the readers who might be interested in exploring further if the behavioural changes could be sustained in this organisation.

A mixed between-within subject analysis of variance was conducted to assess the impact of an exercise intervention on

participants' scores on their physical activity and work performance across two time periods. The non-parametric Kruskal-Wallis test was chosen because it allowed one to test the design of one between group (pre-intervention and post-intervention) and two repeated (physical activity and work performance) measures. A Wilcoxon signed-rank test was used to examine if the comparisons for repeated measures variables were significant. A Chi-square test was used to analyse physical activity level changes (in categorical score) and sickness absence. Two-tailed tests were used in the analysis. Previous literature review results indicated that the effects of workplace exercise intervention on individual and work-related outcomes were inconclusive (Chapter 2, section 2.1.3.). Hence, the direction of the effect in this experiment was not predicted by the researcher. In the Wilcoxon signed-rank *T*-statistic, medians and their corresponding ranges were recommended to be used in reporting the results (Field, 2005).

Prior to the analysis, all background and outcome variables were evaluated for statistical outliers. In the intervention group, 4 (0.02%), 5 (0.04%) and in the waitlist control group, 7 (0.08%), 5 (0.07%) outliers were revealed in physical activity variables at pre-test and post-test periods. Since there was no good reason to suggest that these outliers were not from the population that the researcher intended to sample, these cases were not removed from the data set. Log transformation was used to correct the outlier problems (Field, 2005).

Missing data occurred because of two reasons. Participants provided no response or a partial response to the surveys at baseline and after intervention. This missing data affected the

survey from a cross-sectional point of view. Missing data were also caused by attrition. No detailed analysis on attrition rate was done because participants were informed that they could withdraw from the research without giving any reason. Nevertheless, the organisational committee reported that participants dropped out because of resignation, holidays, or a loss of interest in the study.

Statistical analysis of the study was conducted on available-case analysis. All data available were maximised by an analysis-by-analysis basis. The strength of this method is that it increases power in the analysis. This method tends to produce a standard of errors that are underestimated or overestimated (Coolican, 2009).

6.2. Results

6.2.1. Sample analysis

The sample consisted of 276 workers in the intervention and waitlist control groups. A demographic analysis was conducted to examine whether there were any differences between the characteristics of the two groups. The groups were evenly balanced in terms of gender, age, and work experience in the firm. Kruskal-Wallis test analysis result also indicated no significant difference between the two groups on physical activity levels at baseline ($H(1)=0.143, p<.05$) and post-intervention measurements ($H(1)=0.285, p<.05$).

There were significant differences in education and marital status among the participants in the two worksites. More participants in the waitlist control group had attended

university (99% compared with 87%) and were married (75% compared with 61%). Kruskal-Wallis test analysis result also showed that two groups were not balanced in their work performance scores at baseline and post-intervention. Participants in the waitlist control group reported significantly higher performance than the intervention group at baseline, $H(1)=16.45$, $p<.001$ and at the post-intervention, $H(1)=8.93$, $p<.05$. Table 6.1 shows the sample characteristics at baseline.

Table 6.1 Sample characteristics at baseline

Variables	Intervention Group		Waitlist Control Group	
	Number (n=193)	%	Number (n=83)	%
Gender				
Female	97	50.3	37	44.6
Male	96	49.7	46	55.4
Marital Status				
Single	58	30.1	19	22.9
Married	118	61.1	62	74.7
Neither of the above	17	8.8	2	2.4
Age				
Less than 20	2	1.0	0	0
21-30	93	48.2	34	41.0
31-40	85	44.0	43	51.8
41-50	13	6.7	6	7.2
Education				
University or above	168	87.0	82	98.8
College but no degree	20	10.4	1	1.2
High school or equivalent	5	2.6	0	0
Experience				
Less than 1 year	24	12.4	9	10.8
1 – 3 years	72	37.3	41	49.4
4 – 5 years	26	13.5	5	6.0
5 – 10 years	54	28.0	17	20.5
Over 10 years	17	8.8	11	13.3

6.2.2. Physical activity

Kruskal-Wallis test results showed that both groups had an increase in physical activity scores from baseline to post-intervention. The increase for the intervention group was not significantly higher than the waitlist control group, and therefore the between-group effect was not significant.

Besides, the within-subject increase in physical activity scores in the intervention group from baseline (Mdn=924; IQR=462-2079) to post-intervention measurement (Mdn=1257; IQR=570-2346) was significantly higher, $T(3924)$, $p < .05$, $r = .17$. But the within-group effect in the waitlist control group did not indicate significant increase. Table 6.2 shows a comparison of physical activity levels for intervention and waitlist control group at baseline and at post-intervention.

According to the guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ Research Committee, 2005), the physical activity in a continuous variable was converted into a categorical score. Participants were classified into three levels of physical activity: Low, moderate, and high. Results indicated that both intervention and waitlist control groups reported significant increases in physical activity categorical scores immediately after the intervention and one year after baseline. However, the intervention group increase from baseline to post-intervention was not significantly higher than the waitlist control group increase.

A chi-square analysis of the difference between baseline and post-test result in the intervention group was significant, $\chi^2(4,$

N=142)=23.18, $p < .001$. The result analysis in the waitlist control group also showed significant differences between baseline and post-test results, $\chi^2(4, N=73)=10.37, p < .05$. Table 6.3 shows a comparison of physical activity levels (in categorical score) for both experimental groups at baseline and at post-intervention.

Table 6.2 Comparison of physical activity levels for intervention and waitlist control group at baseline and at post-intervention

		Baseline	Post-intervention	<i>p</i> -value, two-tailed test
Intervention Group	Number	191	143	
	Mean	1322.58	1639.27	
	Median	924.00	1257.00	<.05
	Percentiles			
	25	462.00	570.00	
	50	924.00	1257.00	
	75	2079.00	2346.00	
Waitlist Control Group	Number	86	73	
	Mean	1113.43	1614.60	
	Median	693.00	847.50	<.05
	Percentiles			
	25	381.75	255.75	
	50	693.00	847.50	
	75	1396.50	2352.00	

Table 6.3 Comparison of physical activity levels (in categorical score) for intervention and waitlist control group at baseline and at post-intervention

Physical Activity at	Intervention Group		Waitlist Control Group	
	Number	%	Number	%
Physical Activity at baseline				
High	31	16.2%	8	9.3%
Moderate	91	47.6%	43	50.0%
Low	69	36.1%	35	40.7%
Physical Activity at post-intervention				
High	36	25.2%	17	23.3%
Moderate	66	46.2%	30	41.1%
Low	41	28.7%	26	35.6%

6.2.3. Work-related outcomes

Results showed that the main effects for intervention on work-related outcomes were not significant. No significant changes were observed in work performance scores for the intervention group from baseline (Mdn=7) to post-intervention (Mdn=7) and for waitlist control group from (Mdn=8) to (Mdn=8). Table 6.4 shows a comparison on work performance for intervention group and waitlist control group at baseline and post-intervention.

Table 6.4 Comparison of work performance for intervention and waitlist control group at baseline and at post-intervention

		Baseline	Post-intervention
Intervention Group	Number	188	142
	Mean	6.90	6.94
	Median	7.00	7.00
	SD	1.42	1.54
Waitlist Control Group	Number	84	71
	Mean	7.63	7.52
	Median	8.00	8.00
	SD	1.41	1.76

No significant difference was observed in sickness absence in both the within-group and between-group effects. Table 6.5 shows a comparison on sickness absence for intervention group and waitlist control group at baseline and post-intervention.

Table 6.5 Comparison of sick absence for intervention and waitlist control group at baseline and at post-intervention

		T1 Intervention Group	T2	T1 Waitlist Control Group	T2
None at all	Count	45	33	17	19
	%	23.9%	23.2%	20.2%	26.8%
At most 9 days	Count	127	97	61	45
	%	67.6%	68.3%	72.6%	63.4%
10-24 days	Count	16	10	5	6
	%	8.5%	7.0%	6.0%	8.5%
25-99 days	Count	0	2	1	1
	%	0.0%	1.4%	1.2%	1.4%
100-365 days	Count	0	0	0	0
	%	0.0%	0.0%	0.0%	0.0%
Total	Count	188	142	84	71
	%	100%	100%	100%	100%

Abbreviations: T1- baseline; T2 – post-intervention

6.2.4. Exercise adherence

An objective exercise adherence measure was used by an interactive computer-based system. Individual daily exercise frequency was recorded automatically once they clicked on the screen icon. However, the system did not show accurate data for two reasons. Some participants did not 'click' into the computer during exercise routines. Another reason was that participants practised as a group and only one of them clicked into the system. Notwithstanding the system design limitation,

data indicated a declining adherence rate along the intervention period.

6.2.5. 12-month follow up

A 12-month follow up survey results showed that physical activity scores of the intervention group had increased when compared with baseline (Mdn=924) and a year after (Mdn=1352). Waitlist control group had also shown increase from baseline (Mdn=693) to 12 months after (Mdn=783). Larger improvement was found in the intervention group than the waitlist control group. Table 6.6 shows a longitudinal comparison of physical activity levels for the intervention and waitlist control group.

Table 6.6 Comparison of physical activity levels for intervention and waitlist control group at baseline, post-intervention and 12 months after

Group		N	Median	Mean	SD
Intervention	T1	191	924.00	1322.58	1180.99
	T2	143	1257.00	1639.27	1503.13
	T3	127	1352.00	1527.29	1229.44
Waitlist Control	T1	86	693.00	1113.43	1149.14
	T2	73	847.50	1614.60	1835.30
	T3	54	783.00	1453.16	1715.92

Abbreviations: T1- baseline; T2 – post-intervention; T3 –12 months after baseline

6.3. Discussion

To the researcher's knowledge, this study is the first to examine the effectiveness of Qigong worksite exercise as incorporated into daily work routines for workers performing sedentary job roles in China. Results indicated that participants in both groups reported higher physical activity from baseline to post-intervention, with the greatest change evident in those that received the intervention. This finding is comparable to the result of an employee wellness programme in South Africa which revealed some improvements in individual physical activity, but no significant differences were found between the treatment groups (Edries et al., 2013). The result is also consistent with findings of a recent systematic review and meta-analyses from 2006 to 2012 that 2 out of 4 reviews evaluating exercise interventions did not show evidence for an increased amount of physical activity (Schröer et al., 2014). In addition, some previous reviews summarising the literature promoting physical activity suggests that multi-component interventions, which include exercise, health education, counselling, stress management, and/or a combination of all, are more effective in increasing PA than single-component interventions (e.g. Schröer et al., 2014; To et al., 2013; Robroek et al., 2009). In fact, most study settings were in large organisations or the public sector, and only a few published reports addressed the effect of worksite exercise as a single component in the intervention (Dugdill et al., 2008, Barr-Anderson et al., 2011). This study, which assesses the effect of exercise as a single component in an office setting, will help to expand knowledge of its effectiveness at promoting workplace physical activity.

In the present study, overall improvements in both experimental groups may be a result of the Hawthorne effect, by which participants feel and behave differently since they are aware of being involved in an experiment (Draper, 2014). By making employees feel respect and care with the provision of a workplace health initiative, they may reciprocate with positive responses to individual behaviours. Previous studies have also found the kind of intervention received by the control group comparable with the use of placebo with respect to increased physical activity (Crum & Langer, 2007). As in all field experiments, it is difficult to avoid interpersonal communication, and therefore group contamination (Torgerson, 2000), despite the fact that a design with different sites was intended to improve the internal validity. Studies with longer-term follow-ups would help to investigate whether the difference between two groups becomes more apparent. A follow-up survey was conducted 12 months after the baseline measurement in this study. The intervention group did show larger improvements than the waitlist control group. Above all, this study demonstrates the feasibility of a worksite exercise intervention in China which currently has a limited evidence-base.

Results showed that using short bouts of Qigong exercise breaks twice a day for IT workers at their worksite did not improve perceived work performance. The present study adds to a few published reports addressing the effects of workplace exercise on employees' productivity in the recent systematic reviews (e.g. Pereira et al., 2015; Rongen et al., 2013). One plausible reason for the result on work performance was a 'ceiling effect'. Because of the multi-factorial nature of the

work performance, which can be influenced by individual characteristics and other work-related factors (Ilmarinen, 2007), it is not surprising to observe that changes are not easily attained by worksite exercise interventions in a population that has a relatively high baseline rating. Nevertheless, the trend for studies showing the effect of exercise interventions is promising. Three RCTs carried out in Denmark in recent years reported significant improvements in perceived work ability for the intervention group compared with the reference group from baseline to follow up (Jakobsen et al., 2015; Andersen et al., 2015; Sundstrup et al., 2014). One has to note that workplace exercises in these studies were conducted as components of more comprehensive interventions which included individual coaching sessions and tailored physical training supervised by physiotherapists. Further investigation is needed to examine the sole effect of a worksite exercise intervention on work performance.

The present study did not show any improvement in sickness absence rates, which is comparable to the findings of interventions delivered in the western world (e.g. Andersen et al., 2015; Strijks et al., 2013). This result lends evidence to the researcher's current literature review that workplace exercise shows little effect on sickness absence at both review-level (chapter 2, section 2.1.3.2) and empirical study-level (chapter 2, section 2.1.3.4). On the other hand, findings might be explained by a 'ceiling effect'. More than 90% of the study participants took none or less than 9 sick days in a year, and therefore the sickness absence rate was very low at baseline. China, unlike many Nordic countries, such as Sweden and Norway, does not seem to have a high prevalence of sickness absence among its working population (Selander &

Buys, 2010; Krane et al., 2014). This study, examining intervention effects on work-related variables, contributes to a paucity of research in this area. In the future, proximal measures such as job satisfaction, organisation commitment, and work engagement that might indicate direct effects of intervention on participants warrant further investigation (Lowe, Schellerberg, & Shannon, 2003; Somers, 2010; Torp, Grimsmo, Hagen, Duran, & Gudbergsson, 2013).

Study strengths and limitations

This study found an above average participation rate, a declining exercise adherence rate, and high attrition rate. The participating organisation's senior management incorporated the Qigong exercise routines in the regular team briefing sessions at the introduction stage. That might have accounted for the high participation rate and high initial level of exercise adherence through leading by example (Tucker et al., 2011). As management commitment diminished, and employee enthusiasm waned, both factors might have led to reduced interest in participation. Moreover, objective data indicated declining adherence rates resulting in a lower dose of the interventions that might be needed for attaining significant effects (Jørgensen et al., 2010). Although low adherence and high dropout rates are not uncommon in exercise research, the high attrition rate observed in this study may be related to organisational factors. A number of unanticipated changes occurred during the intervention period, including the change of GM and job re-structuring. Besides, the 'architecture of choice' in this worksite intervention gave participants freedom to choose how to participate. This choice of implementation proved to be relevant in the western studies (e.g. Hopkins et al., 2012; Blangsted et al., 2008) and requires further

investigation and probably modification in China. Chinese culture puts emphasis on group conformity (Bains, 2015). Additional research can further assess the influence of social support with a mandatory group context that would warrant a higher adherence rate. Successful delivery of the workplace intervention requires a change in company culture (Pereira et al., 2015). In Japan, it is part of national culture to start every day at work with workplace gymnastics, commonly known as “radio gymnastics” (Fukue, 2010). Big corporations, including Toyota and Matsushita, have had well-established workplace exercise practices for many years. Occupational health would become a collaborative effort between employer and employee (Kossek, Ozeki, & Kosier, 2001). Not only employee well-being is enhanced by the mutual commitment of employer and employee, but also the community invests more on medical prevention than treatment.

Despite the above study strengths, it is important to pay attention to the limitations. Participants were mostly young and educated (more than 90% were university graduates and aged 21-40). Future work will be needed to investigate if this intervention applies to less educated or older workers. Since participation in this study was voluntary, it was likely that employees involved in the intervention were motivated and already quite physically active. For this reason, this quasi-experiment included a waitlist control group for comparison to minimise the statistical bias.

Although randomisation is often regarded as a gold standard for determining intervention effects (Victoria, Habicht, & Bryce, 2004), it is often impractical and sometimes impossible to deliver in the real-world setting (Lowe & Dick, 2014) because

of the complexities of psychological and behavioural research. Alternative approaches to evaluating interventions may have to be adopted because of practical implementation considerations (Handley, Schillinger, & Shiboski, 2011). In this study, a waitlist controlled trial was chosen because the study design allows the testing of an intervention effect and includes evaluation of within subjects and between groups. Secondly, a consideration of the ethics, feasibility, and attractiveness of a control group is warranted. From the stakeholder's point of view, a no treatment control group is unethical and unacceptable because the organisation has corporate responsibility to treat all workers in both sites fairly in terms of employee welfare in health care and promotion. This method lends support to a recent brief review of the literature on control group design in yoga and Tai Chi interventions for depression: Three out of five studies employed waitlist control groups (Kinser & Robins, 2013). Thirdly, it is almost impossible to take out the treatment from the intervention group when the waitlist control group started the exercise intervention (like a waitlist cross-over study design).

On the other hand, there has been growing concern over the use of waitlist control designs (Deville & Mcfarlane, 2009; Freedland, Mohr, Davidson, & Schwartz, 2011; Henriksson, Anclair, & Hiltunen, 2016). Employing waitlist control designs may artificially inflate intervention effect estimates (Cunningham, Kypri, & McCambridge, 2013). Confounding factors, such as expectancy effect and compliance with demand characteristics, might overestimate the treatment effects (Price, Jhangiani, & Chiang, 2015). Expectancy means a study participant decides to choose one over the other behaviour based on the expected result of the selected

behaviour, sometimes unconsciously. Compliance with demand characteristic is described as a participant being aware of the researcher's expectations and changing their behaviour to conform to the expected result. In this study context, a participant during the wait-time period might have a better awareness of one's own problem after baseline measurement (becoming an intervention in and of itself) and start to improve their physical activity. In every scientific research in real-world organisational situations, there is always a dilemma in determining the best study design with methodological rigour and practicality. When evaluating the effectiveness of a worksite intervention, the provision of a waitlist control group would only be used if a typical experimental/control group model is deemed to be impossible (Price et al., 2015). Even so, caution has to be taken as to how an intervention is actually administered and to avoid enacting unintentional change in participants in the waitlist control group. Future directions for this research might include qualitative interviews to investigate the reactions of participants assigned to the waiting list and have a more comprehensive interpretation of findings.

Study locations were separated geographically with Guangzhou as the intervention group and Beijing as the waitlist control group. To minimise the effect of variations, the differences between participating worksites were kept to a minimum. However, workplaces have their own micro-cultures and thus create differences which might pose potential threats on the study validity (Hopkins et al., 2012). Guangzhou is located in the southern frontier and is the provincial capital of Guangdong. Benefiting from its geographical proximity to Hong Kong, and its ethnic intimacy with overseas Chinese,

Guangzhou has become one of the most marketised cities in China. On the other hand, Beijing has been China's national capital for more than 800 years. It has geographical and relational proximity to the central government which to a great extent engenders high self-esteem among the local inhabitants (Dong, 1985). This study result indicated some support to the above observations. The control group in Beijing reported significantly higher perceived work performance than the intervention group in Guangzhou. Highly rated performance might reflect confidence and self-esteem (Alias & Mohd Hafir, 2009; Baumeister, Campbell, Krueger, & Vohs, 2003).

Significant differences in education and marital status were also shown in two worksites. In western health literature, educated and married workers are found to have a correlation with high levels of physical activity (Gidlow, Johnston, Crone, Ellis, & James, 2006; Pettee et al., 2006). Studies in China show contrasting results. For example, a recent cross-sectional study in Hangzhou, China, in 2012 (n=1,362, 624 men, 738 women, aged 23-59) showed that people who were highly educated and young were the most inactive (Fan et al., 2015). In the present study, although more participants in the waitlist control group attended university and were married than the intervention group, no significant difference in physical activity levels at baseline and post-intervention was found in either group. This study finding will provide useful data and insights for academics as well as practitioners in cross-cultural studies on workplace interventions.

The study used self-report measures for all outcome variables and the results would be prone to response bias. This research

had endeavoured to include only valid and reliable self-report measures. Moreover, objective measures in conjunction with subjective data were solicited. Exercise adherence data were measured by an interactive computer-based system to record individuals' exercise adherence. Moreover, this empirical study emphasised testing the effectiveness of the exercise intervention. The result indicated a within-group effect on individual physical activity. However, the reason why this health initiative did not find between-group effect was not presented in the result. It is thus of interest to learn if the intervention has been delivered as planned, i.e. intervention fidelity and what actually has happened during implementation (Smith et al., 2014). Further study on process evaluation would contribute to corroborate the quantitative data with other data to evaluate the complexity of this study in a real organisational setting (Prick, de Lange, van't, & Pot, 2014).

Study implications

The findings suggest that it is feasible to deliver the exercise intervention for Chinese computer workers. This form of Qigong exercise is culturally relevant since it is well accepted in Chinese culture as beneficial for health (Wang et al., 2014; Jahnke et al., 2010). The age profile of study participants (92.8% were 21-40) is similar to China's economically active population range which allows the results to be generalised to the working age population in China (Ministry of Human Resources and Social Security of China, 2015). In addition, the participating organisation was a small and medium-sized enterprise (SME). It represented a majority of business (99%) and a high percentage of the working population in China (Ministry of Commerce, China, 2015). Most SMEs might not have the resources to invest in comprehensive health

interventions, and exercise as a single component might be a viable option to promote employee well-being. Upon intervention completion for both sites, the participating organisation won an award in an internal corporate competition granted for organisational activity that gains benefits for the whole company and wide acceptance among employees. This provides further support to the acceptability at the organisational level of Qigong worksite exercise for the benefits of both employees and employer.

Conclusions

In conclusion, this study presents with evidence that the intervention strategy of Qigong worksite exercise established its acceptability at the organisational level and was assessed at the individual level in China. Participants in both experimental groups indicated an increase in individual physical activity over a three-month period and sustained it for a year from baseline. No effects on work-related outcomes, i.e. work performance and sickness absence, were found. This study highlights the challenges of conducting worksite exercise interventions in real-world settings and contributes to a limited evidence-base on worksite exercise in China. Since this is the first to examine the effects of a worksite Qigong exercise intervention in China, findings need to be tested in different settings for the results to be generalised to the working population in China.

Chapter 7

Process evaluation

The aim of this study was to conduct a comprehensive evaluation of the implementation process of a worksite exercise intervention for workers doing sedentary jobs in China. This chapter describes the methods, results, and discussion of a process evaluation using RE-AIM framework.

7.1. Methods

7.1.1. Design

This process evaluation was conducted as part of a waitlist controlled trial study for Chinese workers (the main study had been reported in detail in chapter 6). Participants were recruited from the office of an insurance information technology IT firm in Guangzhou which was assigned as an intervention study site in the trial study. The intervention strategy focused on integrating 10-minutes of worksite Qigong exercise breaks into daily work routines.

The RE-AIM evaluation framework was used in this study because it helps to assess interventions beyond effectiveness. This framework was developed by Glasgow, Vogt, and Boles (1999). While there are other evaluation frameworks, such as Precede-Proceed (Gielen, McDonald, Gary, & Bone, 2008) and Health Impact Assessment (Quigley & Taylor, 2002), the RE-AIM health promotion evaluation framework was identified as the best fit to evaluate the current intervention. The Precede-Proceed model provides a structure for applying theories and concepts systematically for planning and evaluating health

behaviour change programmes. However, it is sometimes impractical because it requires many resources, both financial and in terms of manpower, to conduct the process (Sharma, 2015). A Health Impact Assessment is a structured method for assessing and improving health consequences to a population of a policy, project, or programme that does not necessarily have health as its primary objective. This model is limited by a lack of agreed methods in the evidence base for health impacts (Lock & McKee, 2005). The RE-AIM framework was chosen in this study because it is considered as more appropriate for evaluation of behavioural change interventions (e.g. Brace et al., 2015; Farris, Will, Kharjon, & Finkelstein, 2007). It enables interventions in complex settings, such as real-world organisations, to be comprehensively evaluated. Moreover, the evaluative dimensions are well matched with the researcher's need to conduct and report a process evaluation. The framework had previously been used in studies of workplace physical activity interventions (e.g. Estabrook, Zapka, & Lemon, 2012; Kim et al., 2012; Aittasalo et al., 2012).

To evaluate the study process systematically, five dimensions of the RE-AIM framework were used: Reach; Effectiveness; Adoption; Implementation, and Maintenance. Each one of these dimensions provides valuable information on the factors that influenced intervention implementation. The dimension on 'Effectiveness' was presented in chapter 6. This chapter describes the results on the other 4 dimensions of the RE-AIM framework.

