

# Office design and health: a systematic review

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## ABSTRACT

**AIM:** To carry out a systematic review of recent research into the effects of workplace design, comparing individual with shared workspaces, on the health of employees.

**METHODS:** The research question was “Does workplace design (specifically individual offices compared with shared workspaces) affect the health of workers?” A literature search limited to articles published between 2000 and 2017 was undertaken. A systematic review was carried out, and the findings of the reviewed studies grouped into themes according to the primary outcomes measured in the studies.

**RESULTS:** The literature search identified 15 relevant studies addressing health effects of shared or open-plan offices compared with individual offices. Our systematic review found that, compared with individual offices, shared or open-plan office space is not beneficial to employees’ health, with consistent findings of deleterious effects on staff health, wellbeing and productivity. Our findings are also consistent with those of earlier reviews.

**CONCLUSION:** These findings have public health implications for the New Zealand workforce. Decisions about workplace design should include weighing the short-term financial benefits of open-plan or shared workspaces against the significant harms, including increased sickness absence, lower job satisfaction and productivity, and possible threats to recruitment and retention of staff.

In the government, health, and tertiary education sectors of many countries including New Zealand, workplace design is changing from the provision of individual offices for employees, to shared or open-plan workspaces. Open-plan offices can range from large areas with desks arranged in rows, sometimes called “bull pens”, to desks separated by dividers of varying heights.<sup>1</sup> Previous reviews of the literature have suggested that open-plan workspaces have deleterious effects on employees,<sup>2,3</sup> so the increasing use of shared workspaces may have public health implications for the New Zealand workforce.

The increasing use of open-plan offices in the public sector reflects earlier changes in corporate workplace design, where open-plan offices were introduced from the 1920s, becoming common by the 1970s.<sup>1,4</sup> Cost-saving is a major driver for open-plan offices, because this design is cheaper to construct, and makes it possible to accommodate more employees in a given area.<sup>5,6</sup>

For example, it has been reported that 10–20% of a university’s total expenditure can be taken up in space provision, and that cost savings can be made by re-evaluating the amount of space provided for academic and research work.<sup>4</sup> It has been argued that the focus on cost containment and efficiency gains is an example of ‘new managerialism’.<sup>4,7</sup> Essentially, this can be understood as the imposition of “managerial techniques, more usually associated with medium and large ‘for profit’ businesses, onto public sector and voluntary organisations”.<sup>7</sup> Beyond considerations of cost, Nikolaeva and Russo note that “power and politics are communicated through the physical space”,<sup>8</sup> by which they mean that the design of space gives physical expression to a dominance hierarchy in the workplace.

Arguments that open-plan offices provide flexible and collaborative work spaces are frequently put forward to justify their implementation,<sup>9–11</sup> but employees are seldom consulted,<sup>8</sup> and empirical research

has found that improved accessibility can be outweighed by increased noise and distraction.<sup>12,13</sup> Roderick argues that open-plan workspaces give expression to neo-liberal ideologies that normalise deregulation and ‘flexibilisation’ of labour.<sup>14</sup> This approach to office design, it is argued, is ideological, not based on empirical findings, and may be not only inimical to the work required but also detrimental to physical and social well-being.<sup>8</sup> Thus, it is important to determine whether the increasing use of shared workspace has health implications for the New Zealand workforce. We provide here a systematic review of recent research into the effects of shared workspace on the health of employees.

## Method

We reviewed the literature on the effects of workplace design on health, using the broad WHO definition of health; “A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”<sup>15</sup> so that the effects of workplace design on psychological wellbeing and job satisfaction would be included, as well as outcomes such as sickness absence. The research question was “Does workplace design (specifically individual offices compared with shared workspaces) affect the health of workers?”

The search was conducted using Medline, Embase, PsychInfo, Sociological Abstracts, Web of Science, Scopus, Education Source, EBSCO and Google Scholar. Keywords included: interior design and furnishings; facility design and construction; open-plan; office or workplace; design or layout or space; hot-desk; sick leave; noise occupational; psychology, industrial; absenteeism; efficiency; job satisfaction; presenteeism; task performance and analysis; time and motion studies; work simplification; time management; workplace productivity or performance or privacy; efficiency. The search was limited to publications in English, published between 2000 and 2017. Reference lists of the publications meeting our inclusion criteria (please see Results section below) were also searched.

