

Workplace design and perceived health status of office workers – a salutogenic perspective

by Kirsten Brown

Thesis submitted in fulfilment of the requirements for
PhD Health

under the supervision of:

Professor Christine Duffield

Professor Angela Dawson

Professor Michael Roche

Professor Leena Thomas

University of Technology Sydney

Faculty of Health

2021

Certificate of Original Authorship

I, Kirsten Brown declare that this thesis, is submitted in fulfilment of the requirements for the award of PhD in the Faculty of Health at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

This research is supported by the Australian Government Research Training Program.

Signature of Student:

Production Note:

Signature removed prior to publication.

Date: 18 November 2021

Acknowledgements

I am indebted to the case study organisation that participated in this research at both stages of the data collection. Many thanks to those that also gave their time to be interviewed and that led the charge to participate in this research.

Deepest thanks to my supervisors Professor Christine Duffield, Professor Angela Dawson, Professor Leena Thomas and Professor Michael Roche for their patience and wise guidance. Every time we all got together, their insights and knowledge, conversation and advice were inspiring.

A special mention to those that were so supportive with their time and input: Amanda Shea, Steve Cox, Kate Torkington, Lin Zhu and Sarah Wise. Thank you to Virginia Simpson-Young for considered word smithing.

Thank you to the University of Technology Sydney for their support services.

Table of Contents

Certificate of Original Authorship.....	ii
Acknowledgements.....	iii
Table of Contents.....	iv
List of Figures	x
List of Tables.....	xi
Abstract.....	xiii
Chapter 1 Introduction.....	1
Background.....	1
Health defined.....	4
'Salutogenesis' defined.....	4
Health promotion defined.....	5
Aim of this study.....	6
Thesis structure	7
Definitions	9
Chapter 2 Background.....	11
Introduction	11
A brief history of the office workplace.....	11
Office workplace design practice and health.....	13
Factors impacting health-focused workplaces	17
Designing for health.....	19
Using a salutogenic approach for workplace health.....	21
Salutogenic design and current practice	22
Summary.....	23
Chapter 3 Literature Review.....	25
Introduction	25
Purpose of this literature review	25
Search strategy.....	26
Keyword searching.....	26

Databases and Sources.....	27
Quality appraisal of the literature	27
Inclusion criteria	27
Literature screening process	28
Findings of the literature review.....	28
The sedentary office and health implications	29
Individual ergonomics: the office desk and chair.....	30
Office landscape: design and layout.....	34
Indoor Environmental Quality (IEQ).....	41
Influencing factors beyond the built environment	46
Discussion of literature review	50
Summary.....	53
Chapter 4 Measuring health in the office workplace	54
Introduction	54
Measuring health in the workplace	54
Health-related assessment surveys and tools.....	55
Industry assessment and rating tools	57
Post-occupancy evaluation (POE).....	58
Health rating systems for workplaces	59
Building rating systems	64
Summary.....	65
Chapter 5 Methodology	67
Aim and research questions	67
Theoretical framework	67
Pragmatism	67
Post-positivism and constructivist worldviews	68
Methodological approach.....	69
A case study using a mixed-methods design	69
Convergent parallel design	71
Case study: An exploration of design and health in different office workplaces	71

The case study organisation	71
Qualitative methods: site analysis and interviews	72
Site Analysis	72
The objective of interviews with key informants	73
Key informant selection and recruitment	73
Interview protocol	74
Interview format and questions	74
Interview analysis	76
Quantitative methods: before- and after-move occupant surveys	78
Design of the survey	78
Survey format and questions	79
Survey testing and validation	95
Distribution of survey and data collection	96
Study sample	96
Analysis of the before- and after-move surveys	97
Integration of qualitative and quantitative data	99
Ethics approval and participant consent	99
Reflective statement	101
Summary	101
Chapter 6 Results 1 – Site analysis and interviews	103
Introduction	103
The case study organisation	103
Key informants' characteristics (KI)	104
Before-move Sites A & B	105
Before-move Sites A & B attributes	105
Before-move Site A workplace	108
Before-move Site B workplace	112
Major interview themes identified for the before-move sites	116
After-move Site C	119
Interview themes: design and implementation of Site C	119

After-move Site C attributes.....	123
Key designed elements described.....	126
Summary.....	129
Chapter 7 Results 2 – Survey results.....	131
Introduction	131
Survey participant profile	131
Before-move survey.....	132
Before-move Sites A and B BOSSA scores compared with BOSSA benchmarks	132
Comparison of survey results for Sites A and B.....	133
After-move survey.....	143
Comparison of Cohort A and Cohort B in their new workplace (Site C)	144
Individual workpoint (desk and chair)	148
Office Layout.....	149
Indoor Environmental Quality (IEQ).....	149
Elements beyond the office.....	150
Satisfaction responses at after-move sites.....	151
Physical activity at the after-move site.....	152
SF-12 results for Cohort A and Cohort B at after-move Site C	153
Workplace elements and their relationship to health status.....	154
Environmental elements and SF-12 results.....	155
Key workplace elements and SF-12 results	158
Satisfaction and health status.....	161
Satisfaction with workpoint and health status.....	162
Satisfaction with office layout and health status	163
Satisfaction with IEQ and health status	164
Summary.....	164
Chapter 8 Discussion	166
Salutogenic design for health-enhancing workplaces	167
Meta-theme 1: Enabling physical activity in the office workplace	169
Stairs	169