Data collection mechanisms included focus groups with participants and non-participants, organisational committee

(committee formation was reported previously in the pilot study, chapter 5, section 5.1.3) and senior management. A focus group with key informants was adopted in the present study because it offered an economical alternative to direct observation of intervention impacts, where direct observation would be logistically difficult and too costly (Saldana, 2011). In principle, focus groups allowed the researcher to find contextual answers to questions about why this worksite exercise had no significant main effects on individual physical activity and work-related outcomes. In addition, qualitative assessment on project documents, field notes, communication, and meeting minutes and promotional materials would be conducted in this study. Adapted from a recent study on physical activity intervention which used the RE-AIM framework to assess three intervention constructs (Jenkinson, Naughton, & Benson, 2012), this study aimed to use the same framework to specifically assess six design constructs of the intervention as follows:

1. Organisational support
2. Programme facilitators
3. Programme barriers
4. Exercise adherence
5. Exercise acceptance
6. Ways to sustain exercise behaviour

The Ethics Committee, Institute of Work, Health and Organisations, University of Nottingham, approved the study design, protocols, and informed consent procedures in June 2013 and the study started upon the receipt of approval (Appendix 11).

7.1.2. 4 dimensions of RE-AIM framework

7.1.2.1. *Reach*

The evaluation of 'Reach' is defined as the ability to identify the targeted population, the absolute number, proportion, and representativeness of individuals who participate in an intervention. It was done at individual assessment levels to determine if the exercise intervention was reaching all employees within the organisation. Demographic data (gender, age, marital status, and length of time working for the company) were collected at baseline measurement. Data were also collected from the HR department and used to compare the characteristics between the participants and overall employees' profile, to explore whether the sample was biased (Pannucci & Wilkins, 2010).

7.1.2.2. *Adoption*

Adoption is defined as organisational support to deliver the intervention. Perception and feedback on general receptivity about the interventions were solicited through focus groups. In addition, facilitators and barriers to the intervention's adoption were identified through focus groups with participants and organisational committee members upon completion of the intervention.

7.1.2.3. *Implementation*

Implementation is defined as intervention fidelity. The measurement of implementation fidelity is the measurement of adherence, i.e. how far those responsible for delivering an intervention actually adhere to the intervention as it is

outlined by the researcher (Sabat e, 2003). Adherence includes the exercise dose, i.e. its content, frequency, duration and coverage. The degree to which the intended dose is implemented is the degree of implementation fidelity achieved for the intervention. The level achieved is also affected by participants responsiveness, i.e. exercise acceptance (Carroll et al., 2007). For example, the less enthusiastic participants are about an intervention, the less likely the intervention to be implemented properly and fully. In fact, participants covered not only the individuals receiving the intervention, but also those responsible for it. If an organisation, as represented by senior management for example, is not committed to an intervention, then the responsiveness of individuals may be affected, too. This is the key aspect in many organisational change literature (Todnem, 2005). In this study, exercise adherence data were collected through an interactive computer-based system to record individuals' exercise adherence. In addition, qualitative assessment on the adherence throughout the phases from initial uptake to adoption of main routine was conducted. Focus groups with the participants, senior management and organisational committee members were used to gather data on their responsiveness towards exercise appropriateness, promotional posters, and videos.

7.1.2.4. Maintenance

Maintenance is defined as the long-term effects of the intervention. Responses through focus groups were collected on ways to integrate the intervention as part of the long-term organisational policy.

Measures used to evaluate the 4 dimensions of RE-AIM, as operationally defined for this study, are outlined below and further detailed in Table 7.1. The data source for each dimension is also listed.

Table 7.1 Measures, data sources and data collection timeline by RE-AIM framework

Assessment Dimension	Definition	Measures	Data sources	Timeline
Reach	The ability to identify the targeted population, the absolute number, proportion, and representativeness of individuals who participate in an intervention	<ul style="list-style-type: none"> - Demographic information - Participant characteristics (participants vs population) 	<ul style="list-style-type: none"> - Survey items - HR data 	<ul style="list-style-type: none"> Baseline Post-intervention
Adoption	Organisational support to deliver the intervention	<ul style="list-style-type: none"> - Perception and feedback - Facilitators and barriers 	<ul style="list-style-type: none"> - Focus group data 	<ul style="list-style-type: none"> Post-intervention
Implementation	To determine exercise adherence, consistency and quality of implementation, participant responsiveness	<ul style="list-style-type: none"> - Exercise adherence - Exercise acceptance 	<ul style="list-style-type: none"> - Exercise logs - Focus group data - project document review 	<ul style="list-style-type: none"> Post-intervention
Maintenance	Long-term effects of the intervention	<ul style="list-style-type: none"> - Integration into organisational routine - Sustained interests for behavioural change 	<ul style="list-style-type: none"> - Survey items - Focus group data 	<ul style="list-style-type: none"> Post-intervention

Adapted from Wozniak et al., 2012

7.1.3. Data collection

The purpose of post-intervention focus groups was to capture participants' experience and perceptions of the intervention. One key factor to determine the sample size, i.e. running six focus groups ranging from two to eight participants, was saturation (Rygg et al., 2010). In other words, more focus groups would not yield any new information to the analysis result. Besides, smaller groups were easier to manage in terms of facilitating group discussion (Liamputtong, 2011).

7.1.3.1. Focus groups with participants and non-participants

Three focus groups with participants (n=7,8,9) and one group with non-participants (n=5) were arranged upon completion of the intervention in July 2013. The objective of having one group of non-participants was to understand the 'Reach' and 'Adoption' of the intervention from the non-participants' points of view. Each group consisted of seven to eight participants from different departments. The samples were conveniently selected (a HR officer invited employees from various departments who were not occupied with work in hand to attend).

The researcher started the focus group by briefing the participants on the purpose and content of the study. Participants were informed of their right of choice to participate before they were asked to give consent.

Data confidentiality was assured by the researcher (Data Protection Act, 1998). After the introduction, all workers agreed to participate in the focus group and signed consent forms. Permission to voice-record the focus groups was sought from each participant in the consent as well as before the focus groups started. In cases where any participants were not comfortable with recording, detailed note taking would be undertaken by the researcher. No such cases were reported in any of the study groups.

Each focus group lasted for 45 minutes. A focus group guide was developed by the researcher with the aim of producing a comprehensive picture of the factors impacting employee participation or non-participation in the worksite intervention. Questions were based on commonly reported effects of workplace physical activity interventions within the literature (e.g. Tucker et al., 2011; Fletcher et al., 2008). The researcher moderated the focus groups and asked questions such as the following:

1. Explain why you chose to participate/not to participate if you did not?
2. To what extent did the programme meet your expectation? How and please state specific reasons.
3. How did the programme influence on you, in person and at work? Please state specific examples.
4. How would you see the advantages and disadvantages of integrating this exercise break as part of the long-term organisational policy?

During the focus groups, participants were given the opportunity to ask questions if they were unsure of the

meaning of a particular question, or if they needed clarification regarding specific terminology. They were encouraged to respond freely and honestly to each question. Participants were thanked for their responses by the end of the focus groups. Focus groups took place in one of the meeting rooms at the participating organisation. Circle seating was arranged to aim for optimal discussion among group participants (Hennink et al., 2011). Focus groups were conducted in Chinese. They were audio-recorded and anonymised on transcription for subsequent analysis.

7.1.3.2. Focus group with organisational committee

A focus group with organisational committee (n=3) was conducted. The objective was to capture committee members' experience in the implementation process and their observations on general adherence towards the intervention. The focus group lasted for an hour. The researcher conducted the focus group with the use of an extended guide from the study as mentioned in the previous section 7.1.3.1. Committee members were asked, for example, from their observation:

- a) To what extent did employees adhere to the exercise intervention, why and why not?
- b) What were the major enabling factors and barriers for successful delivery of this intervention?
- c) What were the visible actions to show company commitment?
- d) Please suggest ways to maintain this health initiative in the long-term.

The focus group was delivered in the same procedural manner as the post-intervention focus groups with participants.

7.1.3.3. Focus group with senior management

A focus group with senior management (n=2) including the general manager and the HR manager was conducted. The objective was to understand the intervention constructs on 'organisational support' and 'programme maintenance' from the employer's perspective. A similar approach was used in recent literature to understand employers' motivation to promote PA (Renton, Lightfoot, & Maar, 2011). The researcher conducted the focus group with the use of a focus group guide. Questions were based on factors identified in the literature referring to barriers and facilitators in workplace physical activity intervention (Mayer et al., 2013; Renton et al., 2011). The researcher moderated the focus group and asked questions such as the following:

1. Please state your reasons for sponsoring this exercise intervention study.
2. To what extent did the programme meet your expectation? How and please state specific reasons.
3. What were the visible actions to show company commitment?
4. Please suggest ways to maintain this health initiative in the long-term.

The focus group was delivered in a venue near the office of the participating organisation. It lasted for an hour. Senior

managers were encouraged to respond openly to each question. The researcher took detailed recording by notes on all the responses. Participants were thanked for their responses by the end of the focus group.

7.1.3.4. Document review/project documents, field notes and administrative datasets

Qualitative assessment was conducted on the project documents. Firstly, daily reports to record individuals' exercise frequency as generated by the computer system were reviewed upon completion of the intervention. All the promotional materials, including posters and videos, were reviewed for quality, relevancy, and consistency. Furthermore, the employee profile data from the HR department, including gender, age, marital status, educational level, and length of time working for the company were used for comparison with the demographic data of the participating group. Documents on how the interventions unfolded, such as field notes, communication, and meeting minutes were reviewed. All qualitative data sources, including focus group transcripts and documents, were compiled and managed using Microsoft Word.

7.1.4. Data analysis

Qualitative data were collected from focus groups conducted by the researcher. All focus groups were transcribed verbatim in Chinese and then translated into English by the researcher. This process, in addition to the field notes, resulted in one document that provided the researcher with a reliable source of information for data

analysis (Bowen, 2009). Translation was focused on 'conceptual equivalence' which refers to a term used in Chinese that has a comparable meaning when translated into English (Tsai et al., 2004). Conceptual equivalence also needs to address social norms in the participating organisation into the English transcribed text. For example, Chinese culture is less likely to share personal feelings openly, and the Chinese health concept emphasises prevention rather than the treatment of disease (Chew, Tan, & Ooi, 2011).

To minimise the potential effects of a single person translating on the quality of the data, such as the risk of misinterpretation, an independent translator who was fluent in English and Chinese helped to validate the transcripts through repeated listening to all focus group recording. In the event of any disagreement on the translation, the researcher agreed to meet with the translator in person, discuss and agree on a common translation. Subsequently, some minor changes were made to develop a final version of the transcripts. For example, a participant raised an issue on management communication style in the focus group. The researcher and translator listened to the recording, bounced ideas back and forth, and finally agreed on the translation regarding the participant's perspective on parental style of care in that context: Management provided moral support. He told the staff what was good for the health. However he did not practice it himself.

In addition, research procedures were documented and best practices were followed to ensure quality (Moore et al.,

2014; Beaton et al., 2002). Documentation was carefully handled including transcripts, recordings, and field notes. Data were anonymised, stored securely and preserved, both electronically and on paper. No software was used to analyse the data.

Thematic analysis was used as a systematic approach for coding qualitative data, and for then using that coding to identify patterns across the dataset. The researcher took a deductive way to identify the themes within the data because she had the analytic preconceptions which was driven by her interest in the topic (Braun & Clarke, 2013). These analytical methods have been commonly used for process evaluation with semi-structured interviews (e.g. Al-Busaidi, 2008; Thomas, 2006). Consistent phrases and expressions among the participants were grouped under a pre-existing coding frame, i.e. six intervention constructs, namely organisational support, programme facilitators and barriers, exercise adherence, exercise acceptance, and ways to sustain exercise behaviour. Excerpts from the sessions that best reflect the design constructs were presented in the results section.

7.2. Results

7.2.1. Reach

The results were conducted at the individual assessment level based on the data retrieved from surveys and the HR department. Results showed that the intervention reached 100% of employees within the organisation. There were a total of 276 employees enrolled in the intervention at the

two experimental sites, which represented 40% of the employee population at those worksites. According to a recent literature review, the average participation rate of workplace physical activity intervention programmes was 33% (Robroek et al., 2009), this study has an above average participation rate. A demographic analysis was conducted to examine whether there were any differences between the characteristics of the participants and the whole workforce in both sites. The sample was representative of the workforce in terms of gender, age, marital status, and length of time working for the company. In addition, there were no significant differences between the characteristics of participants and non-participants in terms of gender, age, and work experience in the firm. However, there were significant differences in education and marital status among the participants at the two worksites.

The organisational committee branded the intervention as “Move It 動起來” (details were covered in chapter 6, section 6.1.4). A prompt signal in each employee’s desktop computer was scheduled to pop up twice a day: 10.50am and 3.50pm respectively. All employees had access to the exercise interventions. A participant proudly said:

This programme had definitely got 100% attention rate. Everyone from the top management to the junior staff knew about ‘Move It’. All levels of employees participated in the exercises. (Data security officer, female)

In this process review, all levels of the workforce were reported to have participated in the exercise routines to some level, including those who did not enrol as study participants. Therefore the participation rate might be understated. An organisational committee member commented:

Even though some employees did not enrol in the programme for whatever reasons, they watched the videos and practised the exercise altogether. (HR officer, male)

7.2.2. Adoption

Adoption of the exercise intervention, defined as organisational support to deliver the intervention for employee participants, was exceptionally good. This dimension was further evaluated by two intervention constructs: Programme facilitators and programme barriers. The results are presented in the sections below.

7.2.2.1. Organisational support

Data from the focus groups with the organisational committee and study participants indicated that company management was perceived as very supportive. In this study, a joint employee-management steering committee was set up. Commitment of senior management was manifested in their involvement in a 30-minute orientation and motivation briefing session to all team leaders before the intervention started. The organisational committee reported that management provided good support on the

technical side, including the pop-up windows system development.

Study results indicated that Chinese culture was embedded in this organisational setting which put emphasis on obedience to the authority of the group (Bains, 2015). One focus group participant commented: '*We would definitely do the exercise if the boss asked for it.*' Another comment by an organisational committee member also showed the influence of paternalistic style of management which has been found to be prevalent in Chinese organisations (Farh, Liang, Chou, & Cheng, 2008). Paternalistic leadership is generally described as combining strong discipline and authority with fatherly benevolence and moral integrity. An organisational committee member said:

The senior management provided moral support and parental style of care. They told us to do what was good for our health. However they did not practice themselves. (HR assistant manager, female)

A clear branding strategy seemed to help with promoting this physical activity intervention. A majority of participants gave positive feedback on the organisational support in the design and development of promotional posters and exercise demonstration videos. The organisational committee placed posters in high visibility areas, including office corridors and the staff pantry. In addition, a big movie screen to show promotional videos in the cafeteria during lunch hours provided additional environmental support. Although team leaders (n=25) were nominated by the organisational committee to undertake the role to

model the sequence of movements during each exercise break session, not all leaders adopted this role adequately. Focus group participants highlighted that regular requests were made to assign a person from each team to lead the exercise.

7.2.2.2. *Programme facilitators*

Many participants found the intervention a good company initiative to promote employee physical and mental health. *'It helped to build employees' awareness of the importance of health at work.'* Since the organisational committee leader as nominated by senior management was a project manager and not a HR personnel, focus group data showed that this intervention was described as an *'employee activity, not an official or standard programme launched by the HR. Employees were more willing to give ideas'*. Employees seemed to have stronger sense of ownership for this health initiative. *'To make them feel like I am part of it, they will then participate more actively.'* (Project manager, male)

A number of employees volunteered in the intervention development. Participants also reported the enjoyment of the camaraderie feeling during the implementation process. An organisational committee member said:

Many enthusiastic employees participated in the project, including the production of promotional videos and technical support to download the videos in the i-share (company intranet). We had the support of a group of volunteers. (HR manager, female)

The intervention marketing and communication was reported to be very successful. *'This was a very good programme. Activities were attractive and logistics were user-friendly.'*

Exercise videos were downloaded onto the company intranet and were easy for the employees to see. *'The company videos were tailor-made. They were funny. Everybody enjoyed watching the videos.'* Moreover, a lot of time seemed to have been spent on software design for monitoring exercise adherence. An organisational committee member said:

It took us a long time developing this computer-based interactive system to record individuals' exercise adherence. If we asked participants to take records manually, it would be like asking them to do extra work. It might create negative feelings towards the programme. (HR officer, male)

7.2.2.3. Programme barriers

One employee reported, *'I had personal health problems...in fact, serious neck and back pain and I was seeking medical advice.'* which indicated valid reason for non-participating. The most common reason why employees did not enrol in the study was reported to be fear of too much commitment. A few non-participants shared their respective views as follows:

To begin with, I was not sure about the programme content, I worried that there would be too many activities that I couldn't handle. (System analyst, male)

I had already participated in too many activities outside work. (Data entry operator, male)

Honestly, I worried about too many surveys. (System programmer, male)

Age and gender also seemed to have an effect on participation. Young male employees were reported to be less interested in taking part in the workplace exercise. One participant commented:

There were many young boys in my department and they had quite good health. They didn't seem to care too much of this kind of exercise breaks. (Senior programmer, female)

Peer support was identified as an important factor and people preferred to practise exercise routines in group sessions. Nevertheless, some focus groups reported difficulty in exercising as groups because of limited space. An example of this common comment was:

The mood was contagious. It was boring to do the exercise alone. For myself, when I saw the pop-up window and nobody nearby participated in the exercise, I would not do it. (Data entry clerk, female)

The pop-up screen was intended to make it difficult for employees to ignore the message. However, some people found it disturbing, especially when they were busy and concentrating in their work. Despite some participants stated that *'we should keep the programme flexible because during the pop-up time, colleagues might be occupied by jobs on hand,'* periodic prompts were still considered as necessary to interrupt people from prolonged sitting. An organisational committee member said:

They needed to be prompted, no matter by machine or in person. They needed to be prompted to stop their work on hand and take exercise break. (Project manager, male)

7.2.3. Implementation

Implementation, as defined as intervention fidelity, was examined based on the focus group data, exercise logs, and project document reviews. All promotional materials were found to be relevant to the intervention and the quality was rated very high. Interventions had been delivered broadly as planned. Whilst the modules were delivered in the correct order, and completed within the pre-determined timeframe, the organisational committee, for the sake of convenience, delivered all the modules when the intervention started. This might have led to declined adherence of exercise uptake because of a short span of excitement from exercise novelty. Besides, intervention preparatory works in the waitlist control group started before the post-intervention survey, such as team leaders' involvement in the production of promotional videos. This

early start of quasi-intervention might have led to both groups reporting an increase in the individual outcome measure on physical activity. The dimension on implementation was also evaluated by two intervention constructs, namely exercise adherence and exercise acceptance. The results are presented in the sections below.

7.2.3.1. Exercise adherence

Both objective data and qualitative data from focus groups on exercise adherence indicated that many employees participated in the exercise routines in the first few weeks. Most of them claimed to have whole teams practising altogether. They mentioned that once the screen popped up, they would start the exercise and they remembered the movements well. One example of this positive comment was:

The majority of participants practised the full version of exercise movements in the first two weeks, regardless of whether the exercise might have lasted for 20 minutes or more. Many behaved in the same way...the whole team practised together. (Customer service officer, female)

A few employees reported that because of work commitments, they practised the exercise at their own convenience. Some mentioned practising at home with children. A few participants requested access to the exercise demonstration online at home so they could practise with family. Nevertheless, excitement from the

novelty seemed to fade out quickly. *'The exercise lacked continuity once we got used to the movements.'*

7.2.3.2. *Exercise acceptance*

Many participants reported that the exercise was simple and easy to learn. They *"could practise the exercise at the workstations and not much space was required."* Some liked exercises well-structured to cover different parts of the body. The idea of incorporating Chinese Qigong in the exercise movements seemed to appeal to most participants. A participant commented specifically on this aspect:

My favourite moves were for the shoulders and spine. The programme had incorporated traditional Chinese martial arts, namely Qigong 8 Sections Brocade in the exercise. It would be better to incorporate more movements from Tai Chi. (System analyst, male)

7.2.4. *Maintenance*

Maintenance, as defined as the long-term effects of the intervention, was evaluated based on the focus group data and survey results. Members of the organisational committee indicated that the intervention could be sustained and integrated into long-term organisational policy. A majority of participants had shown appreciation of this health initiative. Employee enthusiasm for the "Move It" intervention was evident in the animated discussion and the provision of ideas for ways to sustain this initiative in the longer-term. Nevertheless, at the end of the intervention, there were 216 participants involved in the post-test survey, representing a 22% attrition rate. A

follow-up study was conducted 12 months after baseline measurement: 181 participants were in the longitudinal study, representing a 34.66% attrition rate. Compared with other similar studies, where the attrition rate varied from 9.2% to 10% (Malik et al., 2014), this study had a high attrition rate.

On-going commitment and investment for maintaining this health initiative need to be put into consideration by the participating organisation. At the time of the focus group, this had not been confirmed as concrete actions by senior management.

7.2.4.1. Ways to sustain exercise behaviour

To sustain healthy behaviour beyond the intervention period, some participants suggested '*new elements should be added in the pop-up windows every now and then,*' for example, '*in-depth health-related knowledge or employees' experience sharing*'. Some suggested producing an integrated version of the exercise video, in addition to modular versions. Ideas about introducing competition, team-based approaches and incentives were raised in the focus groups. Suggestions were also offered about incorporating exercise into other company activities, such as sports days. One intriguing finding was general awareness of the importance in building regular exercise as a habit and a proper mindset. For example, two participants commented respectively:

We should take the exercise breaks regularly...develop it as a habit and be aware of its importance on health. (Data entry operator, male)

We should persist with the programme maintenance and reinforce employees' interests in this initiative. Mind-set training was crucial. (System support senior officer, male)

7.3. Discussion

To the author's knowledge, this study is the first to conduct a process evaluation of a worksite exercise intervention in China, by using a RE-AIM evaluation framework. Four dimensions of the framework, namely Reach, Adoption, Implementation, and Maintenance, were used to describe the study results. This study was designed to reach a general working population in China and was tested in a predominantly young IT population. It was good in reaching IT workers who have high risk in suffering from musculoskeletal discomfort (Crawford et al., 2008; Griffiths, Mackay & Adamson, 2007) and collecting insights about their experience with this exercise intervention. Study findings with perceived organisational support and high acceptance among employees suggested good adoption of the interventions at organisational and individual levels. The interventions had been delivered broadly as planned and the extent to which the intervention was maintained as intended was modest.

Focus groups reported that this intervention had reached all levels of employees in the organisation (e.g. 100% of

employees were aware of it, and so overall reach was excellent). Evaluation results also showed that the study samples represented the characteristics of the overall employee population in the company. In spite of the above average participation rate in this intervention, fewer than half of the employee population registered to join the intervention. This finding is similar to a recent systematic review that participation levels in health promotion interventions at the workplace vary widely from 10% to 64% and were typically below 50% (Robroek et al., 2009). The feedback from focus groups was encouraging because some workers did not enrol and yet, in reality, they did report participating in this exercise routine at work, and some engaged in the exercise outside of work in the home setting. The findings support another previous review showing that studies with high recruitment rates in workplace physical activity interventions tend to include interventions as part of working day in paid time (Ryde, Gilson, Burton, & Brown, 2013). It is concluded that overall reach in terms of both employee awareness of the intervention, and participation rate, was good. The results provide useful qualitative data allowing for better understanding of the effects of an exercise intervention in China which currently has a very limited evidence-base (Siu et al., 2013).

As related to the second dimension on "Adoption", management was perceived to be committed by the fact that the employer allowed the study to occur during paid working hours. The success of the intervention to get good adoption is comparable to previous findings that leadership support has been identified as an essential component of

successful workplace health promotion programmes (Milner et al., 2015). The influence of Chinese culture, especially the appeal to high authority in the organisational hierarchy, was found to be prevalent in this study (Chan & Qiu, 2011). Moreover, lack of leadership by example, i.e. leaders just giving advice but not leading by actions, was reported in the focus group. It is possible that employees expected more of managers' direct involvement, for example, actively participating in role-modelling during exercise breaks or in team meetings, which is perceived as the best way to demonstrate management support in workplace health promotion (Della et al., 2010). That said, management support is multidimensional. Another level of support that demonstrates leadership buy-in is the provision of technical assistance and resources for intervention development. These investments are likely to be indicative of the organisation's recognition of the need for workplace health promotion and are portrayed as a means of supporting organisational values on corporate social responsibility (Leone et al., 2015).

This dimension of "Adoption" was further evaluated by two intervention constructs, namely programme facilitators and barriers. Qualitative data indicated that strategic positioning of the intervention as an employee activity was identified as the most important facilitator to the success of this intervention. This study used a participatory approach and managed to engage managers, supervisors, and workers to work collaboratively for this health initiative. This may explain the good adoption of the intervention within this study. Similar participatory practices have been used successfully in other studies to reduce sedentary time

for office workers (Parry, Straker, Gilson, & Smith, 2013) and address musculoskeletal complaints in office workplaces (Van Eerd et al., 2010). This study showed that many employees volunteered and offered assistance on technical support, video production, and exercise demonstration. In addition, the study interventions were tailor-designed and therefore very relevant to the study population. The logistics was described as user-friendly. The quality of the intervention's promotional materials, including posters and videos, was also highly praised by study participants. All these factors led to employees' high receptivity of this worksite intervention.