Because most of the published research on workplace design and health, job satisfaction and productivity is observational, and some studies generated qualitative findings, this

is a systematic review rather than a meta-analysis, although we used the PRISMA framework<sup>16</sup> as a guide. The findings of the reviewed studies have been grouped into themes according to the primary outcomes measured in the studies.

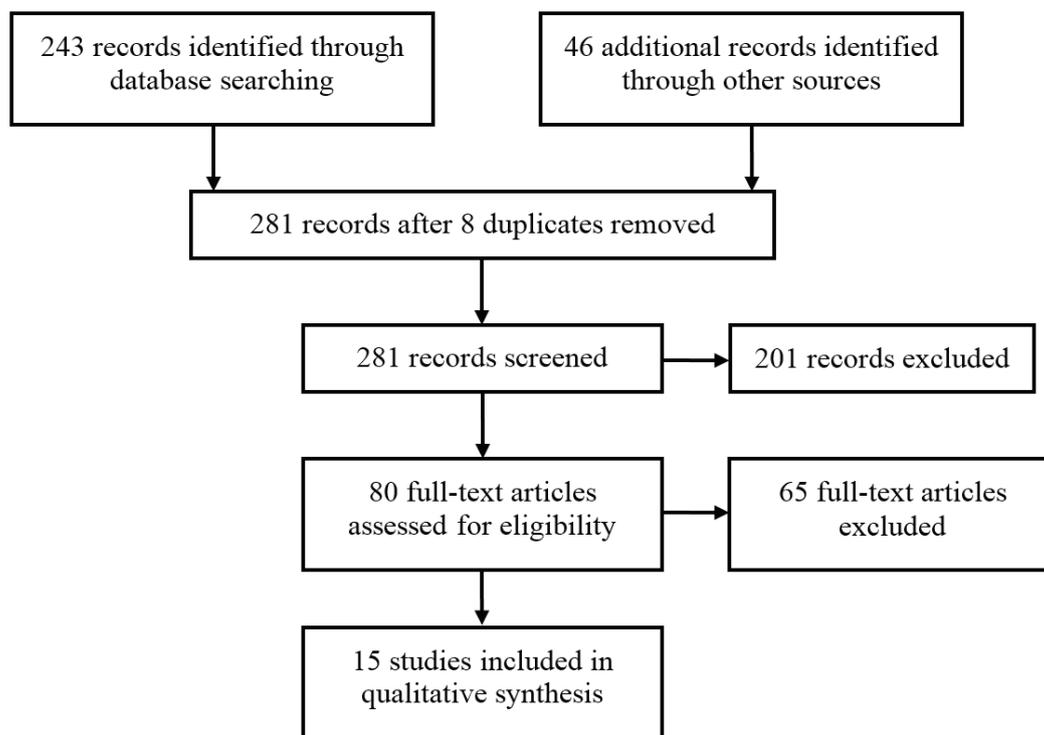
## Results

The literature search identified 15 relevant studies (Figure 1) addressing the health effects of shared or open-plan offices compared with individual offices, published between 2000 and 2017. The 15 relevant studies were observational rather than interventional studies, and differed in primary outcomes, so we were unable to carry out a meta-analysis. We used a consistent approach to determining study quality by assessing threats to internal validity (chance, bias and confounding) and external validity (generalisability); summarised in the comments column in Table 1.

Studies were excluded if they (i) did not address the research question about whether workplace design (specifically individual offices compared with shared workspaces) affects the health of employees (studies on co-working spaces, aspects of open-plan office design such as cubicle size, partition height, lighting, indoor air quality, thermal control, noise masking techniques and ergonomics were excluded), (ii) were not published in peer-reviewed journals, (iii) were opinion pieces or case studies, (iv) were review articles rather than reports from individual studies. The findings of the 15 studies are reported below grouped into themes according to the primary outcomes measured in the studies (sickness absence; health and wellbeing; job satisfaction; concentration), and summarised in Table 1.