ABW workplaces	171
Access to gym	171
Active commuting and ETF	172
Meta-theme 2: Indoor environmental elements for a healthy office	172
The Workstation	173
Flexibility of work settings within the office	176
Meta-theme 3: Workplace flexibility	177
Choice of work location beyond the office	178
Flexibility of hours	178
Meta-theme 4: Health promotion in the office workplace	179
Ergonomic training	179
Communication	180
Diversity and health-enhancing workplace factors	181
Meta-theme 5: Evidence-based benchmarking for the design and evaluation of a healthy office 181	
The case study organisation's use of evidence	181
Access to evidence for industry professionals	182
Healthy workplaces in the COVID era	183
Health in a post-COVID office environment	186
Summary	186
Limitations of this study	187
Chapter 9 Recommendations and Conclusion	188
A framework for health-enhancing workplace design	189
Recommendations	189
Recommendation 1: Adopt a collaborative and inter-disciplinary approach	189
Recommendation 2: Design to encourage physical activity in the workplace	190
Recommendation 3: Promote health in the workplace	191
Recommendation 4: Incorporate elements into the office that have the greatest impact on health 192	
Recommendation 5: Incorporate aligned organisational workplace policies	193
Recommendation 6: Measure and benchmark the health status of office workers ...	194

Conclusion	195
References.....	198
Appendices	214
Appendix A Before-move survey	214
Appendix B After-move survey	235
Appendix C Before and after-move interview questions	256
Appendix D Information and Consent Form for Interviews	261
Appendix E Ethics Approval	264
Appendix F Additional statistical analyses	266
Before-move comparative descriptive tables.....	266
Before-move comparisons by demographics	269
After-move comparative descriptive tables.....	276
Before-move / After-move comparative descriptive tables by cohort.....	279
Consolidated Cohorts-working hours.....	284
Cohort A-working hours by age and gender.....	284
Cohort B- working hours by age and gender.....	284

List of Figures

Figure 3.1 Literature review process using the PRISMA diagram (Moher et al. 2009)	28
Figure 5.1: Stages of the case study	70
Figure 6.1: Site A typical floor plan with three space types	110
Figure 6.2: Chair and standard L-shaped desk with 1,200 mm high screens (Site A)	111
Figure 6.3: Partitions along corridors are 1,200 mm, limiting natural daylight into central spaces (Site A).....	112
Figure 6.4: A common space on the inside of the building with no access to natural daylight (Site A).....	112
Figure 6.5: Site B has workstations consisting of individual chairs and desks with 1,200 mm high screens	113
Figure 6.6: Typical floorplan of floors occupied by the organisation (Site B).....	114
Figure 6.7: Site B trialled open desking without screens prior to the office move	115
Figure 6.8: Site B had an internal staircase connecting some floors.....	115
Figure 6.9: After-move Site C typical floorplan with six setting types and stairs	125
Figure 6.10: Each floor had open communal spaces with natural light penetration from large windows, access to kitchen areas and access to internal open stairs (Site C).....	126
Figure 6.11: Significant, open and inviting stairs joined many of the floors together to encourage physical activity (Site C)	127
Figure 6.12: Workstation types varied in style, finish, layout and adjustability and were located with plenty of natural light and open views (Site C)	128
Figure 6.13: Plants feature extensively throughout Site C.....	129
Figure 7.1 Access to internal stairs and health status for Cohort A and Cohort B at Site C	156
Figure 7.2: ETF and health status for Cohorts A and B at Site C	157
Figure 7.3 Office layout and health status after-move for Cohorts A and B at Site C	158
Figure 7.4: Choice of work location and health status at Site C	159
Figure 7.5: flexible working hours arrangements and health status for Cohorts A and B at Site C	160
Figure 7.6: Desk sharing and health status at Site C	161
Figure 7.7 Satisfaction of workpoint and health status at Site C	162
Figure 7.8 Satisfaction with office layout and health status for Cohorts A and B at Site C.	163
Figure 7.9 Satisfaction with IEQ and health status for Cohorts A and B at Site C	164