For those that did not take part, fear of too much commitment was found as the major reason for not participating. Worry about over-commitment can be interpreted as lack of time or low self-efficacy which is considered as a common reason for non-participation in previous literature on workplace physical activity intervention (Bardus, Blake, Lloyd, & Suggs, 2014; Fletcher et al., 2008). While a few participants found the intervention pop-up screens distracting, some openly expressed the need to get prompted by computer or by person. A recent systematic review showed enhanced effectiveness in health promotion and health behaviour when prompts were frequent and personal contact was included (Fry & Neff, 2009). Moreover, suggestions were made by some participants on designating a person in each team to lead the exercise during breaks. These 'exercise champions' might engender social support and camaraderie as mentioned in previous workplace health promotion literature (Taylor, 2005). The reasons why team leaders did

not play this role adequately needs to be further explored. Social support for physical activity from leaders or co-workers as a specific strategy to change behaviour in China workplace setting merits further study.

Evaluation results indicated that sample age and gender might affect the level of participation. Previous research in a midsized university in the United States (n=2,199) highlighted the association between the motivation and exercise behaviours varying across different age groups and genders (Egli, Bland, Melton, & Czech, 2011). A more recent research in Malaysia (Molanorouzi, Khoo, & Morris, 2015) with mainly Asian college students supported the importance of considering age and gender when studying adult participation in physical activity. Molanorouzi and his colleagues (2015), using self-determination theory (Ryan & Deci, 2000) in motivation to engage in physical activity, found that males were commonly motivated by intrinsic factors, i.e. strength, competition, challenge whereas females were motivated by extrinsic factors, i.e. weight management and appearance. Results also showed that young adults (aged 20-40) participated in physical activity because of higher affiliation, mastery, and enjoyment while middle-aged adults (aged 41-60) were driven by psychological conditions and the expectation of others. Another study setting in the American workplace (Grossmeiler, 2012) among 34,291 employees from 52 companies, also provided evidence in gender and age differences in the participation of workplace health promotion programmes. Grossmeiler's (2012) study showed gender as the best predictor of programme enrolment; with older women being more likely to enrol,

and age was the best predictor of active participation and completion. Despite the above studies indicating the relationship of age and gender with physical activity, they used solely cross-sectional designs and there is limited evidence on the causal effects. The present focus group findings only reported young male workers showing less interest to participate. These young men might prefer to take part in sports outside work, with more vigorous intensity of exercise. Further investigation is required to provide useful data and insights on individual variables including gender, age, and race that might affect participation in physical activity interventions at the workplace.

This evaluation study also aimed to assess the implementation fidelity of the process. Although delivered in entirety, in the correct order and within the intervention timescale, exercise demonstration videos were delivered at the outset instead of staggered, which may have resulted in reduced adherence over time, and thus a reduced effect from lower intervention dose and intensity experienced by participants (Dunbar et al., 2015). Moreover, the waitlist control group started intervention preparatory works earlier than original plan. The early delivery of quasi-intervention might have led to an effect in the outcome measures for the waitlist control group. Similar challenges, in that reality does not match with the original plan, have also happened in other real life organisational research studies (Justine et al., 2016; Dunbar et al., 2015). In terms of future considerations, regular interim assessment of intervention fidelity during the study period is recommended to ensure

delivery is fully compliant with the original implementation plan (Belza, Toobert, & Glasgow, 2006).

The dimension on 'Implementation' was further evaluated by two intervention constructs, i.e. exercise acceptance and adherence. This workplace exercise was well received by a majority of participants. Employees found the exercise simple and easy to do. This form of Qigong exercise was culturally relevant and it was well accepted among the Chinese workers as beneficial for health (Wang et al., 2014). Moreover, study results showed the adherence rate was high in the initial stage of implementation. However, employees did not adhere to the exercise routines consistently throughout the intervention period, and results indicated a gradual decrease of exercise uptake. It is a common challenge in most workplace physical activity interventions to sustain behavioural change (Jordan, Holden, Mason, & Foster, 2010). High adherence in the early stage could partly be attributed to excitement. Capitalising in the initial enthusiasm expressed by most participants is important before the sense of novelty wanes and slows down the momentum of implementation. A better understanding of what effect is needed to warrant both immediate success of implementation and long-term sustainability is important (Hopkins et al., 2012).

Whilst enthusiasm was apparent, 'Maintenance' at the organisational level was inconsistent and inadequate. Lack of a concrete plan and a clear message on programme maintenance, such as resources or administrative support, may be related to the characteristics of this organisational context (Pereira et al., 2015). Staffing changes might have

affected organisational priorities which are commonly found to have differences between research and real-life commercial application (Glasgow et al., 2003). The high attrition rate in this study was also a concern, although employees' engagement in the focus group discussion suggested there was some promise in programme maintenance at employees' level. Further information concerning the employer's motivation to maintain this initiative in the long-term is needed.

Study strengths and limitations

A major strength of this study was the use of different approaches to evaluate the intervention process systematically using the RE-AIM framework. The insights from actual participants and non-participants who had experienced this intervention expand the research base on worksite exercise interventions. In addition, focus groups also included an organisational committee and senior management, which allowed different opinions and views to be captured (Kreuger & Casey, 2009). In addition, qualitative assessment was conducted on the project documents, field notes, and administrative datasets. The UK Medical Research Council updated guidance in 2015 for evaluating complex interventions recommends integrating process evaluation within outcome evaluation designs (Moore et al., 2015). This study provides valuable process information when, combined with outcome information on effectiveness as reported in the main study (chapter 6), it enables a comprehensive evaluation of this corporate health initiative. In addition, the present study shows what actually happened during the implementation of a worksite exercise intervention in China. Results would help in a

better understanding of the complexities of conducting workplace interventions in real-world environments.

Despite these strengths, the result is not without limitations. In a similar way to the survey, the qualitative study was prone to sampling bias. Focus group participants were convenience samples selected from different departments, and they might not represent the views of the whole population. Since the focus was more on understanding participants' perspectives than it was on generalisability (Vaterlaus & Higginbotham, 2011), samples were chosen based on the practicality and feasibility in a real organisational environment. However, there was a possibility that in the focus groups, participants might not speak freely of their views. Although confidentiality was assured by the researcher, social desirability bias could not be neglected (van de Mortel, 2008). Individual interviews might be a better option, but it will be more costly and time-consuming. Focus group with the organisational committee members might also suffer from over-reporting of compliance with elements of the programme. Moreover, focus group participants were only from the intervention site. Inputs from the waitlist control group participants might give additional insights on the reasons why no significant difference was found between the two experimental groups. Nevertheless, data collection in this process evaluation also included a review of project documents in order to have a comprehensive assessment.

The same researcher conducted and transcribed the focus groups, translated the transcripts, and presented the result based on content analysis. All focus group recordings and

transcripts were validated by an independent translator. When data were collected and analysed, subjective judgement was not disputed. On the other hand, subjectivity could be interpreted as a qualitative sensibility which was one of the essential skills for becoming a good qualitative researcher (Braun & Clarke, 2013). Reflexivity, i.e. critical reflection on the research process was one way the researcher used to enhance her sensibility. Besides, organisation and documentation were carefully handled including transcripts, recordings, and field notes. Extensive time on qualitative evaluation from planning the entire process helped to increase the coherence in the design and procedures (Maxwell, 2009). Even so, caution is needed in discussing implications and generalising findings.

Conclusions

This study contributes to the very limited literature to report on a process evaluation of a worksite exercise intervention in China based on the 4 dimensions of RE-AIM framework. It is concluded that the study results had demonstrated success in reaching all workers at both experimental sites and getting their full awareness. Evaluation results of three design constructs, including organisational support, programme facilitators, and barriers, showed that adoption of the intervention was good. Feedback on a particular strength of the study interventions was a participative mode of intervention. As a result of the collaboration with the workers, the feedback and judgement of the focus groups was positive. This study's findings suggest that this facilitator to programme adoption, and the tailored-design to cater for employees' needs at these worksites, might have fostered employees'

high receptivity of the intervention. But compliance with the intervention delivery protocol might help to achieve more consistent adherence in exercise participation throughout the study period. Moderate intervention maintenance at the organisational level suggested management's long-term commitment warrants further investigation. This worksite study is the first to conduct a process evaluation of the exercise intervention in China. Additional research is needed to assess the generalisability of its results.

Chapter 8 Overall Discussion & Conclusion

This chapter aims to summarise all study findings and presents an overview of the study implications. The main purpose is to highlight major insights from wider perspectives after synthesising the results of all studies. Cultural difference between the east and west, as well as potential differences among blue-collar workers and white-collar workers on physical activity participation in the workplace, are highlighted. Reviews on the viability of exercise breaks and the usefulness of applying theoretical frameworks are also reported. The final section is on the study's strengths and limitations and is followed by recommendations for future research.

8.1 Summary of study findings

This thesis examined the effects of a Qigong worksite exercise intervention on individual physical activity, work performance, and sickness absence. Although physical activity has been widely recognised as beneficial to health (CDC, 2015), not many people do enough exercise, and global physical activity levels have declined in the last decades (Dumith et al., 2011). Since most people spend one-third of their life at work, the workplace is the most convenient setting to reach a working population (Quintilliani et al., 2007). Exercise breaks, when incorporated into organisational routines, can be one of the possible strategies to encourage workers to become more physically active (Yancey et al., 2013).

The literature on workplace physical activity intervention has grown substantially in recent decades, and the results tend to find strong support on individual health-related outcomes. Emerging evidence indicates some positive effects on physical activity, but the relationship between exercise interventions and work-related outcomes is an under-researched area. Furthermore, a large body of research is conducted in the west. Studies on workplace health promotion are very rare in China which has suffered a prevalence of disease associated with physical inactivity increasing rapidly in recent years (Tang et al., 2013). Most study settings on workplace physical activity literature were in large organisations and the public sector. There is a dearth of research in small- and medium-sized enterprises. Moreover, many intervention strategies used in the empirical research have multicomponent approaches, including health counselling, stress management, and a diverse composite of exercise modality. Consequently, to evaluate the sole effect of a single intervention component is virtually impossible. Many SMEs would not have as many resources as large organisations to invest on comprehensive programmes, even though they might want to promote employee health and well-being.

This thesis intended to fill the above-mentioned research gaps and investigated the effectiveness of a workplace exercise intervention in the SME setting. Evidence would help to explore the strengths of using Qigong exercise as a single intervention component compared to multicomponent approaches. Contribution of this thesis is to extend very limited literature in China on workplace physical activity interventions. It also makes a contribution

to exercise research by using theory-based models on intervention development and process evaluation.

This research started with a comprehensive literature review so as to explore the effectiveness of workplace exercise interventions, at both systematic review-level (workplace physical activity intervention in general as study inclusion criterion) and empirical study-level (workplace exercise intervention in specific as inclusion criterion). The results revealed that effects on physical activity was strong, particularly in accordance with the empirical study-level evidence. But the effects on sickness absence and work performance were small or mixed (literature review results were reported in detail in chapter 2, section 2.1).

A Behaviour Change Wheel (BCW) model (Michie et al., 2014) was used as a guide for intervention development. By adhering to the BCW model and the COM-theory, the employee's capability (physical activity level), opportunity (physical and social environment enabling physical activity), and motivation (health culture) were examined. Short bouts of exercise were identified as the focal point of the study. Three intervention functions deemed to have the potential to effect changes in Chinese employees' physical activity behaviour were selected: Training, modelling, and enablement. To operationalise these functions, behaviour change techniques (BCTs) to link between the BCW and the taxonomy of BCTs were used. Four BCTs that are most frequently linked with the selected intervention functions were identified, namely instruction, demonstration, prompts, and behavioural practice (Colquhoun et al., 2014). Intervention marketing and communication was also

chosen as the key organisational policy to support the delivery of the intervention functions. A worksite exercise routine, which was divided into six modules that catered for different parts of the body, was then developed by a certified Tai Chi master (chapter 3, section 3.2).

To fulfill the research objectives, i.e. to examine the effect of a worksite exercise intervention on individual physical activity and work-related outcomes with comprehensive qualitative and quantitative assessment, 4 inter-related studies were designed and presented in this thesis. The first one was a feasibility study (chapter 4). It aimed to test the delivery of a worksite exercise intervention for workers doing sedentary job roles in China. Results showed that it was highly feasible to implement this workplace intervention in a small factory setting and the intervention was perceived positively. Results also indicated that the intervention might improve individual physical activity and have an influence in the changes with employees' job satisfaction and work performance. However, this study had a single cohort group design with a small sample size which limits generalisation of the results. Even so, this study consisted of a post-intervention focus group design and the findings provided evidence to the positive effects on an employee's healthy behaviour and attitude towards the employer. This preliminary study played a significant role in preparing for a larger controlled trial to test the intervention effectiveness.

A pilot study (chapter 5) aimed to prepare for a main study and ensure the key processes were tested, including on-line data collection, assessment of outcome measures, and

exercise interventions. It was also designed to encourage methodological rigour and determine acceptability of intervention in a pilot sample (LaGasse, 2013). Study instruments and an exercise intervention were found to be appropriate for a larger trial. This study had focus group designs that aimed to gather a variety of leaders' experiences and ideas. The exercise intervention was reported as beneficial for health, work performance, and corporate image. Study findings indicated that the success of the intervention might be enabled by engaging leaders as role-models, intervention marketing and promotion, and positive health culture. On the other hand, interruption to work and behavioural change unsustainability were identified as potential barriers to the success of the intervention. The focus group findings also indicated team leaders' commitment to the pilot study as well as the main study which aimed for all employees in the participating organisation. Nevertheless, study bias because of social desirability could not be neglected (van de Mortel, 2008). Importantly, this pilot study contributed in tailor-making the intervention design and development for the main study.

Affirmative results of the two preliminary studies led to a smooth transition to a main study, i.e. a larger controlled trial (chapter 6). Two separate sites were chosen for an intervention group and a waitlist control group respectively. Randomisation is considered as the gold standard for effectiveness study (Victoria et al., 2004), although in real-world organisational research, this approach was found to be impractical. For this reason, this study used a waitlist control group with delayed intervention for comparison.

Results showed that participants in both intervention group and waitlist control group reported higher physical activity over a three-month period and sustained for a year from baseline. Not only did this study indicate high acceptance of the Qigong worksite exercise intervention strategy in China, but also highlighted the challenges of conducting the intervention in real-world settings.

The main study showed the increases in individual physical activity for both experimental groups, but it did not explain the reasons why the intervention did not detect the between-group difference. To have a comprehensive assessment, a process evaluation based on a RE-AIM framework (Glasgow et al., 1999) was implemented (chapter 7). Since the dimension on 'Effectiveness' had been covered in the main study, the other 4 dimensions were used to examine the process in the intervention study, i.e. Reach, Adoption, Implementation, and Maintenance. Results showed that the intervention had reached 100% of employees in the organisation. Adoption was exceptionally good because of the high acceptance at both organisational and individual levels. Study interventions had been implemented broadly as planned. Although from the focus group findings, employees showed much enthusiasm in sustaining this initiative, no concrete action plan was suggested on maintaining the interventions at the organisational level. This study contributed to workplace health literature by using a theory-based health promotion evaluative model to assess a worksite exercise intervention systematically.

Results from the feasibility study and pilot study were very

positive. Both studies resulted in important contributions being made to the design of the main study. The findings of the controlled trial study revealed some improvements in individual physical activity, with the greatest change evident in those that received the intervention. Study on process evaluation also showed some encouraging results, especially on successfully reaching the whole study population. Many employees were reported to have participated in the exercise routines, and some engaged in the exercise outside of work in the home setting. Implementation fidelity, i.e. what actually happens during implementation, tends to pose challenges in testing interventions in organisational settings. For example, process evaluation results indicated the deviation of intervention delivery pattern which might affect the intervention dose and thus intervention effects. A pre-emptive delivery for the waitlist control group might have also affected the post-intervention survey and led to an increase in the physical activity levels for both experimental groups.

On work-related outcomes, the feasibility study showed significant improvements in job satisfaction and work performance. The main study also showed desired the positive direction on work performance even though the increase was not significant. However, both the feasibility study and main study did not find significant changes in sickness absence because of the intervention. Despite the differences in the study design, setting, and population, these results lent support to my previous review finding that there was limited evidence to show the effect of a workplace exercise intervention on sickness absence

(Chapter 2, Section 2.1.3.2 and 2.1.3.4). Results on work performance were nil or mixed (Section 2.1.3.2 and Section 2.1.3.5). In conclusion, the present study demonstrates that a Qigong worksite intervention succeeded in getting workers to take regular exercise breaks during working hours. The assessment on the effects of worksite exercise as a single intervention component contributes to expanding the limited evidence base of its advantage.

8.2 Implications

8.2.1 Cultural insights between east and west

Short exercise as incorporated into daily work routines has been proven a success in the western world (Barr-Anderson et al., 2011). However, this approach has rarely been studied in China. Results in this research indicated high participation and exercise adherence among study participants. These outcomes were unexpected because low adherence and high drop-out rates are common in previous western exercise research. Could it be the influence of Chinese culture that leads to these positive results? Culture plays a dominant role in influencing beliefs and attitudes towards physical activity and health. Understanding Chinese culture might help to explain the high level of employee participation in these studies (Chew, Tan, & Ooi, 2011).

The basic principles of Chinese culture in relation to physical activity are on healthy living and prevention of disease. Chinese workers believe exercise is a good way to promote health and well-being. The idea of Qi in Qigong

exercise as an energy booster has deep-rooted culture among Chinese (Yang et al., 2015). Every morning, public parks in Chinese cities are packed with people practising Qigong and Tai Chi, which are Chinese martial arts aimed at improving health via the pursuit of harmony between mind and body. On the other hand, western people are influenced by ancient Greek exercise philosophy and are more likely to take exercise for competition and high-level athletic achievement (National Center for Complementary and Integrative Health, US Department of Health and Human Services, 2013). Therefore employees in China might appreciate the provision of this workplace exercise programme more than their counterparts in western countries.

Hofstede (2011) identified 4 main dimensions by which national cultures differ, one of which is their collectivism-individualism orientation. Collectivistic cultures, such as China and Japan, emphasise group binding that involves conformity to the authority of the group (e.g. family and organisation), as originated from Confucius' belief in 'status and hierarchy' (Bains, 2015). Moreover, in collectivistic culture, submission of one's interests to the group is positively valued, along with interdependence, cohesion, and harmony. As a consequence, employees can be assumed to have a stronger socially oriented achievement motivation and their behaviour is driven by an extrinsic motivation for social approval, mainly to fulfil the expectations of the work team and of the organisation (Hong, Wyer, & Fong, 2008). The intervention in this research involved a peer-led, 10-minute Qigong exercise session delivered twice a day. This intervention design with

the group context seems to align with the collectivistic culture and thus might explain why the participation rate was high.

In contrast, individualistic cultures, such as in Western Europe, emphasise personal autonomy, self-fulfilment, and independence. Employees are encouraged to target personal goals and achievement. It can be assumed that employees in these societies are driven by an individually oriented, autonomous motivation to fulfil their needs of personal growth (Deci & Ryan, 2006). Accordingly, workplace physical activity intervention formats, such as corporate memberships in fitness centres, health counselling, and professional-led exercise classes that require participation individually or under the influence of external professionals, might appeal to workers in western countries. Further research on the differences in culture between the east and west may assist in the design of exercise interventions to maximise adherence and sustainable physical activity behaviours (Guelfi et al., 2015).

In addition to the cultural impact, participation in worksite exercise interventions might also be attributed to a combination of other factors, including company health culture, leadership support, and intervention design. On top of looking at what researchers can learn from the western health-related theories and testing their generalisability to the east, this study might help to shed light on western workplace exercise research.

8.2.2 Insights on blue-collar and white-collar workers

Participants' profiles in this research were similar to the economically active population range in China (Ministry of Human Resources and Social Security of China, 2015). The study population included young (aged 25-40) and poorly educated (junior high schools or below) blue-collar workers as well as educated (80% university graduates) white-collar workers. Despite the differences in job demands between these two occupational groups, both reported similar health complaints in psychosocial risk factors and musculoskeletal symptoms (Roelen, Schreuder, Koopmans, & Groothoff, 2008). Worksite exercise interventions might be beneficial in promoting health in all working populations.

Previous literature in western countries shows that blue-collar workers, in comparison to white-collar workers, tend to have less interest and low intention to engage in worksite physical activity programmes (Leslie et al., 2013; Blue, Black, Conrad, & Gretebeck, 2003; Blue, Wilbur, & Marston-Scott, 2001). However, this research suggests contrasting results. Study results indicated higher participation and adherence in a worksite exercise intervention among employees in a small factory setting than in an office setting. One plausible explanation would be the fact that Chinese blue-collar workers tend to demonstrate considerable reverence for authority, and thus comply with organisational rules (Chan & Qiu, 2011). Study participants were all young blue-collar migrant workers and they travelled from their provincial home villages to work in big cities. They work long hours and the chance to take exercise outside work is limited (China Labour Bulletin,

2016). The high receptivity indicated that this worksite exercise might be a practical option to promote the workplace health of these migrant workers who make up the majority of China's industrial workforce (Kynge, 2013). Recent media coverage on the high strike rate and difficult economic environment has shown the imperative in attending to labour welfare in China (Gabbatt, 2012). For example, the labour strike among young workers in Foxconn, the world's largest electronics contract manufacturer with 800,000 workers in more than 20 locations has reflected the brittle employer-employee relationship in China (Hille & Mitchell, 2010). Workplace health promotion by introducing exercise breaks would provide an efficient means as an organisational effort to improve employee welfare and thus corporate image. Further studies are needed to examine if there is difference in the workplace physical activity participation between blue-collar and white-collar workers in China so that an appropriate strategy might be targeted for maximum recruitment and retention of participants.

8.2.3. Viability of exercise breaks

This research demonstrated that it was feasible to integrate brief bouts of Qigong exercise into workday routine for workers in China. It lent evidence to the studies of worksite exercise in the western countries (Taylor et al., 2014; Yancey et al., 2013; Barr-Anderson et al., 2011). Study results showed that both employers and employees were highly receptive to this Qigong exercise intervention. Detailed reporting on the exercise dose and modality

provided a high chance for a comparison of the intervention efficacy across studies to be reliably carried out.

In this research, intervention development was guided by a theoretical framework, but behavioural change techniques (BCTs) were tailor-designed for individual participating organisations. This custom-design strategy was used because it is deemed to gain receptivity at the organisational level and maximum recruitment of participants (Hopkins et al., 2012). For this reason, the intervention approach for the study on blue-collar workers was slightly different from the study for white-collar workers. The study on blue-collar workers used a structured and peer-led group exercise breaks approach whereas the study on white-collar workers used a flexible 'choice of architecture', i.e. workers could choose how they would like to participate, in a group or individually, peer-led or computer-led. Results indicated that exercise adherence rates for the structured group delivery format was much higher than the less structured although participation for both were voluntary. In addition, post-intervention focus group findings also provided evidence on workers' preference to have structured peer-led group sessions during exercise breaks in the office setting (Chapter 7, section 7.2.2.1). These observations seem to be parallel to the cultural insights in the previous section that in Chinese culture, group conformity takes precedence over individualism (section 8.2.1). The choice of implementation without a mandatory group context proved to be relevant in western studies (e.g. Hopkins et al., 2012; Blangsted et al., 2008) and requires further investigation for its application in China. Above all, researchers and

practitioners should consider using exercise breaks at work as a strategy to promote employees' physical activity and encourage change in sedentary behaviour.

8.2.4. Applying theoretical framework

Using theory in complex intervention studies is highly recommended by the UK Medical Research Council (Craig et al., 2008). This paper has adopted theory-informed methods for intervention development and process evaluation. By adhering to the guidance of the Behaviour Change Wheel (BCW) model, a theoretical approach which was chosen a priori, lent direction, structure, and transparency to the process of developing the intervention in multiple ways (Michie et al., 2014). Despite the researcher having a predefined idea of what the worksite exercise intervention would be at the outset, she benefited from knowing what the available intervention options were and what she aimed to achieve. By using the links between the BCW model and the taxonomy of behaviour change techniques, a wide range of well-validated intervention approaches and ways to operationalise the intervention functions were identified.