### Sickness absence

A national cross-sectional survey of 14,969 Danish employees aged 18–59 years, working in a variety of office environments (response proportion 62%), found that sickness absence was higher in open-plan than in cellular (individual) offices. Sickness absence was statistically significantly related to having a greater number of occupants in the office after adjusting for confounding by age, sex, socioeconomic status, body mass index, alcohol consumption, smoking habits and physical activity during leisure time. Compared to cellular offices, occupants in

**Figure 1:** Identification of relevant research.

two-person offices had 50% more days of sickness absence; relative risk (RR) 1.50, 95% confidence interval (95% CI) 1.13–1.98; occupants in three- to six-person offices had 36% more days of sickness absence (RR 1.36, 95% CI 1.08–1.73); and occupants in open-plan offices (>6 persons) had 62% more days of sickness absence (RR 1.62, 95% CI 1.30–2.02).<sup>17</sup>

A Swedish longitudinal study of 1,852 employees aged 16–64 (response proportion 57%) found similar results, adjusted for sex, age, labour market sector and job rank.<sup>18</sup> Elevated risks of short sickness absence (a week or less) were found among employees in open-plan offices compared with individual offices. Odds ratios (OR) were reported, with employees in small open-plan offices (OR 1.9, 95% CI 1.16–3.1) medium-sized open-plan offices (OR 1.92, 95% CI 1.08–3.4) and large open-plan offices (OR 1.82, 95% CI 1.14–2.88) statistically significantly more likely to have sick leave than those in individual offices. The only statistically significant result for long sickness absence (more than a week) was for women in large open-plan offices (OR 2.14, 95% CI 1.08–4.26).

## Health and wellbeing

A 12-month longitudinal study of 71 employees in Sweden (response proportion 70%) who moved from individual offices to open-plan offices found a statistically significant deterioration in perceived health ( $p=0.002$ ) and performance ( $p=0.026$ ) 12 months after the employees had moved from individual offices to an open-plan office space.<sup>19</sup>

A cross-sectional study of 207 German insurance workers with similar jobs, in offices with different workspace density (from individual offices up to open-plan with 30 occupants), was undertaken to determine whether workspace density was associated with physical and mental health.<sup>20</sup> The response proportion to an online survey was 83%, with respondents asked to state the number of people working in their enclosed office space. Logistic regression analysis, adjusted for age, showed that higher workspace density was associated with higher psychosocial work stressors and environmental dissatisfaction, which, in turn, were associated with poorer physical health ( $p<0.05$ ), emotional and cognitive irritation ( $p<0.05$ ), and lower mental work ability ( $p<0.001$ ).

In an Australian cross-sectional study, 1,000 office workers who had volunteered to participate in research completed an online questionnaire that was designed to collect data on the socioemotional effects of shared workspaces.<sup>21</sup> The questionnaire sought information on the extent of sharing in the workspace, ‘demands’ such as distractions, uncooperative behaviours, distrust and negative relationships, and ‘resources’ (positive aspects of sharing) such as co-worker friendships and supervisor support. The study found that shared work environments, particularly hot-desking, were associated with higher demands ( $p=0.009$ ) and lower friendship opportunities ( $p=0.013$ ). Shared work environments were associated with perceptions of less supportive supervision ( $p=0.001$ ).

### Job satisfaction

A post-occupancy survey compared two newly-designed academic environments in the UK. The first (environment A) was a design where 32 academics had access to shared resources and their own workspaces in an open-plan area. The second (environment B) was a design where 28 academics had access to shared resources and their own designated individual offices. Self-administered questionnaires were used (response proportions were not provided). Occupant satisfaction was reported as statistically significantly higher for environment B than for environment A; however, some measures used to assess satisfaction differed between the two environments, and  $p$  values were not provided.<sup>22</sup>

The University of California at Berkeley Center for the Built Environment carried out an analysis of their database of responses to surveys of 42,764 office workers in a variety of workplaces.<sup>23</sup> The surveys used a validated, standardised instrument; the Post-Occupancy Evaluation questionnaire, one of the most widely-used instruments to survey workers about their satisfaction with the indoor environmental quality (IEQ) of their work places, including overall satisfaction, temperature, sound privacy, visual privacy, noise level, ease of interaction, cleanliness and building maintenance. Enclosed private offices outperformed open-plan offices on all aspects of IEQ ( $p<0.05$ ), except cleanliness and building maintenance. Benefits of enhanced ease of

interaction were reported to be “smaller than the penalties of increased noise level and decreased privacy resulting from open-plan office configuration” and the authors concluded that “our results categorically contradict the industry-accepted wisdom that open-plan layout enhances communication between colleagues and improves occupants’ overall work environmental satisfaction”.<sup>23</sup>