List of Tables

Table 4.1: WELL Building Standard and health rationale	60
Table 4.2: Fitwel Standard attributes description and rationale).....	62
Table 5.1 Labelling of Interview data	74
Table 5.2 Template analysis of interviews: Key themes/categories and codes	78
Table 5.3 Part One: Survey questions and rationale- Before and after move	81
Table 5.4: Part Two: Survey questions and rationale-other workplace factors- Before and after move	91
Table 5.5 Data sources	99
Table 6.1: Summary of attributes of case study sites A, B and C.....	104
Table 6.2 Key informant (KI) characteristics	104
Table 6.3: Comparison of building and interior attributes of before-move sites	106
Table 6.4: Summary of building and interior attributes for after-move Site C.....	123
Table 7.1: Before-move survey responses from Site A and Site B	131
Table 7.2 Characteristics of the before and after-move survey participants	132
Table 7.3 Mean scores for Sites A and B and comparison to BOSSA benchmarks	133
Table 7.4: Perceived Importance to Health of elements for Site A and Site B	134
Table 7.5: Perceived Importance to Health of elements for Site A and Site B by age	135
Table 7.6 Perceived Impact on Health of workplace elements for Site A and Site B	136
Table 7.7 Perceived Impact on Health of workplace elements for Site A and Site B by age ...	137
Table 7.8 Types of ergonomic chair training.....	138
Table 7.9: Satisfaction with work area for Site A and Site B.....	140
Table 7.10: Workplace-based physical activities at Site A and Site B.....	141
Table 7.11: physical activity times by age group at before-move sites A and B.....	142
Table 7.12: Weighted scores on the SF-12 for combined sites A and B	142
Table 7.13: SF-12 scores compared with community norm scores in the before-move cohort	143
Table 7.14: SF-12 scores of before-move cohorts by age.....	143
Table 7.15: Mean scores of Importance to Health of elements for Cohort A before and after- move	145
Table 7.16 Mean scores of Impact to Health of elements for Cohort A before and after-move	146
Table 7.17: Mean scores for elements' Importance to Health for Cohort B before and after-move	147
Table 7.18: Mean scores for elements' Impact on Health for Cohort B before and after-move	148
Table 7.19 Movement between desks for Cohort A and B at Site C	149
Table 7.20 Flexibility options responses for Cohort A & B at Site C.....	150
Table 7.21 Commuting times for Cohort A & B before and after-move	151
Table 7.22: Satisfaction with key elements before and after-move for combined cohorts A and B	152
Table 7.23: Comparison of physical activity before and after-move for Cohort A and Cohort B	152

Table 7.24: Comparison of before- and after-move SF-12 results and sick days for Cohorts A and B 153

Table 7.25: SF-12 scores compared with community norm scores in the after-move cohorts. 154

Abstract

Almost a third of Australia's working population is employed in sedentary indoor office environments (Australian Bureau of Statistics 2017-2018), putting them at increased risk of cardiovascular disease and cancer, as well as metabolic, musculoskeletal and psychiatric disorders (Owen et al. 2010; van der Ploeg et al. 2012). This study used a 'salutogenic' approach to examine factors contributing to perceived health rather than disease, particularly the relationship between office workers' health and workplace design. With a holistic approach, health-promotive offices incorporate elements and strategies that enable physical activity and promote health positive outcomes.

This research used a mixed-methods convergent parallel case study design to examine the workplace elements that impacted the perceived health of office workers occupying two buildings (Sites A and B), who later relocated to a single new building (Site C). The influence of workplace elements (including workpoint, office layout, indoor environmental quality and organisational policy) on workers' perceived health was explored through semi-structured interviews and survey questionnaires with workers at all sites before and after relocation. Site analyses were also conducted. Key informants involved in the project design were interviewed about the workplaces and approach to occupant health. Qualitative interview data were analysed using template analysis. Survey respondents were recruited from 1,200 employees and invited to complete a 66-item survey (including SF-12) to determine the impact and importance of workplace elements on perceived health. The quantitative survey data were analysed using SPSS software.

Nine key informants were interviewed at Sites A and B and four at site C. Interviews revealed shortcomings in current practice, including a lack of communication with employees and consideration of health promotion that limited the potential positive impact of the physical environment.

The survey questionnaire was distributed to all employees, and 515 useable surveys were returned. Results show that the interior elements such as the individual workpoint, access to daylight, and access to stairs to support health and enable physical activity should be prioritised to maximise positive health impacts on occupants. Flexibility was consistently highly rated for its positive impact on occupant health.

To avoid a fragmented approach to workplace planning, designers must incorporate workers' views alongside health experts'. This will reframe current design practice to ensure holistic approaches and develop health-promoting workplaces and policies that embrace positive health and well-being. This multi-professional and collaborative approach will ensure the co-design of office environments responsive to occupants' health needs. The inclusion of workplace features that have the greatest positive impact on worker's health,

such as access to daylight and stairs, must be prioritised. This study has highlighted the importance of integrated workplace policies such as choice of work location and timing. Finally, there is a need for a standard approach to measuring occupant health in the office environment to generate data to ensure future evidence-based solutions.

A proactive multi-disciplinary salutogenic approach incorporating both policy-based and physical elements to workplace design will advance current practice by placing worker health and well-being at the centre of decision-making.