In this study, 4 BCTs were used for the operationalisation of the intervention functions. The first BCT, on providing instructions, was found to be useful for both studies on blue-collar and white-collar workers. Based on the COM-B theory (C stands for capability), clear instructions were given to all participants so that they were equipped with capability and skills to perform the healthy behaviours appropriately. The second BCT, on demonstration, was

aimed to provide role models through the team leaders and peers. The idea of 'Exercise Champions' seemed to be implemented more successfully in the factory than office setting. When combined with another BCT, on behavioural practice, exercise participation and adherence rates were significantly higher in the factory setting. As discussed previously in section 8.2.3, further investigation is needed to see if structured and peer-led exercise breaks approach would be more applicable to sedentary workers in China. Lastly, the BCT, on providing prompts, to remind participants to take exercise breaks was proven to be feasible for IT workers in China. Although only 4 BCTs were ultimately included in the description of the intervention, others influenced various aspects of intervention development and the implementation strategy. For example, in terms of other BCTs on repetition, techniques on habit formation (defined as prompting of the behaviour in the same context repeatedly so that the context elicits the behaviour, Michie et al., 2013) and generalisation of a target behaviour (defined as giving advice to perform the wanted behaviour, which is already performed in a particular situation, in another situation, Michie et al., 2013) were incorporated into the intervention design. The participants were prompted repeatedly either by their leaders or by computers to take regular exercise breaks during working hours. Moreover, employees were encouraged to practise the exercise routines during other events, such as company Sports Day or Annual Dinner.

Despite the systematic and structured approach of the BCW, there are challenges associated with its use. For example, the researcher must make some subjective and pragmatic

decisions throughout the process based on the real organisational context. To counter this, and to improve the transparency and generalisability of the methods, at each step of the BCW, detailed reporting on selected options and the supporting rationale was carefully handled (Michie et al., 2014). Hilton and Johnston's (2017) used cooking analogy to explain the challenges in applying theory to health interventions in their paper on health psychology. In addition to giving a cooking recipe with instructions on the ingredients (e.g. standardised approach in health interventions), more guideline is needed regarding how to prepare and combine ingredients (e.g. practical skills required to put into practice, including researcher's theoretical orientation and interpersonal skills). Although using the taxonomy of BCTs would aid the implementation and replication of the intervention, proper training is required for the researchers to be able to master the techniques for applying individual BCT in the study. Nevertheless, this research confirms the usability and usefulness of this framework for the study of a workplace intervention for Chinese workers.

The UK Medical Research Council's guidance recommends that a mixture of process and outcome information is used to evaluate all complex interventions in health promotion (Moore et al., 2015). RE-AIM provides a framework for identifying how the programme actually operated in a real-world environment and what actually occurred during implementation (Glasgow et al., 1999). Evaluation of health interventions is often limited to efficacy studies, the RE-AIM evaluation framework was designed to assess interventions beyond effectiveness to include multiple criteria such as

adoption, reach, and maintenance (Brace et al., 2015). The evaluation corroborated the quantitative data with other data collected through focus groups and provides insights on factors that facilitated or hindered participants' full uptake of the interventions.

On the other hand, there are challenges on applying this framework in the Chinese office setting. All five RE-AIM dimensions are important, but they might not be equally weighted. In this study, differential weights for each dimension could be potentially assigned based on the data collected. But this model has no clear guideline on how to assign weights to each dimension (Glasgow et al., 1999). Moreover, instead of conducting the evaluation of all RE-AIM dimensions upon completion of the intervention, it is possible to have each dimension assessed at different stages of the study and produce better evaluative impacts. For example, assessing 'Reach' is crucial from the early stage so that percentage and characteristics of participants who receive the intervention are defined. Corrective actions can be taken if the result is not satisfactory. 'Effectiveness' represents the outcomes to be measured upon completion of the intervention. 'Implementation', the extent to which the intervention has been delivered as intended, can be assessed throughout the intervention period. The RE-AIM framework used in this study proved to be useful in outlining real world challenges, limitations, and future considerations for translating an evidence-based intervention into health promotion practice.

8.3 Study strengths and limitations

This thesis has unique contribution to a limited database in China and provides insights for researchers and practitioners who are interested in promoting employee health and well-being. A major strength of this research was the use of a variety of methods to test and examine the effects that help to encourage methodological rigour (Brown, Elliott, & Leatherdale, 2015). Four inter-related studies provide a comprehensive step-by-step approach in examining the feasibility, development, implementation, and evaluation of a worksite exercise intervention. A theory-based behavioural change model was used as a guide for intervention development. Exercise modality was considered as culturally relevant and the exercise mode, frequency, and duration were well received. The logistics were user-friendly and promotional materials, including posters and videos, were produced in-house by the participating organisations with minimum external influence from the researcher. Accessibility and management support were also reported as major study strengths because workers were allowed to take breaks and do short bouts of exercise during working hours. These results lend support to previous literature review that workplace physical activity interventions had better success when interventions were integrated into part of working routines during paid hours (Ryde et al., 2013).

Furthermore, this research had taken a joint employee-management approach in the intervention design and development. The participative approach, that requires collaborative efforts of the employer and employees, had generated a strong sense of ownership and commitment. Study results suggest that high receptivity to the study

interventions at both organisational and individual levels might be partly attributed to the adoption of this approach. The organisational committee was composed of senior managers in the steering committee and employee representatives in the task force (chapter 5, section 5.1.3). Leaders' active involvement in role modelling and marketing lends further evidence on its important role in the success of the workplace interventions (DeJoy & Wilson, 2009). Employees volunteered to help in the design of the intervention webpage, promotional videos, and pop-up screens for this study. Their participation in the intervention development, which is comparable to similar participatory practices in previous studies (Parry et al., 2013; Van Eerd et al., 2010), resulted in positive impacts.

The inclusion of outcome variables that might have an immediate effect on organisational functioning indicates another strength in this study. Workplace health promotion research addressing work-related measures is relatively sparse and inconsistent to come to any conclusions about work-based attitudes and behaviours. Work-specific attitudes, such as job satisfaction or performance, are relevant to the operational imperatives of HR practitioners, team leaders, and other personnel with people management responsibilities. These study results can provide opportunities for managers to improve employees' attitudes and behaviours. Additionally, the present study involved the use of longitudinal data for 12 months. A number of authors strongly support the use of longitudinal data in workplace health promotion research (Newsom, Jones, & Hofer, 2012; Hoven, Wahrendorf, & Siegrist, 2015). The analysis of longitudinal data will therefore

provide valuable knowledge in both the short-term and long-term effectiveness of the exercise intervention on individual and organisational behaviour.

In terms of study population, this research managed to engage an economically active working population from two small organisations in major Chinese cities, i.e. Shenzhen, Guangzhou, and Beijing. These SMEs represent 99% of business in China. Worksite exercise might be a viable option for small companies with limited resources who are interested in promoting employee health. The present study had also succeeded in engaging computer workers. The prevalence of musculoskeletal discomfort, such as lower back pain and repetitive shoulder strain, is found to be high among computer workers (Crawford, Laiou, Spurgeon, & McMillan, 2008). Study results indicated that a majority of these workers would have the chance to take regular exercise breaks during work for three months and sustain this healthy behaviour for a year.

On the other hand, there are study limitations to be considered. All measures were self-reported which will be subject to study bias. To overcome this risk, only valid and reliable measures were used and objective data in conjunction with subjective data including work performance and exercise adherence rate were gathered. Study populations were from two companies and they were all young. Studies with different settings and older workers would enhance the results to be generalised to all working population.

Random sampling helps to reduce statistical bias, but one has to take consideration of the practicality and feasibility in doing research in organisational settings. In this research, a waitlist controlled trial with two experimental groups located at different geographical sites was used. This study design was chosen because it allows testing intervention effectiveness and a typical experimental/control group model was not possible in this organisational context. Concerns with confounding factors that might inflate the effect estimates, especially the expectancy effect, have put the scrutiny of the use of waitlist control group design more closely (Cunningham et al., 2013; Henriksson et al., 2016). As a result of practical implementation considerations, this study design with evaluation of both within subjects and between groups was adopted. The group profiles were matched strategically, for example, doing the same type of work and under the same head office. However, different locations have their own microcultures and therefore might affect study validity. When a focus group was used to collect qualitative data, only convenience samples were recruited. Complexities in conducting research in real-world settings also affected the intervention fidelity, including intervention delivery and communication. The researcher tried to strike a balance between conducting the research in adherence with the protocol to encourage scientific rigour, and meeting 'real-world' challenges in organisational settings (Panda & Gupta, 2014; Crosby, Salazar, DiClemente, & Lang, 2009). For example, an unexpected change of senior management (i.e. general manager) who played a pivotal role in the study had abruptly requested to take out a major outcome measure on job satisfaction before data collection started.

Job satisfaction is considered as one of the important proximal variables that indicate an employee's attitude towards work and company (Saari & Judge, 2004). Subsequently, the main study included only work performance and sickness absence, but excluded job satisfaction in the outcome measures. To have a comprehensive assessment of the intervention study, a theory-based process evaluation was conducted.

The same researcher conducted the qualitative study throughout the process. Even though all focus group recordings and transcripts were validated by an independent translator and documentation was carefully handled, subjective judgement was not disputed and caution is needed in generalised finding.

8.4 Future Research

This study contributes to the limited evidence-base in China and highlights the challenges of conducting workplace intervention in real-world settings. In future research, findings need to be tested with a large-scale randomised controlled trial and focus group with randomly selected participants. Objective measurements will also allow more accurate data and comparisons of strategy efficacy across different interventions. For example, pedometers or accelerometers could be used to corroborate with self-reported measures in assessing physical activity levels (Vallance, Eurich, Gardiner, Taylor, & Johnson, 2016; Ahn et al., 2015). The two experimental groups did not show any significant difference in their physical activity scores despite the waitlist control group

having more married and educated participants. Process evaluation results reported young male Chinese workers showing less interest in participation. Individual variables including gender, education, and age that might affect participation in physical activity interventions in China merit more investigation.

In this thesis, study results on blue-collar workers were more positive than on white-collar workers. These inconsistencies may reflect differences in the research design, including the study setting and methods. Future studies have to assess if there is any difference between these two occupational groups. Limited resources in promoting workplace health can be allocated strategically and appropriate interventions can be deployed. In addition, study results on blue-collar workers showed significant improvements in work-related outcomes i.e. job satisfaction and work performance. But in the study on white-collar workers, no significant improvement was found on work performance, subsequent to the general manager's decision to take out the outcome measure on job satisfaction. In future research, proximal variables on work-related outcomes that might indicate direct effects of intervention on participants' affects, such as job satisfaction, work engagement, and organisational commitment would be recommended (Lowe et al., 2003; Somers, 2010; Torp et al., 2013).

This research, that assesses the effect of exercise as a single component in workplace interventions, has helped to expand knowledge of its effectiveness at promoting workplace physical activity. To encourage wider application

of theory into practice, further investigation is needed to examine the sole effect of this worksite exercise because it might provide a practical and efficient option for organisations to promote employee well-being. In terms of intervention delivery, results indicated that structured group exercise sessions were associated with higher adherence rate. Workplace intervention designs are advised to be culturally relevant (WHO, 2009). The influence of Chinese culture was found to be prevalent in the present study. Therefore, future research would need to examine if Chinese culture would lead to worksite exercise in peer-led structured group sessions being more adaptable in this setting.

This research used theory-informed frameworks for intervention development and process review. Both the BCW model and RE-AIM framework are found to be relevant and useful in studies. More research using the same theory-based frameworks in similar settings would help lend evidence for their generalisability in Chinese work culture. With the BCW model as a guide of this intervention development, 4 behavioural change techniques (BCTs), namely instruction, demonstration, prompts, and behavioural practice, were used. In future, each BCT might be investigated separately to see if there is any difference in their competitive advantage. Moreover, this intervention lasted for three months and follow-up data were collected a year after baseline measurement. Studies with longer-term follow-up would be able to test the effect sustainability reliably (Malik et al., 2013).

In conclusion, the present study findings provide valuable insights as to how a worksite exercise intervention was implemented for Chinese workers doing sedentary job roles and why it did, or did not, work. Since this is the first to test the delivery and effects of a worksite Qigong exercise in China, findings for larger samples in different settings should be tested for the results to be generalised to the working population.

REFERENCES

- Aaviksoo E. & Kiivet R.A. (2014). Sickness benefit cuts mainly affect blue-collar workers. *Scandinavian Journal of Public Health*. 42(6), 497-503.
- Abraham C. & Graham-Rowe E. (2009). Are worksite interventions effective in increasing physical activity? A systematic review and meta-analysis. *Healthy Psychology Review*. 3(1), 108-44
- Abraham C. & Michie S. (2008). A taxonomy of behaviour change techniques used in interventions. *Health Psychology*. 27(3), 379-87.
- Abraham, C. and Sheeran, P. (2005) The Health Belief Model. In: Conner, M. and Norman, P., Eds., *Predicting Health Behaviour: Research and Practice with Social Cognition Models*, 2nd Edition, Open University Press, Maidenhead, 28-80.
- Adams J. & White M. (2005). Why don't stage-based activity promotion interventions work? *Health Education Research*, 20(2), 237-243.
- Ahn G.E., Chmiel J.S., Dunlop D.D., Helenowski I.B., Semanik P.A. *et al.* (2015). Self-reported and objectively measured physical activity in adults with systemic lupus erythematosus. *Arthritis Care & Research* 67(5), 701-707.
- Ainsworth B.E., Haskell W.L., Herrmann S.D., Meckes N., Bassett Jr DR., Tudor-Locke C., & Greer J.L. *et al.* (2011). The Compendium of Physical Activities Tracking Guide. Retrieved from <http://sites.google.com/site/compendiumofphysicalactivities>
- Aittasalo M., Rinne M., Pasanen M., Kukkonen-Harjula K. & Vasankari T. (2012). Promoting walking among office employees: evaluation of a randomized controlled intervention with pedometers and e-mail messages. *BMC Public Health*. 12. 403.
- Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology*, 32, 665-683.
- Ajzen I., & Fishbein, M. (2005). The influence of attitudes on behavior. In D. Albarracín, B.T. Johnson, & M.P. Zanna

(Eds), *The Handbook of Attitudes*, 173-222, Mahwah, New Jersey: Lawrence Erlbaum Associates.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Al-Bannay H., Jarus T., Jongbloed L., Yazigi M. & Dean E. (2013). Culture as a variable in health research perspectives and caveats. *Health Promotion International*, 29(3):549-557.

Al-Busaidi Z.Q. (2008). Qualitative research and its uses in health care. *Sultan Qaboos University Medical Journal*. 8(1), 11-9.

Alexander K.E., Brijnath B. & Mazza D. (2014). Barriers and enablers to delivery of the healthy kids check: an analysis informed by the theoretical domains framework and COM-B model. *Implementation Science*. 9(60).

Alias M. & Hafir N.A.H.M. (2009). The relationship between academic self-confidence and cognitive performance among engineering students. *Proceedings of the Research in Engineering Education Symposium*. Palm Cove QLD.

Amaya M. & Petosa R.L. (2011). An evaluation of a worksite exercise intervention using the social cognitive theory: a pilot study. *Health Education Journal*. 7(2) 133-143.

American College of Sports Medicine (2015). <http://www.acsm.org/public-information/acsm-journals/guidelines>

American College of Sports Medicine and American Heart Association (2011). ACSM AHA Federal Support Physical Activity Guidelines. <http://www.acsm.org/about-acsm/media-room/acsm-in-the-news/2011/08/01/acsm-aha-support-federal-physical-activity-guidelines>

Anderson L.M., Quinn T.A., Glanz K., Ramirez G., Kahwati L.C., Johnson D.B., Buchanan L.R., Archer W.R., Chattopadhyav S., Kalra G.P. & Katz D.L. (2009). The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity: a systematic review. *American Journal of Preventive Medicine*. 37(4), 340-57.

Andersen L.N., Kristensen B., Roessier K.K., Herborg L.G. & Sjøgaard K. (2015). Efficacy of 'tailored physical activity'

on reducing sickness absence among health care workers: a 3-months randomised controlled trial. *Manual Therapy*. 20(5), 666-671.

- Anokye N.K., Trueman P., Green C., Pavey T.G. & Taylor R.S. (2012). Physical activity and health related quality of life. *BMC Public Health*, 12, 624.
- Armitage C.J. & Conner M. (2001). Efficacy of the theory of planned behaviour: a meta-analytic review. *British Journal of Social Psychology*, 40(Pt 4), 471-99.
- Armstrong T. & Bull F. (2006). Development of the World Health Organization Global Physical Activity Questionnaire (GPAQ). *Journal of Public Health*. 14(2), 66-70.
- Asbury L.D., Wong F.L., Price S.M. & Nolin M.J. (2008). The VERB campaign: applying a branding strategy in public health. *American Journal of Preventive Medicine*. 36(6 Suppl), S183-7.
- Auerbach C. & Silverstein L.B. (2003). *Qualitative data: an introduction to coding and analysis*. NYU.
- Bachmann K.H. (2007). Obesity weight management and health care costs: a primer. *Disease Management*. 10(3), 129-137
- Bains G. (2015). Cultural DNA. *The psychology of globalization*. Wiley:New Jersey.
- Bale J.M., Gazmararian J.A. & Elon L. (2015). Effect of the work environment on using time at work to exercise. *American Journal of Health Promotion*. 29(6), 345-52.
- Bandura A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: PrenticeHall.
- Bardus M., Blake H., Lloyd S. & Suggs L.S.(2014). Reasons for participating and not participating in a e-health workplace physical activity intervention: a qualitative analysis. *International Journal of Workplace Health Management*. 7(4), 229-246.
- Barr-Anderson D.J., AuYoung M., Whitt-Glover M.C., Glenn B.A. & Yancey A.K. (2010). Integration of short bouts of physical activity into organisational routine: a

- systematic review of the literature. *American Journal of Preventive Medicine*. 40(1), 76-93.
- Barredo R.D.V. & Mahon K. (2007). The effects of exercise and rest breaks on musculoskeletal discomfort during computer tasks: an evidence-based perspective. *Journal of Physical Therapy Science*, 19(2); 151-163.
- Baumeister R.F., Campbell J.D., Krueger J.I. & Vohs K.D. (2003). Does high self-esteem cause better performance interpersonal success happiness or healthier lifestyle? *Psychological Science in the Public Interest*. 4(1).
- Beaton D.E., Bombardier C., Guillemin F. & Ferraz M.B.. Recommendations for the Cross-Cultural Adaptation of Health Status Measures. (2002). Rosemont (IL): *American Academy of Orthopedic Surgeons*.
- Beaton D., Bombardier C., Escorpizo R., Zhang W., Lacaille D., Boonen A. *et al.* (2009). Worker productivity: frameworks and measures. *Journal of Rheumatology*. 36(9), 2100-9.
- Belza B., Toobert D.J. & Glasgow R.E. (2006). RE-AIM for program planning: Overview and applications. https://www.ncoa.org/wp-content/uploads/IssueBrief_ReAim_Final-2.pdf
- Bennie J., Timperio A., Dunstan D., Crawford D. & Salmon J. (2010). Environmental correlates of physical activity in Australian workplaces. *International Journal of Workplace Health Management* 3(1), 25-33.
- Bi Jieli & Wang Lin (2012). Woguo xiandai xuetuzhi Jianshe de lilun sikao (Theoretical reflection over development of modern apprenticeship in China). *China Training* 8.
- Bilic B. (2005). The theory of planned behaviour and healthy behaviours: critical analysis of methodological and theoretical issues. *Hellenic Journal of Psychology*, 2, 243-259.
- Bite R., Johnson J.A. & Plotnikoff R.C. (2007). Physical activity level and health-related quality of life in the general adult population: A systematic review. *Preventive Medicine*, 45(6), 401-415.
- Blake H., Zhou D.Y. & Batt M.E. (2013). Five year workplace wellness intervention in the NHS. *Perspectives in Public Health*. 133(5), 262-71.

- Blake H., Mo P., Malik S. & Thomas S. (2009). How effective are physical activity interventions for alleviating depressive symptoms in older people? A systematic review. *Clinical Rehabilitation* 23, 873–887.
- Blangsted A.K., Sjøgaard K., Hansen E.A., Hannerz H & Sjøgaard G. (2008). One-year randomized controlled trial with different physical activity programs to reduce musculoskeletal symptoms in the neck and shoulders among office workers. *Scandinavian Journal of Work & Environmental Health*. 34(1), 55-65.
- Blissmer B. & McAuley E. (2002). Testing the requirements of stages of physical activity among adults: the comparative effectiveness of stage-matched, mismatched, standard care and control interventions. *Annals of Behavioural Medicine*. 24(3), 181-9.
- Bloor M., Frankland J., Thomas M. & Robson K. (2000). *Focus groups in social research*. Thousand Oaks CA: SAGE Publications.
- Blue C.L., Black D.R., Conrad K. & Gretebeck K.A. (2003). Beliefs of blue-collar workers: stage of readiness for exercise. *American Journal of Health Behaviour*. 27(4), 408-20.
- Blue C.L., Wilbur J. & Marston-Scott M. (2001). Exercise among blue-collar workers: application of the theory of planned behaviour. *Research in Nursing and Health*. 24(6), 481-93.
- Borer K.T. (2005). Physical activity in the prevention and amelioration of osteoporosis in women – interaction of mechanical hormonal and dietary factors. *Sports Medicine*. 35(9), 779-830.
- Borg G. (1998). Borg's perceived exertion and pain scales. in *Human Kinetics* Champaign IL US. p.104.
- Boyle T., Keegel T., Bull F. Heyworth J. & Fritschi L. (2012). Physical activity and risks of proximal and distal colon cancers: a systematic review and meta-analysis. *Journal of the National Cancer Institute*. 104(20), 1548-1561.
- Bowen G.A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*. 9(2), 27-40.
- Brace A.M., Padilla H.M., DeJoy D.M., Wilson M.G., Vandenberg R.J. & Davis M. (2015). Applying RE-AIM to

- the evaluation of FUEL Your Life: a worksite translation of DPP. *Health Promotion Practice*. 16(1), 28-35.
- Braun V. & Clarke V. (2014). What can “thematic analysis” offer health and wellbeing researchers? *International Journal of Qualitative Studies in Health and Well-being*.
- Braun V. & Clarke V. (2013). *Successful Qualitative Research: A practical guide for beginners*. Sage Publications Ltd. London.
- Braun V. & Clarke V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.
- Bravata D.M., Smith-Spangler C., Sundaram V., Gienger A.L., Lin N., Lewis R., Stave C.D., Olkin I & Sirard J. R. (2007). Using pedometers to increase physical activity and improve health: A systematic review. *The Journal of the American Medical Association*. 298, 2296–2304.
- Bredahl T.V.G., Særvoll C.A., Kirkeluud L., Sjøgaard G. & Andersen L.L. (2015). When intervention meets organisation, a qualitative study of motivation and barriers to physical exercise at the workplace. *The Scientific World Journal*. 2015.
- Bridle et al. (2005). Systematic review of the effectiveness of health behaviour interventions based on the transtheoretical model. *Psychology and Health*, 20(3), 283-301.
- Brown A., Kitchell M., O’Neill T., Locklear J., Vosier A. *et al.* (2001). Identifying meaning and perceived level of satisfaction within the context of work. *Work*. 16(3), 219-226.
- Brown D.K., Barton J.L., Pretty J. & Gladwell V.F. (2012). Walks4work: rationale and study design to investigate walking at lunchtime in the workplace setting. *BMC Public Health*. 12(550).
- Brown H.E., Gilson N.D., Burton N.W. & Brown W.J. (2011). Does physical activity impact on presenteeism and other indicators of workplace well-being? *Sports Medicine*. 41(3), 249-262.
- Brown K.M., Elliott S.J. & Leatherdale S.T. (2015). Searching for rigour in the reporting of mixed methods population health research: a methodological review. *Health Education Research*. 30(6), 811-839.

- Brox A.U. & Froystein O. (2005). Health related quality of life and sickness absence in community nursing home employees: randomized controlled trial of physical exercise. *Occupational Medicine* 55(7), 558-562.
- Bull F.C., Maslin T.S. & Armstrong T. (2009). Global physical activity questionnaire (GPAQ): nine country reliability and validity study. *Journal of Physical Activity and Health* 6, 790-804.
- Campbell Collaboration Systematic Reviews: Policies & Guidelines, 2017.
<https://www.campbellcollaboration.org/library/campbell-collaboration-systematic-reviews-policies-and-guidelines.html>. Accessed 6 February 2018.
- Carlson S.A., Fulton J.E., Pratt M., Yang Z. & Adams E.K. (2014). Inadequate physical activity and health care expenditures in the United States. *Progress in Cardiovascular Diseases*. 57(4), 315-23.
- Carpenter C.J. (2010). A meta-analysis of the effectiveness of health belief model variables in predicting behaviour. *Health Communication*, 25(8), 661-9.
- Carroll C., Patterson M., Wood S., Booth A., Rick J. & Balain S. (2007). A conceptual framework for implementation fidelity. *Implementation Science*. 2(40).
- Carter S.E., Jones M. & Gladwell V.F. (2015). Energy expenditure and heart rate response to breaking up sedentary time with three different physical activity interventions. *Nutrition Metabolism and Cardiovascular Diseases*. 25(5), 503-509.
- Caspersen C.J., Powell K.E. & Christenson G.M. (1985). Physical activity exercise and physical fitness: definitions and distinctions for health-related research. *Public health reports* 100(2), 126.
- Centers for Disease Control and Prevention. Leadership Support (2013).
www.cdc.gov/workplacehealthpromotion/planning/leadership.html
- Centers for Disease Control and Prevention (2015).
<http://www.cdc.gov/physicalactivity/basics/pa-health/>
- Chan S. H. & Qiu H.H. (2011). Loneliness job satisfaction and organisational commitment of migrant workers: empirical evidence from China. *The International*

Journal of Human Resource Management. 22(5), 1109-1127.