A longitudinal study of 80 individuals who were relocated from traditional to open-plan offices was undertaken in Canada. This study had been requested by the organisation in which the relocation took place, to assess the long-term effect of the office redesign on employee satisfaction and productivity and to determine whether the change to open-plan offices should be implemented across the whole organisation. Three questionnaires were distributed to 80 employees, and 21 participants returned all the questionnaires at all three time intervals, prior to the move, four weeks after the move and five months after the move (26% response proportion). Open-plan working was associated with decreased employee satisfaction ( $p<0.01$ ), including a decline in team-member relations ( $p=0.001$ ) and perceived job performance ( $p<0.01$ ), and increased stress ( $p<0.01$ ). This did not abate after a six-month adjustment period. The primary concerns of participants were increased noise and lack of privacy and confidentiality.<sup>1</sup>

A cross-sectional study of 93 full-time white-collar workers (sampling method and response proportion not reported) in a variety of jobs at a university in the US found that the association between workspace density and employee reactions could not be “fully understood unless one also accounts for additional organisational variables, namely job characteristics and tenure”.<sup>24</sup> Overall, workspace density was negatively correlated with job satisfaction ( $p\leq 0.05$ ) and organisational commitment ( $p\leq 0.05$ ). High workspace density was inversely associated with job satisfaction for people with high job-complexity and high organisational tenure ( $p\leq 0.05$ ). Job satisfaction was not associated with workspace density for those with high job-complexity and low tenure, or those with low job-complexity irrespective of tenure.

A longitudinal study involving 73 workers in three departments was carried out in the Netherlands. Although this was reported as a case study, it can also be described as a small longitudinal study of workers who made the transition from a traditional work environment, where each department had its own workspace, to a new flexible office layout. The new layout comprised a single shared area with a variety of workspaces (such as meeting rooms and silent open workspaces) and the ability to work from home or other remote locations, with flexible work hours (called “New Ways of Working” or NWW). All 73 workers received an online questionnaire during the transition (response proportion 79%) and 60 (the reduced number of participants is not explained in the paper) received a second online questionnaire six months later (response proportion 87%), with 39 workers completing both questionnaires. NWW was associated with increased ability to work flexibly in time and location, with 60% of work time spent at the office building and the remaining time at home, travelling or working elsewhere. Compared with the traditional environment, now when they were at the office, employees worked in the open area (61% of the time), meeting rooms and team rooms (38% of the time) or phone booths (1% of the time). There was no change in collaboration, employees’ satisfaction or perceived suitability of the environment to perform work tasks. Knowledge sharing decreased but this was not a statistically significant change. Suggested reasons that the change to a flexible office layout did not deliver the anticipated benefits were that the NWW had not been fully implemented or that, contrary to expectations, the NWW was not beneficial.<sup>25</sup>

Also in the Netherlands, a post-occupancy survey was carried out when the Faculty of Architecture at Delft University of Technology relocated from a building with individual offices (after a fire destroyed the building) to “New Ways of Working” including ‘non-territorial’ office space. In the new space, administrative staff were assigned personal desks but there was desk sharing and a ‘clear desk’ policy for all other staff. Personal storage space was limited, but there was shared storage space in communal areas. An online survey was completed by

266 employees (26% response proportion), and 83 employees also completed a three-day diary describing their daily activities. Overall, when comparing their new work situation with their previous individual offices, employees were less satisfied with their own work situation ( $p < 0.001$ ) and the accommodation for their department ( $p < 0.005$ ), but there was no change in satisfaction with the accommodation for their faculty. Perceived advantages of the new space were the opportunities to meet other people, and to have informal conversations. Perceived disadvantages were lack of suitable spaces for confidential (telephone) conversations, insufficient visual and auditory privacy, and lack of secure storage. It was reported to be more difficult to find staff after the relocation. Respondents were more likely to work at home after the relocation; working at home for 26.6% of their time, compared with 15.6% in the former situation ( $p < 0.001$ ). The occupancy level in the new environment was 27%.<sup>26</sup>

Preliminary results of a Swedish longitudinal study of 1,852 employees aged 16–64 (response proportion 57%) of office type on job satisfaction showed that hot-desking was associated with statistically significantly lower scores ( $p < 0.05$ ) on factors important for job satisfaction, such as decision authority and social support.<sup>27</sup> The results of this study in relation to sickness absence are reported above.<sup>18</sup>