Chew K.S., Tan T.W. & Ooi Y.T. (2011). Influence of Chinese cultural beliefs among Malaysian Chinese in a suburban population: a survey. *Singapore Medical Journal*. 52(4), 252-256.

China Labour Bulletin (2016). Supporting the worker's movement in China: Migrant workers and their children. <http://www.clb.org.hk/content/migrant-workers-and-their-children>

Christensen J.R., Overgaard K., Hansen K., Søgaard K. & Holtermann A. (2013). Effects on presenteeism and absenteeism from a 1-year workplace randomized controlled trial among health care workers. *Journal of Occupational and Environmental Medicine*. 55(10):1186-90.

Chu A.H.Y., Koh D., Moy F.M. & Muller-Riemenschneider F. (2014). Do workplace physical activity interventions improve mental health outcomes? *Occupational Medicine-Oxford*. 64(4), 235-245.

Cloostermans L., Bekkers M.B., Uiters E. & Proper K.I. (2015). The effectiveness of interventions for ageing workers on (early) retirement work ability and productivity: a systematic review. *International Archives of Occupational and Environmental Health*. 88(5), 521-32.

Collins J.A. & Fauser B.C.J.M. (2005). Balancing the strengths of systematic and narrative reviews. *Human Reproduction Update*, 11(2), 103-4

Collins J.L. & Wechsler H. (2008). The VERB™ campaign. *American Journal of Preventive Medicine*. 34(6):S171-172.

Colquhoun H., Leeman J., Michie S., Lokker C., Bragge P. *et al.* (2014). Towards a common terminology: a simplified framework of interventions to promote and integrate evidence into health practices systems and policies. *Implementation Science* 9:51.

Conn V.S., Hafdahl A.R., Cooper P.S., Brown L.M. & Lusk S.L. (2009). Meta-analysis of workplace physical activity interventions. *American Journal of Preventive Medicine* 37(4), 330-339.

Conner M. and Norman P. (2005). *Predicting health behaviour: Research and practice with social cognitive models*.

McGraw-Hill Education, UK.

- Conraads V.M., Deaton C., Piotrowicz E., Santaularia N., Tierney S., Piepoli M.F. *et al.* (2012) Adherence of heart failure patients to exercise. *European Journal of Heart Failure*. 14(5), 451-458.
- Coolican H. (2009). *Research methods and statistics in psychology*. 4th ed. Hodder Arnold: London.
- Craig P., Dieppe P., Macintyre S., Michie S., Nazareth I. & Petticrew M. (2008). Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ*. 337:a1655.
- Craig C.L., Marshall A.L., Sjostrom M., Bauman A.E., Booth M.L. *et al.* (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine and Science in Sports & Exercise*. 35(8), 1381-95.
- Crawford P.B., Gosliner W., Strode P., Samuels S.E., Burnett C., Craypo L. & Yancey A.K. (2004). Walking the talk: Fit WIC wellness programs improve self-efficacy in pediatric obesity prevention counseling. *American Journal of Public Health*. 94(9). 1480-1485.
- Crawford J.O., Laiou E., Spurgeon A. & McMillan G. (2008). Musculoskeletal disorders with the telecommunications sector – a systematic review. *International Journal of Industrial Ergonomics*. 38(1), 56-72.
- Creswell J.W. (2003). *Research Design: Qualitative and Quantitative Approaches*. Sage Publications: London.
- Crosby R.A., Salazar L.F., DiClemente R.J. & Lang D.L. (2010). Balancing rigor against the inherent limitations of investigating hard-to-reach populations. *Health Education Research*. 25(1), 1-5.
- Crum A.J. & Langer E.J. (2007). Mind-set matters: exercise and the placebo effect. *Psychological Science*. 18(2), 165-71.
- Cunningham J.A., Kypri K. & McCambridge J. (2013). Exploratory randomized controlled trial evaluating the impact of a waiting list control design. *BMC Medical Research Methodology*. 13: 150.
- Csikszentmihalyi M. (2008). *Finding Flow: The psychology of engagement with everyday life*. Basic Books: NY.

- Cycle to work scheme implementation guidance. London. Department for Transport (2011). https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/11305/cycle-to-work-guidance.pdf, accessed 4 October 2017.
- Dababneh A.J., Swanson N. & Shell R.L. (2001). Impact of added rest breaks on the productivity and well being of workers. *Ergonomics*. 44(2), 164-74.
- Data Protection Act (1998). <http://www.legislation.gov.uk/ukpga/1998/29/contents>
- Davies H.T.O. (2002). Understanding organisaitonal culture in reforming the National Health Service. *Journal of the Royal Society of Medicine*. 93(3), 140-142.
- Deci E.L. & Ryan R.M. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice self-determination and will? *Journal of Personality*, 74(6).
- DeJoy D.M. & Wilson M.G. (2009). Creating healthy work organizations. In M.E. Kenny L.E. Reese A.M. Horne & P. Orpinas (Eds.). *Realizing social justice: The challenge of preventive interventions*. Washington DC: American Psychological Association.
- DeJoy D.M., Wilson M.G., Vandenberg R.J., Richardson H.A. & McGrath A.L. (2004). Work characteristics and employee health & well-being: Test of a model of healthy work organization. *Journal of Occupational & Organisaitonal Psychology*. 77(4), 565-588
- Del Duca G.F., Nahas M.V., De Sousa T.F., Mota J., Hallal P. & Peres K.G. (2013). Clustering of physical inactivity in leisure work commuting and household domains among Brazilian adults. *Public Health*. 127(6).
- Della L.J., DeJoy D.M., Mitchell S.G., Goetzel R.Z., Roemer E.C. & Wilson M.G. (2010). Management support of workplace health promotion: field test of the leading by example tool. *American Journal of Health Promotion*. 25(2), 138-46.
- Demaio A.R., Nielsen K.K., Tersbøl B.P., Kallestrup P. & Meyrowitsch D.W. (2014). Primary Health Care: a strategic framework for the prevention and control of chronic non-communicable disease. *Global Health Action*. 7.
- Department of Commerce the USA (2006). The US Census Bureau on small business.

<http://www.census.gov/econ/smallbus.html>

Department of Medicine University of California San Francisco.
Guidelines for translating surveys to cross-cultural
research (2007)

<http://medicine.ucsf.edu/cadc/cores/measurement/methods.html>.

Department of Health UK (2011).

<https://www.gov.uk/government/publications/uk-physical-activity-guidelines>

Devilly G.J. & Mcfarlane A. (2009). When wait lists are not feasible, nothing is a thing that does not need to be done. *Journal of Consulting and Clinical Psychology*. 77(6): 1159-68.

de Zwart B.C., Frings-Dresen M.H. & van Duivenbooden J.C. (2002). Test-retest reliability of the Work Ability Index questionnaire. *Occupational Medicine London*. 52(4), 177-181.

DiClemente C.C. & Hughes S.O. (1990). Stages of change profiles in outpatient alcoholism treatment. *Journal of Substance Abuse Treatment*. 2(2), 217-35.

DiClemente C.C. et al. (1991). The process of smoking cessation: An analysis of precontemplation, contemplation, and preparation stages of change. *Journal of Consulting and Clinical Psychology*. 59(2), 295-304.

Dishman R.K., DeJoy D.M., Wilson M.G. & Vandenberg R.J. (2009). Move to improve: A randomized workplace trial to increase physical activity. *American Journal of Preventive Medicine*. 36(2), 133-141.

Dishman R.K., Oldenburg B., O'Neal H.A. & Shephard R.J. (1998). Worksite physical activity interventions. *American Journal of Preventive Medicine* 15(4), 344-361.

Dong L.M. (1985). Beijing: the development of a socialist capital. V.F.S. Sit (Ed.). *Chinese cities: The growth of the metropolis since 1949*. Oxford University Press. Oxford New York. 67-93.

Draper S.W. (2014). The Hawthorne Pygmalion Placebo and other effects of expectation: some notes.

<http://www.psy.gla.ac.uk/>

Dugdill L., Brettell A., Hulme C., McCluskey S. & Long A.

- (2008). Workplace physical activity interventions: a systematic review. *International Journal of Workplace Health Management* 1(1), 20-40.
- Dugdill L., Crone D. & Murphy R. (2009). *Physical Activity and Health Promotion: Evidence-based approaches to practice*. Wiley-Blackwell.
- Dumith S.C., Hallah P.C., Reis R.S. & Kohl H.W. (2011). Worldwide prevalence of physical inactivity and its association with human development index in 76 countries. *Preventive Medicine*. 53(1-2), 24-8.
- Dunbar J.A., Hernan A.L., Janus E.D., Vartiainen E., Laatikainen T. *et al.* (2015). Challenges of diabetes prevention in the real world – results and lessons from the Melbourne Diabetes Prevention Study. *BMJ Open Diabates Research & Care*. 3:e000131.
- Edmunds S., Stephenson D. & Clow A. (2011). The effects of a physical activity intervention on employees in small and medium enterprises: A mixed method study. *Work*, 46, 39-49.
- Edries N., Jelsma J. & Maart S. (2013). The impact of an employee wellness programme in clothing/textile manufacturing companies: a randomized controlled trial. *BMC Public Health*. 13(25).
- Egger M. & Smith G.D. (1998). Meta-analysis bias in location and selection of studies. *British Medical Journal*. 315(7109), 629-634.
- Egli T., Bland H.W., Melton B.F. & Czech D.R. (2011). Influence of age, sex, and race on college students' exercise motivation of physical activity. *Journal of American College Health*, 59(5): 399-406.
- Eime R.M., Young J.A., Harvey J.T., Charity M.J. & Payne W.R. (2013). A systematic review of the psychological and social benefits of participation in sport for adults: informing development of a conceptual model of health through sport. *International Journal of Behavioural Nutrition and Physical Activity*. 10(135).
- Eriksen H.R., Ihlebaek C., Mikkelsen A, Gronningsaeter H., Sandal G.M. & Ursin H. (2002). Improving subjective health at the worksite: a randomized controlled trial of stress management training physical exercise and an integrated health programme. *Occupational Medicine-Oxford*. 52(7), 383-391.

- Estabrook B., Zapka J. & Lemon S.C. (2012) Evaluating the implementation of a hospital work-site obesity prevention intervention: applying the RE-AIM framework. *Health Promotion Practice*. 13(2), 190-7.
- European Commission Enterprise and Industry (2013). Retrieved May 1 2013 from <http://ec.europa.eu/enterprise/policies/sme>
- Evans R.E., Fawole H.O., Sheriff S.A., Dall P.M., Grant P.M. & Ryan C.G. (2012). Point-of-choice prompts to reduce sitting time at work: a randomized trial. *American Journal of Preventive Medicine*. 43(3), 293-7.
- Fain J.A. (2010). Should we publish pilot/feasibility studies? *Diabetes Education*. 36(4), 521.
- Fan M.Y., Su M., Tan Y.Y., Liu Q.M., Ren Y.J., Li L.M. & Lv J. (2015). Gender age and education level modify the association between body mass index and physical activity: a cross-sectional study in Hangzhou China. *PLOS ONE*. 10(5).
- Farh J.L., Liang J., Chou L.F. & Cheng B.S. (2010). Paternalistic leadership in Chinese organisations: research progress and future research directions. In *Leadership and Management in China. Philosophies theories and practices*. Chao C.C. Cambridge University Press.
- Farris R.P., Will J.C., Khavjou O. & Finkelstein E.A. (2007). Beyond effectiveness: Evaluating the public health impact of the WISEWOMAN program. *American Journal of Public Health*. 97(4), 641-647.
- Ferrari R. (2015). Writing narrative style literature review. *The European Medical Writers Association*, 24(4), 230-235.
- Field A. (2005). *Discovering Statistics Using SPSS*. 2nd edition. Sage: London.
- Fisher G.G., Matthews R.A. & Gibbons A.M. (2015). Developing and investigating the use of single-item measures in organisational research. *Journal of Occupational Health Psychology*.
- Fleming A., Bradley C., Cullinan S. & Byrne S. (2014). Antibiotic prescribing in long-term care facilities: a qualitative multidisciplinary investigation. *BMJ Open* 4:e006442.

- Fletcher G.M., Behrens T.K. & Domina L. (2008). Barriers and enabling factors for worksite physical activity programs: a qualitative examination. *Journal of Physical Activity and Health*. 5, 418-429.
- Fonseca V.R., Bobre M.R.C., Pronk N.P. & Santos L.A. (2010). The association between physical activity productivity and health care utilization among employees in Brazil. *Journal of Occupational and Environmental Medicine*. 52(7): 706-712.
- Forgelholm M. (2010). Physical activity fitness and fatness: relations to mortality morbidity and disease risk factors: a systematic review. *Obesity Reviews*. 11(3), 202-221.
- Freedland K.E., Mohr M.C., Davidson K.W. & Schwartz K.W. (2011). Usual and unusual care: existing practice control groups in randomized controlled trials of behavioural interventions. *Psychosomatic Medicine*, 73(4): 323-335.
- Fry J.P. & Neff R. A. (2009). Periodic prompts and reminders in health promotion and health behavior interventions: systematic review. *Journal of Medical Internet Research*. 11(2).
- Fukue Natsuko (2009-07-22). "[Wake up hike out tune in move it](#)". *Japan Times*. Retrieved 2010-10-12
- Gabbatt A. (2012). Foxconn workers on iPhone 5 line strike in China right group says. *The Guardian*. Accessed 5 October 2012.
- Galinsky T., Swanson N., Sauter S., Dunkin R., Hurrell J. & Schleifer L. (2007). Supplementary breaks and stretching exercises for data entry operators: a follow-up field study. *American Journal of Industrial Medicine*. 50(7), 519-527.
- Gao Y., Griffiths S. & Chan E.Y. (2008). Community-based interventions to reduce overweight and obesity in China: a systematic review of the chinese and English literature. *Journal of Public Health*. 2008; 30(4), 436-38.
- Garmy P., Berg A. & Clausson E.K. (2015). A qualitative study exploring adolescents' experiences with a school-based mental health program. *BMC Public Health*. 15, 1074.
- Gebhardt W.A. & Maes S. (2001). Integrating social-psychological frameworks for health behaviour research. *American Journal of Health Behaviour*, 25(6), 528-36.

- Gidlow C., Johnston L.H., Crone D., Ellis N. & James D. (2006). A systematic review of the relationship between socio-economic position and physical activity. *Health Education Journal*. 65(4), 338-367.
- Gielen A.C., McDonald E.M., Gary T.L. & Bone L.R. (2008). Using the PRECEDE/PROCEED Model to Apply Health Behavior Theories. In K. Glanz F.M. B. K. Rimer & K. Viswanath (Eds.) *Health Behavior and Health Education: Theory Research and Practice*. 4th edition pp. 407-433. San Francisco: Jossey-Bass
- Gill D., Hammond, C.C., ReFlsteck E.J., Jehu C.M. et al. (2013). Physical Activity and Quality of Life. *Journal of Preventive Medicine & Public Health*, 46(Suppl 1), S28-34.
- Gill P., Stewart K., Treasure E. & Chadwick B. (2008). Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal*. 204, 291-5.
- Gillison F.B., Skevington S.M., Sato A., Standage M. & Evangelidou S. (2009). The effects of exercise interventions on quality of life in clinical and healthy populations: a meta-analysis. *Social Science & Medicine*, 68(9), 1700-10.
- Glasgow R.E., Vogt T.M. & Boles S.M. (1999). Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *American Journal of Public Health*. 89, 1322-1327.
- Glasgow R.E., Lichtenstein E. & Marcus A.C. (2003). Why don't we see more translation of health promotion research into practice? Rethinking the efficacy-to-effectiveness transition. *American Journal of Public Health*. 93(8), 1261-1267.
- Glazer N.L., Lyass A., Esliger D.W., Blease S.J., Freedson P.S., Massaro J.M., Murabito J.M. & Vasan R.S. (2013). Sustained and shorter bouts of physical activity are related to cardiovascular health. *Medicine and Science in Sports & Exercise*. 45(1), 109-15.
- Glionna J.M. (2010). China's state-mandated lunge break. *Los Angeles Times*.
- Gram B., Holtermann A., Bultmann U., Sjøgaard G. & Søgaard K. (2012). Does an exercise intervention improving aerobic capacity among construction workers also improve musculoskeletal pain work ability productivity

perceived physical exertion and sick leave? A randomized controlled trial. *Journal of Occupational and Environmental Medicine*. 54(12), 1520-1526.

Grawitch M.J., Gottschalk M. & Munz D.C. (2006). The path to a healthy workplace: A critical review linking healthy workplace practices employee well-being and organisaitonal improvements. *Consulting Psychology Journal*. 58(3), 129-147.

Green B.N. (2008). A literature review of neck pain associated with computer use: public health implications. *The Journal of the Canadian Chiropractic Association*. 52(3), 161-167.

Gregg E.W., Getzoff R.B., Caspersen C.J., Williamson D.F. & Narayan V. (2003). Relationship of walking to mortality among US adults with diabetes. *Archives of Internal Medicine* 163(12), 1440-1447.

Griffiths K.L. ,Mackey M.G. & Adamson B.J. (2007). The impact of a computerized work environment on professional occupational groups and behavioural and physiological risk factors for musculoskeletal symptoms: a literature review. *Journal of Occupational Rehabilitation*. 17(4), 743-65.

Grimm P. (2010). Pretesting a questionnaire. *Wiley International Encyclopedia of Marketing 2*. John Wiley & Sons.

Grossmeier J. (2013). The influence of worksite and employee variables on employee engagement in telephonic health coaching programs: a retrospective multivariate analysis. *American Journal of Health Promotion*. 27(3), e69-e80.

Gu D., Reynolds K., Duan X. *et al.* (2003). Prevalence of diabetes and impaired fasting glucose in the Chinese adult population. *Diabetologia* 46(9), 1190-1198.

Guelfi K.J., Wang C., Dimmock J.A., Jackson B., Newnham J.P. & Yang H. (2015). A comparison of beliefs about exercise during pregnancy between Chinese and Australian pregnant women. *BMC Pregnancy Childbirth* 15, 345.

Gummesson E. (1998). Productivity quality and relationship marketing in service operations. *International Journal of Contemporary Hospitality Management*. 10(1), 4-15.

Gürses S. & Kiliç C.K. (2013). Corporate image aspect of corporate management in healthcare industry:

- definition measurement and an empirical investigation. *International Business Research*. 6(12).
- Hall A.M., Maher C.G., Latimer J., Ferreira M.L. & Lam P. (2009). A randomized controlled trial of taichi for long-term low back pain (TAICHI): study rationale design and methods. *BMC Musculoskeletal Disorders*. 10(55).
- Hallal P.C., Andersen L.B., Bull F.C., Guthold R., Haskell W. & Ekelund U. (2012). Global physical inactivity levels: surveillance progress pitfalls and prospects. *Lancet*. 380, 247-57.
- Hambrick D.C. (2007). The field of management's devotion to theory: too much of a good thing? *Academy of Management Journal*, 50(6), 1346-1352.
- Hammerback K. *et.al* (2015). Perspectives on workplace health promotion among employees in low-wage industries. *American Journal of Health Promotion*. 29(6), 384-392.
- Han J. & Han J. (2009). Network-based recruiting and applicant attraction in China: insights from both organisational and individual perspectives. *The International Journal of Human Resource Management*. 20(11), 2228-2249.
- Handley M.A., Schillinger D. & Shiboski, S. (2011). Quasi-experimental designs in practice-based research settings: design and implementation considerations. *The Journal of American Board of Family Medicine*. 24(5): 589-596.
- Harvey S.B., Hotopf M., Øverland S. & Mykletun A. (2010). Physical activity and common mental disorders. *The British Journal of Psychiatry*. 197(5), 357-64.
- Hennink M., Hutter I. & Bailey A. (2011). *Qualitative Research Methods*. Sage: London UK.
- Henriksson S., Anclair M. & Hiltunen A.J. (2016). Effectiveness of cognitive behavioural therapy on health-related quality of life: an evaluation of therapies provided by trainee therapists. *Scandinavian Journal of Psychology*. 57(3):215-22.
- Hengel K.M., Blatter B.M., van der Molen H.F., Bongers P. & van der Beek A.J. (2013). The effectiveness of a construction worksite prevention program on work ability health and sick leave: results from a cluster randomized controlled trial. *Journal of Work*

Environment & Health. 39(5).

- Hensing G. (2009). The measurements of sickness absence – a theoretical perspective. *Norwegian Journal of Epidemiology*. 19(2).
- Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Accessed from <http://handbook.cochrane.org>.
- Hille K. & Mitchell T. (2010). Foxconn raises pay by 30% in China. *Financial Times* p. 14. Accessed 3 June 2010.
- Hillman C.H., Erickson K.I. & Kramer A.F. (2008). Be smart exercise your heart: exercise effects on brain and cognition. *Nature Reviews Neuroscience*. 9, 58-65.
- Hillsdon M., Thorogood M., White I. & Foster C. (2002). Advising people to take more exercise is ineffective: a randomized controlled trial of physical activity promotion in primary care. *International Journal of Epidemiology*. 31(4), 808-15.
- Hillston M., Foster C. & Thorogood M. (2005). Interventions for promoting physical activity. *Cochrane Database Systematic Reviews*. 1.
- Hilton C. E. & Johnston L.H. (2017). Health psychology: It's not what you do, it's the way that you do it. *Health Psychology Open*.
- Hodges N.J. & Franks I.M. (2002). Modelling coaching practice: the role of instruction and demonstration. *Journal of Sports Science*. 20(10), 793-811.
- Hofstede G. (2011). Dimensionalizing cultures: The Hofstede model in context. *Online Readings in Psychology and Culture* 2(1).
- Hofstede G., Hofstede G.J. & Minkov M. (2010). *Cultures and organisations: software of the mind, rev. 3rd ed.* New York: McGraw-Hill.
- Hogan C.L., Mata J. & Carstensen L.L. (2013). Exercise holds immediate benefits for affect and cognition in younger and older adults. *Psychology & Aging*. 28(2), 587-594.
- Hong Y.Y., Wyer S.W. & Fong P.S. (2008). Chinese working in groups: Effort dispensability versus normative influence. *Asian Journal of Social Psychology*. 11, 187-195.

- Hopkins J.M., Glenn B.A., Cole B.L., McCarthy W. & Yancey A. K. (2012). Implementing organisational physical activity and healthy eating strategies on paid time: process evaluation of the UCLA WORKING pilot study. *Health Education Research*. 27(3), 285-398.
- Horner S., Rew L. & Torres R. (2006). Enhancing intervention fidelity: a means of strengthening study impact. *Journal for Specialists in Paediatric Nursing*. 11(2), 80-89.
- Hoven H., Wahrendorf M. & Siegrist J. (2014). Occupational position work stress and depressive symptoms: a pathway analysis of longitudinal SHARE data. *Journal of Epidemiology & Community Health*. 69, 447-452.
- Hu B., Lin L.F., Yuan A.Y., Yang Y.J., LV M., YE W.M., Yu S.Z., Li J. & Wang X.F. (2013). A validity study of three physical activity questionnaires. *Modern Preventive Medicine*. 16.
- Hunt S.M. & Bhopal R. (2004). Self report in clinical and epidemiological studies with non-English speakers: the challenge of language and culture. *Journal of Epidemiology & Community Health*. 58, 618-622.
- Hurtwitz E.L., Carragee E.J., van der Velde G., Carroll L.J., Nordin M., Guzman J., Peloso P.M., Holm L.W., Côté P., Hogg-Johnson S., Cassidy J.D. & Haldeman S. (2008). Treatment of neck pain: noninvasive interventions. *European Spine Journal*. 17(Suppl 1), 123-152.
- IJmker S., Huysmans M.A., van der Beek A.J., Knol D.L., van Mechelen W., Bongers P.M. & Blatter B.M. (2011). Software-recorded and self-reported duration of computer use in relation to the onset of severe arm-wrist-hand pain and neck-shoulder pain. *Occupational & Environmental Medicine*. 68(7), 502-509.
- Ilmarinen J. (2007). The work ability index. *Occupational Medicine*. 57, 160.
- Imamura K., Kawakami N., Furukawa T.A., Matsuyama Y., Shimazu A. & Kasai K. (2015). Effects of an internet-based cognitive behavioural therapy intervention on preventing major depressive episodes among workers: a protocol for a randomized controlled trial. *BMJ Open*. 5:e007590.
- IPAQ Research Committee. Guidelines for the Data Processing and Analysis of the International Physical Activity Questionnaire (2005). <http://www.ipaq.ki.se/scoring.pdf>. Accessed 10 January 2013.

- Jaka M.M., Haapala J.L., Wolfson J. & French S.A. (2015). Describing the relationship between occupational and non-occupational physical activity using objective measurement. *Preventive Medicine Report*. 2, 213-217.
- Jahnke R., Larkey L., Rogers C., Etnier J. & Lin F. (2010). A comprehensive review of health benefits of Qigong and Taichi. *American Journal of Health Promotion*. 24(6):e1-e25.
- Jakobsen M.D., Sundstrup E., Brandt M., Jay K., Aagaard P & Andersen L.L. (2015). Physical exercise at the workplace prevents deterioration of work ability among healthcare workers: cluster randomized controlled trial. *BMC Public Health*. 15, 1174.
- Jenkinson K.A., Naughton G. & Benson A.C. (2012). The GLAMA (Girls! Lead! Achieve! Mentor! Activate!) physical activity and peer leadership intervention pilot project: a process evaluation using the RE-AIM framework. *BMC Public Health* 12(1), 55.
- Jones C.J., Smith H. & Llewellyn C. (2013). Evaluating the effectiveness of health belief model interventions in improving adherence: a systematic review. *Health Psychology Review*, 8(3), 253-269.
- Jordan J.L., Holden M.A., Mason E.E. & Foster N.E. (2010). Interventions to improve adherence to exercise for chronic musculoskeletal pain in adults. *Cochrane Database Systematic Review*. 1:CD005956
- Jørgensen M.B., Faber A., Hansen J.V., Holtermann A. & Søgaard K. (2010). Effects on musculoskeletal pain work ability and sickness absence in a 1-year randomised controlled trial among cleaners. *BMC Public Health*. 11, 840.
- Justin B., Hirani S. & Stanton N. (2016). Challenges in patient recruitment implementation and fidelity in a mobile telehealth study. *Telemedicine & e-Health*. 22(5), 400-409.
- Kaasalainen K.S., Kasila K., Villberg J., Komulainen J. & Poskiparta M. (2013). A cross-sectional study of low physical fitness self-rated fitness and psychosocial factors in a sample of Finnish 18-to-64-year-old men. *BMC Public Health*. 13(1113).
- Kahn E.B., Ramsey L.T., Brownson R.C., Heath G.W., Howze E.H. et al. (2002). The effectiveness of interventions to

- increase physical activity. A systematic review. *American Journal of Preventive Medicine*. 22(4 Suppl), 73-107.
- Kelly M.P. & Barker M. (2016). Why is changing health-related behaviour so difficult? *Public Health*, 136, 109-116.
- Kessler R.C., Ames M., Hymel P.A., Loeppke R., McKenas D.K., Richling D.E., Stang P.E. & Ustun T.B. (2004). Using the World Health Organization Health and Work Performance Questionnaire HPQ to evaluate the indirect workplace costs of illness. *Journal of Occupational and Environmental Medicine*. 46(6), S23-S37.
- Kilpatrick M., Hebert E. & Bartholomew J. (2005). College student's motivation for physical activity: differentiating men's and women's motives for sport participation and exercise. *Journal of American College Health*. 54(2).
- Kim A.E., Towers A., Renaud J., Zhu J., Shea J.A., Galvin R. & Volpp K.G. (2012). Application of the RE-AIM framework to evaluate the impact of a worksite-based financial incentive intervention for smoking cessation. *Journal of Occupational Environmental Medicine*. 54(5), 610-4.
- Kinser P.A. & Robins J.L. (2013). Control group design: enhancing rigor in research of mind-body therapies for depression. *Evidence-based complementary and alternative medicine*. 2013: 140467.
- Kivimaki M., Elovainio M., Vahtera J., Ferrie J. & Thorell T. (2003). Organisational justice and health of employees: prospective cohort study. *Occupational & Environmental Medicine*. 60(1), 27-34.
- Kossek E.E., Ozeki C. & Kosier W. (2001). Wellness incentives: Lessons learned about organisaitonal change. *Human Resource Planning*. 24(4), 24-35.
- Krane L., Johnsen R., Fleten N., Nielsen C.V., Stapelfeldt C.M., Jensen C & Braaten T. (2014). Sickness absence patterns and trends in the health care sector: 5-year monitoring of female municipal employees in the health and care sectors in Norway and Denmark. *Human Resources for Health*. 12(1).
- Kreuger R.A. & Casey M.A. (2009). *Focus groups: a practical Guide for Applied Research*. 4th ed. Sage Publishing House Thousand Oaks CA.

- Krueger R.A. & Casey M.A. (2014). *Focus Groups: A Practical Guide for Applied Research*, 5thed. London:SAGE.
- Kropf M., Neumann M., Becker M. & Maaz K. (2015). Administrative procedures to increase the response rate in questionnaire studies in the school context: an experimental study of the effects of reminders and incentives. *International Review in Education*. 18(2), 327-350.
- Kuoppala J., Lamminpaa A. & Husman P. (2008). Work health promotion job well-being and sickness absence – a systematic review and meta-analysis. *Journal of Occupational and Environmental Medicine*. 50(11), 1216-1227.
- Kynge J. (2013). Migrant workers shape China's future. *Financial Times*. Accessed 22 April 2013.
- Laaksonen D.E., Lindstrom J., Lakka T.A., Eriksson J.G., Niskanen L. *et al.* (2005). Physical activity in the prevention of type 2 diabetes. The Finnish Diabetes Prevention Study. *Diabetes* 54, 158-165.
- LaGasse A.B. (2013). Pilot and feasibility studies: Application in music therapy research. *Journal of Music Therapy*. 50(4), 304-320.
- Lahart I.M., Metsios G.S., Nevill A.M. & Carmichael A.R. (2015). Physical activity risk of death and recurrence in breast cancer survivors: a systematic review and meta-analysis of epidemiological studies. *ACTA Oncologica* 54(5), 635-654.
- Lahti J., Laaksonen M., Lahelma E. & Rahkonen O. (2010). The impact of physical activity on sickness absence. *Scandinavian Journal of Medicine & Science in Sports*. 20(2), 191-199.
- Lam R.W., Parikh S.V., Ramasubbu R., Michalak E.E., Tam E.M. *et al.* (2013). Effects of combined pharmacotherapy and psychotherapy for improving work functioning in major depressive disorder. *The British Journal of Psychiatry*. 203(5), 358-365.
- Latham G.P. & Locke E.A. (2007) New developments in and directions for goal-setting research. *European Psychologist*, 12, 290-300.
- Lee I.M., Shiroma E.J., Lobelo F., Puska P., Blair S.N. *et al.* (2012). Effect of physical inactivity on major non-

communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* 380(9838), 219-29.

Leone L., Ling T., Baldassarre L., Barnett L.M., Capranica L. & Pesce C. (2015). Corporate responsibility for childhood physical activity promotion in the UK. *Health Promotion International*.

Let's Get Moving resources help promote physical activity (website). London. Department of Health (2012). <https://www.gov.uk/government/news/let-s-get-moving-resources-help-promote-physical-activity> accessed 4 October 2017.

Leslie J.H., Braun K.L., Novotny R. & Mokuau N. (2013). Factors affecting healthy eating and physical activity behaviors among multiethnic blue- and white-collar workers: a case study of one healthcare institution. *Hawaii J Med Public Health*. 72(9), 300-6

Li F., Liu Y. Zhu W. & Harmer P. (2016). China's Challenges in promoting physical activity and fitness. *Lancet*, Sep 24:388(10051), 1278-9

Li S., Li T., Li L.C. & Wang C. (2015). Intervention strategies for the national project of workplace health promotion in China. *Biomedical and Environmental Sciences*. 28(5), 396-400.

Li J. & Siegrist J. (2012). Physical activity and risk of cardiovascular disease – a meta-analysis of prospective cohort studies. *International Journal of Environmental Research and Public Health*. 9(2), 391-407.

Liamputtong P. (2011). *Focus group methodology. Principles and practice*. London: Sage.

Lin S., Wang Z. & Wang M. (2006). Work ability of workers in western china: reference data. *Occupational Medicine London* 56, 89-93.

Liu W. & He W.M. (2008). Applicability of the preventive exercise for office workers. *Journal of Clinical Rehabilitative Tissue Engineering Research*. 24.

Lock D. & Colford N. (2005). International review of the literature relating to the benefits of limbering up exercises at work. *Health & Safety Executive*.

Lock L. & McKee M. (2005) Health impact assessment: assessing opportunities and barriers to intersectoral

- health improvement in an expanded European Union. *Journal of Epidemiology & Community Health* 59(5), 356-360.
- Lowe G.S., Schellenberg G. & Shannon H.S. (2003). Correlates of employees' perceptions of a healthy work environment. *American Journal of Health Promotion*. 17, 390-399.
- Lowe B.D. & Dick R.B. (2014). Workplace exercise for control of occupational neck/shoulder disorders: a review of prospective studies. *Environmental Health Insights*. 8(Suppl 1), 75-95.
- Macfarlane D.J., Lee C.Y., Ho Y.K., Chan K.L. & Chan T.S. (2006). Reliability and validity of the chinese version of IPAQ short last 7 days. *Journal of Science and Medicine in Sport*. 10(1), 45-51.
- Mache S., Jensen S., Linning S., Jahn R., Steudtner M., Ochsmann E. & Preuß G. (2015). Do overweight workers profit by workplace health promotion more than their normal-weight peers? Evaluation of a worksite intervention. *Journal of Occupational Medicine and Toxicology*. 10:28.
- MacMillan F., Fitzsimons C., Black K., Granat M.H., Grant M.P. et al. (2011). West End Walkers 65+: A randomised controlled trial of a primary care-based walking intervention for older adults: Study rationale and design. *BMC Public Health*. 11, 120.
- Macniven R., Bauman A. & Abouzeid M. (2012). A review of population-based prevalence studies of physical activity in adults in the Asia-Pacific region. *BMC Public Health*. 12(41).
- Magnini V.P., Lee G. & Kim B.C. (2011). The cascading effect consequences of exercise among hotel workers. *International Journal of Contemporary Hospitality Management*. 23(5), 624-643.
- Malchaire J.B. (2006). Participative management strategy for occupational health safety and well-being risks. *Giornale Italiano di Medicina del Lavoro ed Ergonomia*. 28(4), 478-486.
- Malik S., Blake H. & Suggs L. S (2013). A systematic review of workplace health promotion interventions for increasing physical activity. *British Journal of Health Psychology*.

- Mangione T.W. & Quinn R.P. (1975). Job satisfaction counterproductive behavior and drug use at work. *Journal of Applied Psychology*. 60(1), 114-116.
- Mannocci A., Thiene D.D., Cimmuto A.D., Masala D., Bocca A et. al (2010). International physical activity questionnaire: validation and assessment in an Italian sample. *Italian Journal of Public Health Archives 2003-2012* 7(4).
- Marcus B.H., Williams D.M., Dubbert P.M., Sallis J.F., King A.C., Yancey A.K., Franklin B.A., Buchner D., Daniels S.R. & Claytor R.P. (2006). Physical activity intervention studies: what we know and what we need to know: a scientific statement from the American Heart Association Council on Nutrition Physical Activity and Metabolism. *Circulation*. 114(24), 2739-52.
- Marshall A.L. (2004). Challenges and opportunities for promoting physical activity in the workplace. *Journal of Science and Medicine in Sport*. 7(1 Suppl): 60-66.
- Matthews E., Salvo D., Sarma P.S., Thankappan K.R. & Pratt M. (2016). Adapting and validating the Global physical activity questionnaire (GPAQ) for Trivandrum India 2013. *CDC* 13:150528.
- Maxwell J.A. (2005). *Qualitative research design: An interactive approach* 2nd ed. SAGE Publications Thousand Oaks CA.
- Maxwell J. (2009). Designing a qualitative study. In L. Bickman & D. Rog (Eds.) *The SAGE handbook of applied social research methods* 2nd ed. 214-254. Thousand Oaks CA:SAGE Publications Inc.
- Mayer J.M., Nuzzo J.L. & Dagenais S. (2013). Use of participant focus groups to identify barriers and facilitators to worksite exercise therapy adherence in randomized controlled trials involving firefighters. *Patient preference and adherence*. 7: 207-215.
- McAuley E., Elavsky S., Motl R.W., Konopack J.F., Hu L. & Marquez D.X. (2005). Physical activity self-efficacy and self-esteem: longitudinal relationships in older adults. *The Journal of Gerontology Series B: Psychological Sciences and Social Sciences*. 60(5), 268-275.
- Merrill R.M., Anderson A. & Thygeson S.M. (2011). Effectiveness of a worksite wellness program on health behaviours and personal health. *Journal of Occupational and Environmental Medicine* 53(9), 1008-1012.

- Michie S., Atkins L. & West R. (2014). The behaviour change wheel – a guide to designing interventions. *Silverbank Publishing*. Great Britain.
- Michie S. & Johnston M. (2012) Theories and techniques of behaviour change: developing a cumulative science of behaviour change. *Healthy Psychology Review*. 6(1).
- Michie S., Richardson M., Johnston M., Abraham C., Francis J., Hardeman W., Eccles M.P., Cane J. & Wood C.E. (2013). The behaviour change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behaviour change interventions. *Annals of Behavioural Medicine*. 46(1), 81-95.
- Miles J. (2014). Special report on China – Building the dream. *The Economist*. Accessed 19-25th April 2014.
- Mills P.R., Kessler R.C., Cooper J. & Sullivan S. (2007). Impact of a health promotion program on employee health risks and work productivity. *American Journal of Health Promotion*. 22(1), 45-53.
- Miller W.R. & Rollnick S. (2013). *Motivational Interviewing: Helping people change*. 3rd Edition. Guilford Press: New York.
- Milner K., Greyling M., Goetzl R., Da Silva R., Kolbe – Alesander T., Patel D., Nossel C. & Beckowski M. (2015). The relationship between leadership support workplace health promotion and employee wellbeing in South Africa. *Health Promotion International*. 30(3), 514-22.
- Ministry of Commerce China (2015). english.mofcom.gov.cn/article/statistic/
- Ministry of Human Resources and Social Security of China (2015). english.gov.cn/state_council/2014/09/.../content_281474986284102.htm
- Moore G.F., Audrey S., Barker M., Bond L., Bonell C. *et al.* (2015). Process evaluation of complex interventions: Medical Research Council guidance. *BMJ*. 350.
- Morris J.N., Heady J.A., Raffle P.A.B. & Parks J.W. (1953). Coronary heart and physical activity of work. *Lancet* 265: 1053-1057.
- Molanorouzi K., Khoo S. & Morris T. (2015). Motives for adult

participation in physical activity: type of activity, age, and gender. *BMC Public Health*. 15:66

- Mozaffarian D., Afshin A., Benowitz B. D. *et al.* (2012). Population approaches to improve diet physical activity and smoking habits: a scientific statement from the American Heart Association. *Circulation*. 126(12), 1514-63.
- Mudie L. (2010). Mass exercises make comeback. *Radio Free Asia*. Accessed 12th August 2010.
- Muswazi M.T. & Nhamo E. (2013) Note taking: A lesson for novice qualitative researchers. *IOSR Journal of Research & Method in Education*, 2(3), 13-17.
- Myers J., Kaykaha A., George S., Abella J., Zaheer N. *et al.* (2004). Fitness versus physical activity patterns in predicting mortality in men. *Journal of Medicine*. 117, 912-918.
- National Bureau of Statistics of China (2012). Retrieved May 1 2013 from <http://www.stats.gov.cn/english/statisticdata>
- National Bureau of Statistics of China (2015) <http://www.stats.gov.cn/english/statisticdata> Accessed May 1 2015.
- National Center for Complementary and Integrative Health U.S. Department of Health and Health Services (2013). Traditional Chinese Medicine: In Depth. <https://nccih.nih.gov/health/whatiscam/chinesemed.htm>
- National Diabetes Research Group (1981). A mass survey of diabetes mellitus in a population of 300000 in 14 provinces and municipalities in China. *Zhonghua Nei Ke Za Zhi*. 29(11), 678-683.
- National Health and Family Planning Commission China (2015). 2014 report on Chinese resident's chronic disease and nutrition. http://en.nhfpc.gov.cn/2015-06/15/content_21008408_3.htm
- National Institute for Health Research (2016). www.nihr.ac.uk
- National Institute for Health and Care Excellence (2014). Behaviour change: general approaches. Public health guideline. <https://www.nice.org.uk/Guidance/ph49>, accessed 26 October 2017.

- National Institute for Health and Care Excellence (2007). Behaviour change: general approaches. Public health guideline. <https://www.nice.org.uk/Guidance/ph6>, accessed 4 October 2017.
- Newsom J.T., Jones R.N. & Hofer S.M. (2012). *Longitudinal data analysis: a practical guide for researchers in ageing health and social sciences*. Routledge Taylor & Francis Group. New York.
- Nicholson N. & Johns G. (1985). The absence culture and the psychological contract – who's in control of absence. *The Academy of Management Review*. 10(3), 397-407.
- Nurminen E., Malmivaara A., Ilmarinen J., Ylostalo P., Mutanen P., Ahonen G. & Aro T. (2002). Effectiveness of a worksite exercise program with respect to perceived work ability and sick leaves among women with physical work. *Scandinavian Journal of Work Environment & Health*. 28(2), 85-93.
- Ng S.W., Howard A.G., Wang H.J., Su C. & Zhang B. (2014). The physical activity transition among adults in China: 1991-2011. *Obesity Reviews*. 15(Suppl 1), 27-36.
- Nystrom M.B.T., Neely G., Hassmen P. & Carlbring P. (2015). Treating major depression with physical activity: a systematic overview with recommendations. *Cognitive Behaviour Therapy*. 44(4), 341-352.
- Odeen M., Magnussen L.H., Maeland S., Larun L., Eriksen H.R. & Tveito T.H. (2013). Systematic review of active workplace interventions to reduce sickness absence. *Occupational Medicine-Oxford* 63(1), 7-16.
- OECD (2014) Health statistics. <http://www.oecd.org/els/health-systems/Briefing-Note-CHINA-2014.pdf>
- Oguma Y. & Tagawa T.S. (2004). Physical activity decreases cardiovascular disease risk in women. *American Journal of Preventive Medicine*. 26(5), 407-418.
- O'Halloran P.D., Blackstock F., Shields N., Holland A. et al. (2014). Motivational interviewing to increase physical activity in people with chronic health conditions: a systematic review and meta-analysis *Clinical Rehabilitation*, 28(12), 1159-71.
- Oldridge N.B. (2008). Economic burden of physical inactivity: healthcare costs associated with cardiovascular disease. *European Journal of Cardiovascular Prevention &*

Rehabilitation. 15(2), 130-9.

- Osilla K.C. Van Busum K., Schnyer C., Larkin J.W., Eibner C. & Mattke S. (2012). Systematic review of the impact of worksite wellness programs. *The American Journal of Managed Care*. 18(2), 68-81.
- Owen N., Bauman A. & Brown W. (2009). Too much sitting: a novel and important predictor of chronic disease risk? *British Journal of Sports Medicine*. 43(2), 81-3.
- Paek H.J., Yu J. & Boem J.B. (2013). Is on-line health promotion culture-bound?: cultural characteristics manifested in U.S. and South Korean Antismoking web sites. *Journal of Advertising*, 38,2009(1), 35-48.
- Paffenbarger R.S., Hyde R.T., Wing A.L. & Hsieh C.C. (1986). Physical activity all-cause mortality and longevity of college alumni. *New England Journal of Medicine* 314(10), 605-13.
- Pal S., Cheng C., Egger G., Binns C. & Donovan R. (2009). Using pedometers to increase physical activity in overweight and obese women: A pilot study. *BMC Public Health*. 9.
- Palumbo M.V., Wu G., McRae H.S., Rambur B. & McIntosh B. (2012). Tai Chi for older nurses: a workplace wellness pilot study. *Applied Nursing Research*. 25(1), 54-59.
- Paluska S.A. & Schwenk T.L. (2000). Physical activity and mental health: current concepts. *Sports Medicine*. 29(3), 167-80.
- Panda A. & Gupta R.K. (2014). Making academic research more relevant: a few suggestions. *IIMB Management Review*. 26(3), 156-169.
- Pannucci C.J. & Wilkins E.G. (2010). Identifying and avoiding bias in research. *Plastic Reconstructive Surgery* 126(2), 619-625.
- Parks K.M. & Steelman L.A. (2008). Organisational wellness programs: A meta-analysis. *Journal of Occupational Health Psychology* 13(1), 58-68.
- Parry S., Straker L., Gilson N.D. & Smith A. J. (2013). Participatory workplace interventions can reduce sedentary time for office workers – a randomised controlled trial. *PLoS One*. 8(11), e78957.
- Pate R.R., Pratt M., Blair S.N., Haskell W.L., Macera C.A. &

- Bourchara C. *et al.* (1995). Physical activity and public health a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine *JAMA*. 273:402-407.
- Pedersen M.M., Zebis M.K., Langhem H., Poulsen O.M., Mortensen O.S. *et al.* (2013). Influence of self-efficacy on compliance to workplace exercise. *International Journal of Behavioural Medicine*. 20(3), 365-370.
- Pedersen M.T., Andersen L.L., Jorgensen M.B., Sjøgaard K. & Sjøgaard G. (2013). Effect of specific resistance training on musculoskeletal pain symptoms. *The Journal of Strength and Conditioning Research*. 27(1), 229-35.
- Pelletier K.R. (2009). A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: update VII 2004-2008. *Journal of Occupational and Environmental Medicine*. 51(7), 822-37.
- Penedo F.J. & Dahn J.R. (2005). Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry*. 18(2), 189-193.
- Pereira J.P., Coombes B.K., Comans A.C. & Johnston V. (2014). The impact of onsite workplace health-enhancing physical activity interventions on worker productivity: a systematic review. *Occupational & Environmental Medicine*.
- Pettee K.K., Brach J.S., Kriska A.M., Boudreau R., Richardson C.R., Colbert L.H., Satterfield S., Visser M., Harris T.B., Ayonayon H.N. & Newman A.B. (2006). Influence of marital status on physical activity levels among older adults. *Medicine & Science in Sports & Exercise*. 38(3), 541-6.
- Piantadosi Steven. (2005) Crossover Designs. In: Piantadosi Steven. *Clinical Trials: A Methodologic Perspective*. 2nd ed. Hoboken, NJ: John Wiley and Sons, Inc.
- Pit S.W., Vo T. & Pyakurei S. (2014). The effectiveness of recruitment strategies on general practitioner's survey response rates – a systematic review. *BMC Research Methodology*. 14(76).
- Pohjonen T. & Ranta R. (2001). Effects of worksite physical activity intervention on physical fitness perceived health status and work ability among home care workers.

Preventive Medicine. 32(6), 465-475.

Prochaska J.O. & DiClemente C.C. (1984). *The transtheoretical approach: Towards a systematic eclectic framework*. Dow Jones Irwin, Homewood, IL, USA.

Price P.C., Jhangiani S. & Chiang I-Chant A. (2015). *Research Methods in Psychology*. BC campus. OpenEd.

Prick A.E., de Lange J., van't L.N. & Pot A.M. (2014). Process evaluation of a multicomponent dyadic intervention study with exercise and support for people with dementia and their family caregivers. *Trials*. 15:401.

Pronk N.P. (2009). Physical activity promotion in business and industry: evidence context and recommendations for a national plan. *Journal of Physical Activity & Health*. 6 Suppl 2:S220-35.

Pronk N.P., Katz A.S., Lowry M. & Payfer J.R. (2012). Reducing occupational sitting time and improving worker health: the take-a-stand project. *Preventing Chronic Disease*. 9:110323.

Proper K.I., Hildebrandt V.H., Van der Beek A.J., Twisk J.W. & Mechelen W. (2003). Effect of individual counselling on physical activity fitness and health: a randomised controlled trial in a workplace setting. *American Journal of Preventive Medicine*, 24(3): 218-26.

Proper K.I., Staal B.J., Hilderbrandt V.H., van deer Beek A.J. & van Mechelen W. (2002). Effectiveness of physical activity programs at worksites with respect to work-related outcomes. *Scandinavian Journal of Work Environment & Health* 28(2), 75-84.

Proper K.I., Singh A.S., van Mechelen W. & Chinapaw M.J. (2011). Sedentary behaviours and health outcomes among adults: a systematic review of prospective studies. *American Journal of Preventive Medicine*. 40(2), 174-82.

Proper K.I., Koning M., Beck A.J., Hilderbrandt V.H., Bosscher R.J. & van Mechelen W. (2003). The effectiveness of worksite physical activity programs on physical activity physical fitness and health. *Clinical Journal of Sport Medicine* 13(2), 106-117.

Proper K.I. & van Mechelen W. (2008). Effectiveness and economic impact of worksite interventions to promote physical activity and healthy diet.

http://www.who.int/dietphysicalactivity/Proper_K.pdf

- Pucci G., Reis R.S., Rech C.R. & Hallal P.C. (2012). Quality of life and physical activity among adults: population-based study in Brazilian adults. *Quality of Life Research*.
- Qu N.N. & Li K.J. (2004). Study on the reliability and validity of international physical activity questionnaire chinese version IPAQ. *Chinese Journal of Epidemiology*. 25(3):265-8.
- Quigley R.J. & Taylor L.C. (2002) *Evaluation as a key part of health impact assessment: the English experience*. <http://www.who.int/bulletin/volumes/81/6/quigley.pdf>
- Quintiliani L., Sattelmair J. & Sorensen G. (2007). The workplace as a setting for interventions to improve diet and promote physical activity. *WHO press World Health Organization*.
- Radkiewicz P. & Widerszal-Bazyl M. (2005). Psychometric properties of Work Ability Index in the light of comparative survey study. *International congress series 1280*. The Netherlands: Elsevier. 304-309.
- Renton S.J., Lightfoot N.E. & Maar M.A. (2011). Physical activity promotion in call centres: employers' perspectives. *Health Education Research*. 25(6), 1050-1059.
- Report on cardiovascular diseases in China. (2011). National Center for Cardiovascular Diseases China. <http://nccd.org.cn/UploadFile/201504/20150416164438110110.pdf>
- Rhoades L. & Eisenberger R. (2002). Perceived organisaitonal support: A review of the literature. *Journal of Applied Psychology*. 87(4), 698-714.
- Ribeiro M.A., Martins M.A. & Carvalho C.R.F. (2013). Interventions to increase physical activity in middle-age women at the workplace: a randomized controlled trial. *Medicine & Science in Sports & Exercise*.
- Robins A., Rountree J. & Rountree N. (2003). Learning and teaching programming: a review and discussion. *Computer Science Education*. 13(2), 137-172.
- Robbins S. P. & Coulter M. (2005). *Management*. 8th Edition. Pearson Prentice Hall.
- Robroek S.J., van Lenthe F.J., van Empelen P. & Burdorf A. (2009). Determinants of participation in worksite health

- promotion programmes: a systematic review. *International Journal of Nutrition and Physical Activity*. 6:26.
- Roelen C.A.M., Schreuder K.J., Koopmans P.C. & Groothoff J.W. (2008). Perceived job demands relate to self-reported health complaints. *Occupational Medicine-Oxford* 58(1): 58-63.
- Roessler K.K., Rugulies R., Bilberg R., Andersen L.L., Zebis M.K. *et al.* (2013). Does work-site physical activity improve self-reported psychosocial workplace factors and job satisfaction? A randomized controlled interventions study. *International Archives of Occupational and Environmental Health* 86(8), 861-864.
- Rollnick S., Miller W.R. & Butler C.C. (2007). *Motivational interviewing in health care: Helping patients change behaviour*. The Guilford Press, New York
- Rongen A., Robroek S.J.W., van Lenthe F.J. & Burdorf A. (2013). Workplace health promotion: a meta-analysis of effectiveness. *American Journal of Preventive Medicine*. 44(4), 406-415.
- Rosenstock, I. M. (1966). Why people use health services. *The Milbank Memorial Fund Quarterly*. 44, 94-127.
- Ruxton G.D. & Neuhäuser M. (2010). When should we use one-tailed hypothesis testing? *Methods in Ecology and Evolution*, 1(2), 114-117.
- Ryan R.M. & Deci E.L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development and well-being. *American Psychologist*, 55: 68-78.
- Ryde G.C., Gilson N.D., Burton N.W. & Brown W.J. (2013). Recruitment rates in workplace physical activity interventions: characteristics for success. *American Journal of Health Promotion*. 27(5), E101-E112.
- Rygg LØ, Rise M.B., Lomundal B., Solberg H.S. & Steinsbekk A. (2010). Reasons for participation in group-based type 2 diabetes self-management education. A qualitative study. *Scandinavian Journal of Public Health*. 38(8), 788-93.
- Saari L.M. & Judge T.A. (2004). Employee attitudes and job satisfaction. *Human Resources Management* 43(4), 395-407.

- Sabat e E. (2003). *Adherence to long-term therapies: evidence for action*. Geneva: World Health Organization
- Saldana J. (2011). *Fundamentals of qualitative research*. Oxford: USA.
- Sallis J.F. & Carlson J.A. (2015). Physical activity: numerous benefits and effective interventions. *Agency for Healthcare Research and Quality*. Rockville. <http://www.ahrq.gov/professionals/education/curriculum-tools/population-health/sallis.html>
- S nchez-Vidal M.E., Cegarra-Leiva D. & Cegarra J.G. (2012). Gaps between managers' and employees' perceptions of work-life balance. *The International Journal of Human Resource Management*. 23(4), 645-661.
- Sattelmair J., Pertman J., Ding E.L., Kohl H.W., Haskell W. & Lee I.M. (2011). Dose response between physical activity and risk of coronary heart disease. *PubMed Central*. 124(7), 789-795.
- Schr er S., Haupt J. & Pieper C. (2014). Evidence-based lifestyle interventions in the workplace – an overview. *Occupational Medicine London*. 64(1), 8-12.
- Schwarz U.V. & Hasson H. (2011). Employee self-rated productivity and objective organisational production levels effects of worksite health interventions involving reduced work hours and physical exercise. *Journal of Occupational and Environmental Medicine*. 53(8), 838-844.
- Schwarz U.V., Lindfors P & Lundberg U. (2008). Health-related effects of worksite interventions involving physical exercise and reduced workhours. *Scandinavian Journal of Work Environment & Health*. 34(3), 179-188.
- Scottish Intercollegiate Guidelines Network (SIGN) (2011). SIGN methodological principles. Retrieved from <http://www.sign.ac.uk/methodology/index.html>
- Selander J. & Buys N. (2010). Sickness Absence as an Indicator of Health in Sweden. *International Journal of Disability Management*. 5(2), 40-47.
- Sharma M. (2015). Multi-theory model (MTM) for health behaviour change. *Open Access Biomedical Publisher*.
- Sheeran P., Gollwitzer P.M. & Bargh J.A. (2013). Nonconscious processes and health. *Health Psychology*, 32, 460–473.

- Sinnott C., Mercer S.W., Payne R.A., Duerden M., Bradley C.P. & Byrne M. (2015). Improving medication management in multimorbidity: development of the Multimorbidity Collaborative Medication Review And Decision Making (MY COMRADE) intervention using the Behaviour Change Wheel. *Implementation Science*. 10:132.
- Siqueira F.V., Facchini L.A., Azevedo M.R., Reichert F.F., Bastos J.P. *et al.* (2009). Physical activity in practice in adolescence and prevalence of osteoporosis in adulthood. *Revista Brasileira De Medicina Do Esporte*. 15(1), 27-30.
- Siu O.L., Cooper C.L. & Phillips D. R. (2013) Intervention studies on enhancing work well-being reducing burnouts and improving recovery experience among Hong Kong health care workers and teachers. *Special issue of International Journal of Stress Management*. Accepted on 26 April 2013 in press.
- Smith M.L., Wilson M.G., DeJoy D.M., Padilla H., Zuercher H., Corso P., Vandenberg R., Lorig K. & Ory M.G. (2014). Chronic disease self-management program in the workplace: Opportunities for health improvement. *Frontier in Public Health*. 2, 179.
- Smolander J., Blair S.N. & Kohl H.W. (2000). Work ability physical activity and cardiorespiratory fitness: 2-year results from project active. *Journal of Occupational and Environmental Medicine*. 42(9), 906-910.
- Sniehotta F.F., Penseau J. & Araújo-Soares V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, 8(1), 1-7.
- Somes M.J. (2010). Patterns of attachment to organizations: commitment profiles and work outcomes. *Journal of Occupational and Organisational Psychology*. 83(2), 443-453.
- Spector P.E. & Pindick S. (2015). The future of research methods in work and occupational health psychology. *Applied Psychology: An International Review*, 65(2), 412-431.
- Strijks J.E., Proper K.I., van Mechelen W. & van der Beek A.J. (2013). Effectiveness of a worksite lifestyle intervention on vitality work engagement productivity and sick leave: results of a randomized controlled trial. *Scandinavian Journal of Work Environment & Health*. 39(1) 66-75.
- Suarez R. (2010). For China's growing middle class expanding waistline pose problem. *PBS Newhour*.

http://www.pbs.org/newshour/bb/health-jan-june10-china_06-01/

- Summary Evaluation of the Curriculum Sport Programme
Bangor: Education and Training Inspectorate of the
Department of Education (2010).
<https://www.etini.gov.uk/publications/summary-evaluation-curriculum-sports-programme>, accessed 4
October 2017.
- Sundstrup E., Jakobsen M.D., Brandt M., Jay K., Persson R.,
Aagaard P. & Andersen L.L. (2014). Workplace strength
training prevents deterioration of work ability among
workers with chronic pain and work disability: a
randomized controlled trial. *Scandinavian Journal of
Work Environment & Health*. 40(3), 244-251.
- Sutton, S. (2005). Stage theories of health behaviour. In
Conner, M. and Norman, P. (eds), *Predicting Health
Behaviour: Research and Practice with Social Cognition
Models*, 2nd edn. Open University Press, Maidenhead,
223-270.
- Sutton J. & Austin Z. (2015). Qualitative research: Data
collection, analysis, and management. *The Canadian
Journal of Hospital Pharmacy*, 68(3):226-231.
- Suzuki T., Miyaki K., Song Y.X., Tsutsumi A., Kawakami N.,
Shimazu A., Takahashi M., Inoue A. & Kurioka S.
(2015). Relationship between sickness presenteeism
WHO-HPQ with depression and sickness absence due to
mental disease in a cohort of Japanese workers. *Journal
of Affective Disorders*. 180, 14-20.
- Svensson A.L., Strøyer J., Ebbelhøj N.E., Schultz-Larsen K.,
Marott J.L., Mortensen O.S. & Suadicani P. (2009).
Multidimensional intervention and sickness absence in
assistant nursing students. *Occupational Medicine*. 59,
563-569.
- Tang S., Ehiri J. & Long Q. (2013). China's biggest most
neglected health challenge: Non-communicable
diseases. *Infectious Diseases of Poverty*. 2, 7.
- Taylor W.C. (2005). Transforming work breaks to promote
health. *American Journal of Preventive Medicine*. 29(5),
461-465.
- Taylor N., Conner M. & Lawton R. (2012). The impact of
theory on the effectiveness of worksite physical activity
interventions: a meta-analysis and meta-regression.
Health Psychology Review. 6(1), 33-73.

- Taylor W.C., Horan A., Pinion C.Jr. & Liehr P. (2014). Evaluation of booster breaks in the workplace. *Journal of Occupational and Environmental Medicine*. 56(5), 529-34.
- Taylor W.C., Shegog R., Chen V., Rempel D.M., Baun M.P., Bush C.L., Green T. & Hare-Everline N. (2010). The booster break program: Description and feasibility test of a worksite physical activity daily practice. *Work*. 37, 433-443.
- The British Psychological Society (2010). Code of ethics and conduct.
www.bps.org.uk/system/files/.../code_of_ethics_and_conduct
- The State Council, The People's Republic of China. China to implement national fitness program. 2016.
http://english.gov.cn/policies/latest_releases/2016/06/23/content_281475378214258.htm (accessed Oct 7, 2017).
- Thomas D.R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation*. 27(2), 237-246.
- To Q.G., Chen T.T., Magnussen C.G. & To K.G. (2013). Workplace physical activity interventions: a systematic review. *American Journal of Health Promotion*. 27(6), e113-23.
- Todnem R. (2005). Organisational change management: a critical review. *Journal of Change management*, 5(4), 369-380.
- Torgerson D.J. (2000). Contamination in trials: is cluster randomization the answer? *BMJ*:322.
- Torp S., Grismsmo A., Hagen S., Duran A. & Gudbergsson S.B. (2013). Work engagement: a practical measure for workplace health promotion? *Health Promotion International*. 28(3), 387-96.
- Tsai J.H.C., Choe J.H., Lim J.M.C., Acorda E., Chan N.L., Taylor V. & Tu S.P. (2004). Developing culturally competent health knowledge: issues of data analysis of cross-cultural cross-language qualitative research. *International Journal of Qualitative Methods*. 3(4), 2-14.
- Tucker S.J., Lanningham-Foster L.M., Murphy J.N., Thompson W.G., Weymiller A.J., Lohse C. & Levine J.A. (2011).

- Effects of a worksite physical activity intervention for hospital nurses who are working mothers. *AAOHN Journal*. 59(9), 377-386.
- Tveito T.H. & Eriksen H.R. (2009). Integrated health programme: a workplace randomized controlled trial. *Journal of Advanced Nursing*. 65(1), 110-119.
- U.S. Task Force on Community Preventive Services (2005). *The guide to community prevention services: what works to promote health?* Oxford: Oxford University Press.
- Vallance J., Eurich D., Gardiner P., Taylor L. & Johnson S. (2016). Associations of Daily Pedometer Steps and Self-Reported Physical Activity With Health-Related Quality of Life. *Journal of Aging & Health* 28(4), 661-674.
- Van de Mortel T.F. (2008) Faking it: social desirability response bias in self-report research. *Australian Journal of Advanced Nursing*. 25(4), 40-48.
- Van den Heuvel S.G., de Looze M.P., Hildebrandt V.H. & Thé KH Affiliation. (2003). Effects of software programs stimulating regular breaks and exercises on work-related neck and upper-limb disorders. *Scandinavian Journal of Work Environment & Health*. 29(2), 106-116.
- Van Eerd D., Cole D., Irvin E., Mahood Q., Keown K. *et al.* (2010). Process and implementation of participatory ergonomics interventions: a systematic review. *Ergonomics*. 53(10).
- Van Poppel M.N.M., deVet H.C.W., Koes B.W., Smid T. & Bouter L.M. (2002). Measuring sick leave: a comparison of self-reported data on sick leave and data from company records. *Occupational Medicine-Oxford*. 52(8), 485-490.
- Van Rhenen W., Blonk R.W.B., Schaufeli W.B. & van Dijk F.J.H. (2007). Can sickness absence be reduced by stress reduction programs: on the effectiveness of two approaches. *International Archives of Occupational and Environmental Health*. 80(6), 505-515.
- Van Uffelen J.G.Z., Wong J., Chan J.Y., Van der Floeg H.P., Gilson N.D *et al.* (2010). Occupational sitting and health risks. *American Journal of Preventive Medicine*. 39(4), 379-388.
- Vaterlaus J.M. & Higginbotham B.J. (2011). Qualitative program evaluation methods. *The Forum for family and*

consumer issues.
<https://ncsu.edu/ffci/publications/2011/v16-n1-2011-spring/vaterlaus-higginbotham.php>

- Veith I. (2002). *Huang Ti Nei Ching Su Wen. The yellow emperor's classic of internal medicine*. University of California Press Ltd. London England.
- Victoria C.G., Habicht J-P. & Bryce J. (2004). Evidence-based public health – moving beyond randomized trials. *American Journal of Public Health*. 94(3), 400-405.
- Vuillemin A., Rostami C., Maes L., Van Cauwenberghe E., Van Lenthe F.J., Brug J., De Bourdeaudhuij I. & Oppert J-M. (2011). Worksite physical activity interventions and obesity: a review of European studies (the HOPE project). *The European Journal of Obesity*. 4, 479-488.
- Waller K., Kujala U.M., Rantanen T., Kaupppinen M., Silventoinen K. *et.al.* (2010). Physical activity morbidity and mortality in twins: a 24-year prospective follow-up. *Journal of Epidemiology* 25(10), 731-739.
- Wang C.W., Chan C.H., Ho R.T., Chan J.S., Ng S.M. & Chan C.L. (2014). Managing stress and anxiety through qigong exercise in health adults: a systematic review and meta-analysis of randomized controlled trial. *BMC Complement Altern Med*. 9(14), 8.
- Wang L., Kong L., Wu F., Bai Y. & Burton R. (2005). Preventing chronic diseases in China. *Lancet* 366(9499), 1821-1824.
- Wang L., Zhang Z., McArdle J.J. & Salthouse T.A. (2008). Investigating ceiling effects in longitudinal data analysis. *Multivariate Behavioral Research*. 43(3), 476-496.
- Watanabe T. (1999). Our preventive exercise for lower back pain. "Qigong". *Proceedings of National Conference on Industrial Safety and Health*. Japan Industrial Safety and Health Association.
- Wanous J.P., Reichers A.E. & Hudy M.J. (1997). Overall job satisfaction: how good are single-item measures? *Journal of Applied Psychology*. 82(2), 247-52.
- Welk G. (2002). *Physical activity assessments for health-related research*. Human Kinetics.
- Weymiller A.J., Lohse C. & Levine J.A. (2011). Effects of a worksite physical activity intervention for hospital

- nurses who are working mothers. *AAOHN Journal*. 59(9), 377-386.
- White M.I., Dionne C.E., Warje O., Koehoorn M., Wagner S.L., Schultz I.Z. *et al.* (2016). Physical activity and exercise interventions in the workplace impacting work outcomes: A stakeholder-centered best evidence synthesis of systematic reviews. *The International Journal of Occupational and Environmental Medicine*. 7(2), 61-74.
- Wildau G. (2015). China migration:at the turning point. *Financial Times*. Accessed May 4 2015.
- Williamson D.F., Vinicor F., Bowman B.A. & CDC Primary Prevention Working Group. (2004). Primary prevention of type 2 diabetes mellitus by lifestyle intervention: implications of health policy. *Annals of Internal Medicine*. 140(11), 951-7.
- Wolever R.Q., Bobinet K.J., McCabe K., Mackenzie E.R., Fekete E., Kusnick C.A. & Balme M. (2012). Effective and viable mind-body stress reduction in the workplace: A randomized controlled trial. *Journal of Occupational Health Psychology*. 17(2), 246-258.
- Wolin K.Y., Yan Y., Colditz G.A. & Lee I.M. (2009). Physical activity and colon cancer prevention: a meta-analysis. *British Journal of Cancer* 100(4), 611-616.
- Wong J.Y.L., Gilson N D., van Uffelen J.G.Z. & Brown W.J. (2012). The effects of workplace physical activity interventions in men: a systematic review. *The American Journal of Men's Health*. 6(4), 303-313.
- World Bank (2011). Toward a healthy and harmonious life in China – stemming the rising tide of NCDs. <http://documents.worldbank.org/curated/en/2011/07/14639951/toward-healthy-harmonious-life-china-stemming-rising-tide-non-communicable-diseases>
- World Bank (2015). China: improving technical and vocational education to meet the demand for high-skilled workers. <http://www.worldbank.org/projects>.
- World Health Organization WHO (2016). Occupational health: Workplace health promotion. http://www.who.int/occupational_health/topics/workplace/en/index1.html
- World Health Organisation (2009). Interventions on diet and physical activity: What works.

<http://www.who.int/dietphysicalactivity/summary-report-09.pdf>

- World Health Organization WHO (2010). *Global recommendations on physical activity for health*. NLM classification: QT 255. Geneva Switzerland: World Health Organization.
- World Health Organization WHO. Representative Office in China (2014). <http://www.who.int/countries/chn/en/>
- World Health Organization WHO (2016). Occupational health: Workplace health promotion. http://www.who.int/occupational_health/topics/workplace/en/index1.html
- Wozniak L., Rees S., Soprovich A., Al Sayah F., Mjumdar S.R. & Johnson J.A. (2012). Applying the RE-AIM framework to the Alberta's caring for diabetes project: a protocol for a comprehensive evaluation of primary care quality improvement intervention. *BMJ Open*. 2(5).
- Wright K.B. (2005). Researching internet-based populations: advantages and disadvantages of online survey research online questionnaire authoring software packages and web survey services. *Journal of Computer-Mediated Communication* 10(3).
- Wu X.G., Gu D.F., Wu Y.F., Yu X.H., Wang S.Y., Wang N., Gao J.M., Duan X.F., Zhou B.F. & Liu L.S. (2003). An evaluation on effectiveness of worksite-based intervention for cardiovascular disease during 1974-1998 in capital iron and steel company in Beijing. *Chinese Journal of Preventive Medicine*. 37(2), 93-7.
- Xu Y., Wang L.M., He J., Bi Y.F. *et al.* (2013). Prevalence and control of diabetes in Chinese adults. *JAMA* 319(9).
- Yan J.H. & McCullagh P. (2004). Cultural influence on youth's motivation of participation in physical activity. *Journal of Sport Behavior*. 27(4), 378-390.
- Yancey A.K. (2010). *Instant Recess*. University of California Press.
- Yancey A.K., Sallis R.E. & Bastani R. (2013). Changing physical activity participation for the medical profession. *JAMA*. 309(2), 141-2
- Yancey A.K., Lewis L.B., Guinyard J.J., Diamant A.L., Nascimento L.M. & McCarthy W.J. (2004). Leading by example: a local health department-community collaboration to incorporate physical activity into

organisational practice. *Journal of Public Health Management Practice*. 10(2), 116-23.

- Yang L., Zhang X., Tan T. & Cheng J. (2015). Commentary: viewpoint: prevention is missing: is China's health reform for health? *Journal of Public Health Policy*. 36, 73-80.
- Yang X., Wang Z., Lan Y. & Wang M. (2004). Appraisal of occupational stress and work ability. *Chinese Journal of Hygiene Research*. 33, 5-8.
- Yu S., Lu M.L., Gu G., Zhou W.H., He L.H. & Wang S. (2015). Association between psychosocial job characteristics and sickness absence due to low back symptoms using combined DCS and ERI models. *Work*. 51(3), 411-421.
- Yuan S.C., Chou M.C., Hwu L.J., Chang Y.O., Hsu W.H. & Kuo H.W. (2009). An intervention program to promote health-related physical fitness in nurses. *Journal of Clinical Nursing*. 18(10), 1404-11.
- Zhang D.F., Wu Y.L., Jiang W.J. & Jiang X.B. (2013). Physical activity and risks of proximal and distal colon cancers: a systematic review and meta-analysis. *Journal of the National Cancer Institute*. 105(10), 746-747.

Appendix I

Worksite Exercise Movements

Source: Chan Ying Tai Chi Institute, Hong Kong

Participants would practice a short series of tailor-made exercise. It is a mixture of Tai Chi and Qigong, which is composed of mainly deep abdominal breathing and simple stretching exercise.

Part 1 Neck Exercises

1. Neck stretching back and forth.		
2. Neck stretching right and left.		
3. Neck stretching sideward left and right.		

Part 2 Shoulder Exercises

<p>4. Shoulder rolling back and forth.</p>		
<p>5. Shoulder up and down.</p>		

Part 3 Shoulder & Arm Exercises

<p>6. Single Side Hitting Hit the right back shoulder muscle with the right hand and the muscle under right armpit with left hand. Hit the left back shoulder muscle with the left hand and the muscle under left armpit with right hand.</p>		
<p>7. Cross Side Hitting Hit the right shoulder with the left hand and hit the muscle under the left armpit with the right hand. Hit the left shoulder with the right hand and hit the muscle under the right armpit with the left hand.</p>		
<p>8. Cross Stretching Cross over both arms and stretch out. Then cross over the arms in the opposite way and stretch out.</p>		

Part 4 Wrist and Ankle Exercises

<p>9. Hold the hands together; rotate the wrists and the right ankle at the same time. Rotate the wrists in the opposite direction and the left ankle at the same time.</p>	
<p>10. Rotate the wrists in circular motions in one direction and then in another direction with the arms upward, sideward and downward.</p>	
<p>11. Bend the left wrist inward with the right hand. Bend the right wrist inward with the left hand.</p>	
<p>12. Rise and stand on toes, up and down, up and down.</p>	
<p>13. Shake hands with full strength and relax.</p>	

Part 5 Chest and Arms Exercises

<p>14. Push the elbows backward twice and stretch the whole arms backward twice, open the chest widely.</p>	
---	--

<p>15. Stretch the arms upward and rotate the body to the left, hold the breath for 5 seconds. Relax. Stretch the arms upward and rotate to the right, hold the breath for 5 seconds. Relax.</p>	
<p>16. Stretch the arms backward and turn to the left, hold the breath for 5 sec. Relax. Stretch the arms backward and turn to the right, hold the breath for 5 sec. Relax.</p>	

Part 6 Full Body Movements

<p>17. Keep the feet in squat position, punch the left arm forward, palm out, palm in, and return the arm in starting position. Punch the right arm forward, palm out, palm in, return the arm in starting position.</p>	
<p>18. Keep the feet in squat position, stretch the arms in the archery style pointing to the left and hold for 5 seconds. Stretch the arms in the archery style pointing</p>	

<p>to the right and hold of 5 seconds.</p>	
<p>19. Place left foot and left arm to the left, punch with the right arm, punch with the left arm, close to the starting position. Place right foot and right arm to the right, punch with the left arm, punch with the right arm, close.</p>	
<p>20. Place left foot and both arms sideways, touch right knee with left hand, return and rotate body backward to the left, close to the starting position. Place right foot and both arms sideways, touch left knee with right hand, return and rotate body backward to the right, close.</p>	

Appendix II

Feasibility Study - Open Invitation Letter

To: All QC Workers

Open Invitation for 'Healthy Exercise Programme'

In order to build up the company health culture and promote employees' well-being, we would like to invite you to participate in a research study project to evaluate an employee workplace exercise programme.

This project is designed for the QC workers to practice a series of workplace exercise. Ms. Betsy Lai is the postgraduate researcher in Occupational Health Psychology and Management, Institute of Work, Health & Organisations, University of Nottingham, UK.

MYWA Swiss Watch and Jewellery (Far East) Ltd. has agreed to host and participate in the study project with Betsy Lai. Our internal committee includes Amy Xu as the facilitator; Vincent as the co-ordinator; Vinci and Antonio as the project supporters.

The study involves completing a questionnaire about yourself and your jobs. In addition, you will be invited to attend a 30-minute Exercise training session on 15th November, 2012 (conducted by Betsy Lai):

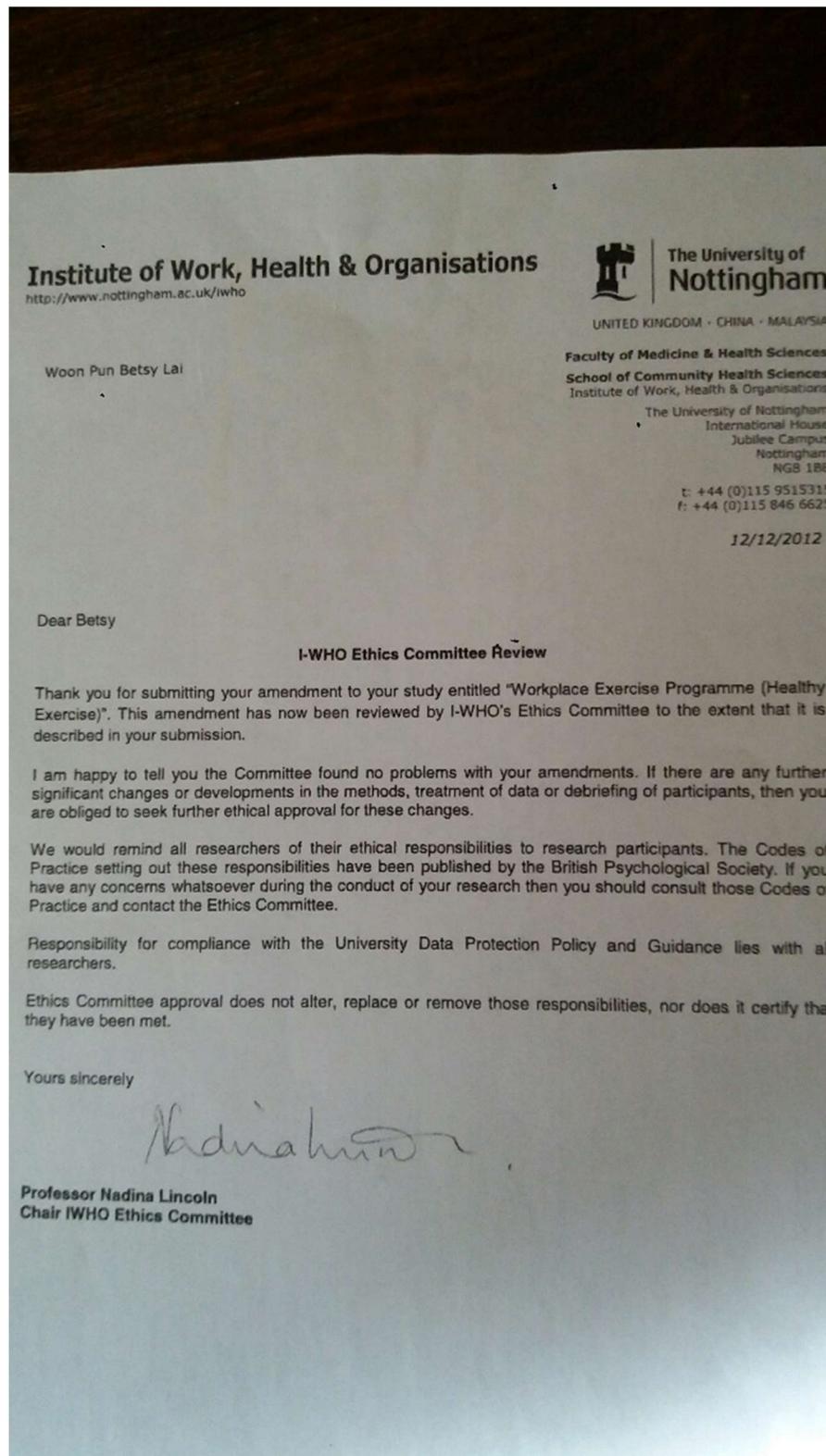
- | | |
|--|--------|
| 1. Introduction | 5 min |
| 2. Exercise briefing and demonstration | 10 min |
| 3. Group practice | 15 min |

All participation is voluntary and you may withdraw from the research at any time, without giving any reason. All answers you provide will be treated in strict confidence and will be accessible only by the research team.

If you are interested to participate in this workplace exercise programme, please give your confirmation to Amy/Vincent on or before (date). We will send you the details of the project time-table accordingly.

Appendix III

Feasibility Study – Ethics approval



Appendix IV

Feasibility Study post-intervention focus group guide

A) Opening

My name is Betsy Lai. I am a postgraduate researcher in the University of Nottingham, UK, supervised by Professor Amanda Griffiths and Dr. Holly Blake. I am doing a research study on the effect of a worksite exercise intervention for sedentary workers in China. As you might have known, your company has agreed to host and participate in this study project named as "Healthy Exercise". This project started in December 2012 and completed by end of February 2013.

This time we would like to invite you to participate in the focus group. The objective is to collect feedback on the "Healthy Exercise" programme that you have participated in the past three months. We would like to know your feelings towards the exercise itself and the arrangement, including the communication process and logistics. There is no right or wrong answer. All answers you provide will be treated in strict confidence. Amy, the committee co-ordinator will help with note taking. I have prepared some questions for the group discussion. Please feel free to express your views and ideas even though they might not be covered in the questions.

B) Semi-structured focus group guide

1. What would be the influential factor in your decision to participate in the "Healthy Exercise" programme?
2. To what extent did the programme meet your expectations?
3. How did the programme influence you, in person and at work?
Please state specific examples.
4. What are your opinions on the exercise movements based on your experience in this programme?
5. What is your comment on the overall process how this study was communicated, including
 - Exercise schedule
 - Venue
 - Music background

6. How might this workplace exercise initiative be sustained in the long term?

C) Closing

I appreciate the time you took for today's meeting. Is there anything else you think would be helpful for me to know, please feel free to contact Amy or Betsinda, the internal committee members. Thanks again.

Appendix V

Pilot study- Open Invitation Letter

To: All Team Leaders

Open Invitation for 'Move It 动起来: Pilot Study'

In order to build up the company health culture and promote employees' well-being, we would like to invite you to participate in a research pilot study project to evaluate an employee workplace exercise programme named 'Move It 动起来'. We are planning to launch an employee fitness program to the whole workforce. Your valuable feedback in this pilot run will help us to gain insights into the effective elements of successful employee health promotion strategies.

This pilot project is designed for the team leaders to get familiarize and interest in the workplace exercise programme. Ms. Betsy Lai is the postgraduate researcher in Occupational Health Psychology and Management, Institute of Work, Health & Organisations (IWHO), University of Nottingham, UK.

AIAIT GZ has agreed to host and participate in the study project 'Move It 动起来' with Betsy. Our internal committee includes Fen Li as the facilitator; Cherry Chen and Riva Li as the co-ordinators; George, Marson & Anna as the project supporters.

The pilot study involves completing a questionnaire about yourself and your jobs. In addition, you will be invited to attend a 40-minute Exercise training session on 24th July 2012 (conducted by Betsy Lai):

- | | |
|--|--------|
| 1. Introduction | 5 min |
| 2. Exercise briefing and demonstration | 10 min |
| 3. Group practice | 10 min |
| 4. Focus group | 15 min |

You will be asked to offer your feedback on the program objectives and process in the Focus group.

All participation is voluntary and you may withdraw from the pilot research at any time, without giving any reason. All answers you provide will be treated in strict confidence and will be accessible only to the research team.

If you are interested to participate in this 'Move It 动起来: Pilot Study', please give your confirmation to Fen/Cherry/Riva on or before (date). We will send you the details of the project timetable accordingly.

Appendix VI

Pilot Study – Focus group guide

A) Opening

My name is Betsy Lai. I am a postgraduate researcher in the University of Nottingham, UK, supervised by Professor Amanda Griffiths and Dr. Holly Blake. I am doing a research study on the effect of a worksite exercise intervention for sedentary workers in China. Your company has agreed to host and participate in this study project. Your internal committee includes Fen Li as the facilitator, Cherry Chen and Riva Li as the co-ordinators, George, Marson and Anna as the project supporters.

We would like to invite you to participate in a research pilot study. This pilot study is catered for the team leaders in AIAIT, Guangzhou. The objective is to test the survey instruments and the exercise intervention before launching this study to the whole workforce. This research involves an online questionnaire which you have already completed before this meeting. Today is a exercise-training session with the agenda as follows:

- | | |
|--|--------|
| 1. Introduction | 5 min |
| 2. Exercise briefing and demonstration | 10 min |
| 3. Group practice | 10 min |
| 4. Focus group | 15 min |

You will be asked to offer your feedback on the research process and the exercise in the focus group. The interview will be voice-recorded. In cases if you are not comfortable with recording, please let me know and detailed note taking would be undertaken. Please note that your participation is voluntary and that you may withdraw from the research at any time, without giving any reason. All answers you provide will be treated in strict confidence and will be accessible only to the research team, i.e. myself and my supervisors. Please take some time and read the participant consent form carefully. If you agree to participate, please give your confirmation on the consent form and pass it to the researcher.

B) Basic ground rules

- The discussion should talk approximately an hour, but might go a little longer.
- Mobile phones should be switched off or on silent mode.

- Try to talk to each other in the group, rather than to me.
- There are no right or wrong answer. Respect different viewpoints.

C) Semi-structured focus group guide

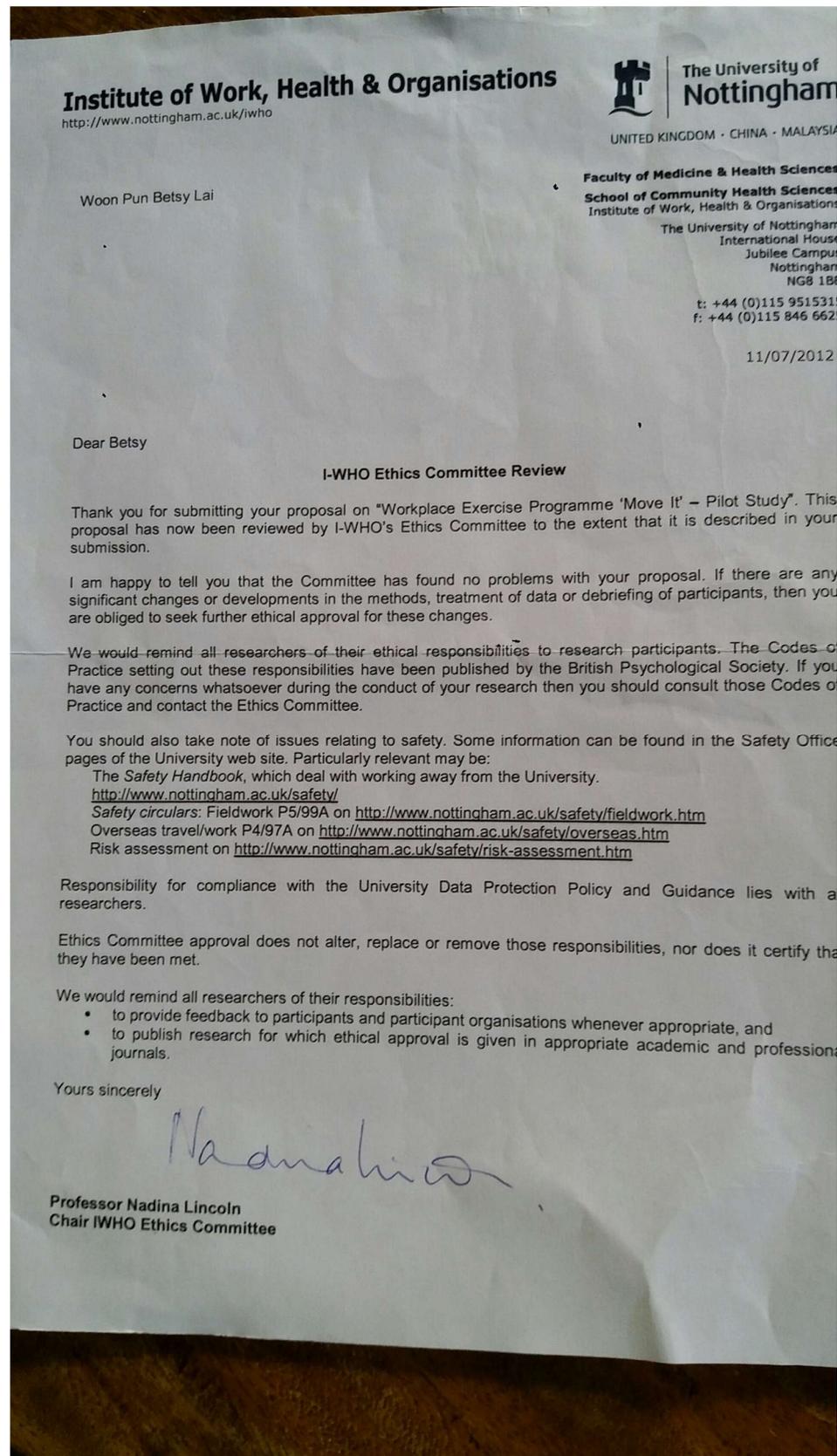
1. Explain what are the best ways to promote employee health and well-being?
2. What are the benefits of integrating Qigong exercise breaks into work routine?
3. Describe your major concerns about this idea of a worksite exercise initiative?
4. What are your opinions on the exercise movements based on your experience in this taster session?
5. In terms of the questionnaire content and design, is there anything you do not understand or find ambiguous? (will go through section A, B & C of the questionnaire, item by item)
6. What is your comment on the overall process how this pilot study was communicated, including
 - a. Open invitation letter
 - b. Participant consent form
 - c. Management briefing
 - d. Exercise training time-table and arrangement
7. What are the major barriers to the success of this workplace exercise initiative?
8. How would you recommend to achieve maximum participation to the initiative?

C) Closing

I appreciate the time you took for today's meeting. Is there anything else you think would be helpful for me to know so that we can introduce this initiative to all the employees successfully, please feel free to contact Fen Li, Cherry Chen or Riva Li, the internal committee members or email me directly. Thanks again. I look forward to having your support when the study is launched to the whole company.

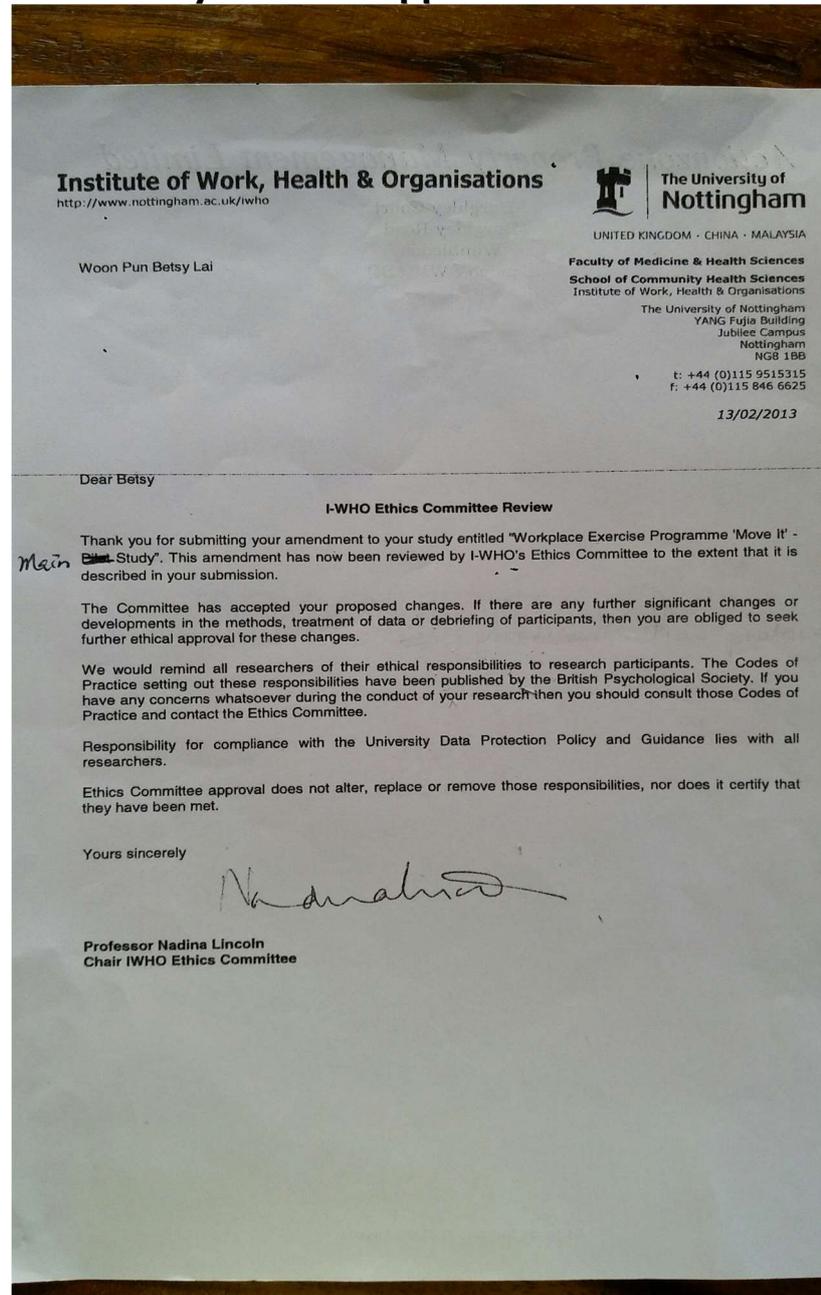
Appendix VII

Pilot study – Ethics approval letter



Appendix VIII

Main Study – Ethics approval



Appendix IX

Main study - Open Invitation Letter



Announcement for MOVE IT 动起来 “MOVE IT - 动起来” 正式启动

The 'MOVE IT – 动起来' worksite exercise program is our company HR initiative to promote employee well-being and health culture. It is one of our 2013 “We care for you” initiatives. You are encouraged to take some exercise breaks during work. The worksite exercise is composed of simple stretching and qigong exercise which are catered for IT workers.

The program involves completing a simple questionnaire about yourself and your jobs. We have a dedicated professional committee on this project. On top of Fen Li being the facilitator, Ms. Betsy Lai, who is the postgraduate researcher in Occupational Health Psychology and Management, University of Nottingham, UK will send you the questionnaire and collect your feedback directly. All answers you provide will be treated in strict confidence.

You will be invited to confirm your participation by completing a *Participant Consent Form* by SharePoint soon, and we will send you the details of the project time-table accordingly. All participation is voluntary and you may withdraw from the research at any time, without giving any reason.

Let's MOVE IT!

Be healthy, be happy!



✓ To be continued.....

Appendix X

'Move It 动起来" Program Study Survey

Thank you for your participation in the "Move It" workplace exercise program.

You are invited to complete the questionnaire. It will take you less than 5 minutes to finish the survey.

The purpose of this survey is to examine your exercise behaviour and attitude towards work.

If you have any query relating to this questionnaire, please feel free to ask Mr. Fen Li, the project facilitator or contact the researcher, Ms. Betsy Lai, lwowl@nottingham.ac.uk

We look forward to your continuous co-operation.

Section A International Physical Activity Questionnaire

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, to get from place to place, and in your spare time for recreation, exercise or sport.

我们对找寻人们在他们日常生活中多种的身体活动有兴趣。这个问卷会问你在最近 7 天花在身体活动的时间，请回答每一个问题，甚至如果你想自己是一个没有活动的人，请想一想你在工作的活动，像是你在家，从一个地方到一个地方及在你空间的时间运动或娱乐。

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

想一想在最近 7 天里你做过所有强而有力的活动。强而有力身体活动是指以费力的身体负荷且让你呼吸较正常更为急促的活动，仅回想你做过每次至少 10 分钟的那些身体活动。

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

最近 7 天里，你花多少天做强而有力的身体活动，像是提重物，苦力，有氧运动或快骑脚踏车？

_____ days per week 天/周

No vigorous physical activities
question 3



Skip to

没有强而有力的身体活动，跳到问题 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?

在参与强而有力的身体活动的那些天，你通常花多少时间做强而有力的身体活动？

_____ hours per day 小时/天

_____ minutes per day 分钟/天

Don't know/ Not sure
不知道/不确定

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than

normal. Think only about those physical activities that you did for at least 10 minutes at a time.

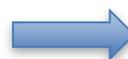
想一想最近 7 天你做过所有适度的活动。适度的活动是指以适度的身体负荷并且让你呼吸比正常费力一些的活动。

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis?

最近 7 天里，你花多少时间做适度的身体活动，像是提轻的物品，正常的速度骑脚踏车或网球双打？不包含走路。

_____ days per week 天/周

No moderate physical activities
question 5



Skip to

没有适度的身体活动，跳到问题 5

4. How much time did you usually spend doing moderate physical activities on one of those days?

在参与适度的身体活动的那些天，你通常花多少时间做适度的身体活动？

_____ hours per day 小时/天

_____ minutes per day 分钟/天

Don't know/ Not sure
不知道/不确定

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

想一想最近 7 天你花多少时间在走路。包括工作，在家，从某地到某地，娱乐，游戏或休闲时的走路。

_____ days per week 天/周

No walking
question 7



Skip to

没有走路，跳到问题 7

6. How much time did you usually spend walking on one of those days?

在走路的那些天，你通常花多少时间在走路？

_____ hours per day 小时/天

_____ minutes per day 分钟/天

Don't know/ Not sure
不知道/不确定

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

最后的问题是在最近连续 7 个非假日时间(扣除周六与周日)你花多少时间坐着, 包含花在工作, 家里, 及休闲时的坐着. 这或许可包含花在书桌, 拜访朋友, 读书或看电视的躺着或坐着。

7. During the last 7 days, on how much time did you spend sitting on a weekday?

最近的 7 天里, 你每天花多少时间在坐着?

_____ hours per day 小时/天

_____ minutes per day 分钟/天

Don't know/ Not sure
不知道/不确定

Section B Performance and Absenteeism Questionnaire

Please give an to the answers of the following questions.

2.1 On a scale from 0 to 10 where 0 is the worst job performance anyone could have at your job and 10 is the performance of a top worker, how would you rate the usual performance of most workers in a job similar to yours?

由 0 至 10 分 (0=最劣的工作表现至 10=最佳的工作表现), 你会如何评估多数执行与你类似工作的员工一般表现?

Worst Performance
最劣的表现

Top Performance
最佳的表现

0	1	2	3	4	5	6	7	8	9	10

2.2 Using the same 0-to-10 scale, how would you rate your usual job performance over the past year or two?

由 0 至 10 分 (0=最劣的工作表现至 10=最佳的工作表现), 你会如何评估最近一, 两年你的一般工作表现?

Worst Performance
最劣的表现

Top Performance
最佳的表现

0	1	2	3	4	5	6	7	8	9	10

2.3 Using the same 0-to-10 scale, how would you rate your overall job performance on the days you worked during the past 4 weeks (28 days)?

由 0 至 10 分 (0=最劣的工作表现至 10=最佳的工作表现), 你会如何评估最近四个星期 (28 天) 你的整体工作表现?

Worst Performance
最劣的表现

Top Performance
最佳的表现

0	1	2	3	4	5	6	7	8	9	10

2.4 How many whole days have you been off work because of a health problem (disease or health care or for examination) during the past year (12 months)?

在最近一年（12个月）里，你有几个整天缺勤是因为健康问题（疾病或体验）？

None at all 完全没有	5	
At the most 9 days 最多9天	4	
10 -24 days 天	3	
25-99 days 天	2	
100-365 days 天	1	

Appendix XI

Process evaluation – Ethics approval letter