### Concentration

A Swedish cross-sectional study of 1,445 individuals (69.5% of the 2,078 approached to take part) in five organisations, examined the impact of office type on concentration. The study found that concentration was better in individual offices than in open-plan. Individual offices were associated with the lowest levels of distraction ( $p < 0.001$ ) and cognitive stress ( $p < 0.001$ ), particularly for employees who rated their work as requiring a high need for concentration. There were no statistically significant associations reported between office type and emotional exhaustion, depersonalisation, personal efficacy or self-reported health, but the authors stated their study may have lacked power to find significant associations.<sup>28</sup> Memory performance of the workers was assessed using an immediate free recall test, once in quiet

conditions (with telephones, computer sounds and email alerts switched off, the doors of individual offices closed and no talking with other workers in open-plan areas until the test had been completed) and later repeated in normal working conditions. There was a statistically significant ( $p < 0.001$ ) decline in memory performance at the second test in individual offices and large open-plan offices, but not in small open-plan offices.<sup>29</sup> An advantage of this study was that the outcome measures were independently assessed rather than self-reported, but the order of the quiet and noisy conditions was not randomly allocated, and the investigators acknowledged this as a limitation. Another limitation was possible selection bias if workers with poor inhibition abilities avoided employment in

open-plan offices.<sup>29</sup> A subsequent analysis of data from 1,205 participants (those who had changed workstations, had been on parental leave or other long periods of leave, or who failed to answer more than two of the personality trait questions, were excluded) investigated the combined effects of office type and personality traits on self-reported distraction, job satisfaction and job performance.<sup>30</sup> There was a positive association between agreeableness and distraction, which was stronger in occupants of open-plan than individual offices ( $p = 0.018$ ). Interactions between personality and office type did not appear to affect job satisfaction or performance, apart from more conscientious people in cellular offices reporting greater job satisfaction than more conscientious people in open-plan offices.<sup>30</sup>

**Table 1:** Summary of studies included in the systematic review.

Source	Study type	Sample size	Response proportion	Comparison	Outcome measure	Results	Comments, and risk of bias
Pejtersen et al 2011 <sup>17</sup>	National cross-sectional	14,969	62%	Open-plan compared with individual offices	Sickness absence	Relative risk 1.62 (1.30–2.02)	National population sample with moderate response proportion reduces selection bias. Self-reported sickness absence; possible recall bias (but self-report validated in other published research). RR adjusted for confounding by age, sex, socioeconomic status, BMI, alcohol, smoking and physical activity.
Bodin Danielsson et al 2014 <sup>18</sup> Danielsson 2016 <sup>27</sup>	Longitudinal	1,852	57%	Open-plan compared with individual offices	Sickness absence Job satisfaction	Odds ratio 1.82 (1.14–2.88) Hot-desking was associated with statistically significantly lower scores ( $p < 0.05$ ) than individual offices.	Nationally representative sample with moderate response proportion. Self-reported sickness absence, but prospective study (two survey waves, two years apart). OR adjusted for confounding by sex, age, labour market sector and job rank.
Bergstrom et al 2015 <sup>19</sup>	Longitudinal	71	70%	Move from individual to open-plan offices	Perceived health Performance	Deteriorated ( $p = 0.002$ ) Deteriorated ( $p = 0.026$ )	High response proportion. Self-assessment of health and performance. Self-administered confidential questionnaires, one month prior, then three months and six months after move.
Herbig et al 2016 <sup>20</sup>	Cross-sectional	207	83%	Workspace density (Higher compared with lower workspace density)	Physical health Emotional and cognitive irritation Mental work ability	Poorer ( $p < 0.05$ ) Increased ( $p < 0.05$ ) Lower ( $p < 0.001$ )	High response proportion. Online survey of workers with similar jobs, in offices with different workspace density (but all employed by one company). Logistic regression analysis, adjusted for age.
Morrison and Macky 2017 <sup>21</sup>	Cross-sectional	1,000	100%	Open-plan compared with individual offices (Extent of sharing)	Workplace demands Friendship opportunities	Higher ( $p = 0.009$ ) Lower ( $p = 0.013$ )	Volunteer sample may reduce external validity. Confidential online questionnaire.

**Table 1:** Summary of studies included in the systematic review (continued).

Haynes et al 2011 <sup>22</sup>	Post-occupancy survey	60	Not reported	Open-plan compared with individual offices	Satisfaction	Statistically significantly higher for individual offices.	Small sample. Response proportion not reported. Some measures used to assess satisfaction differed between the two environments, and p values were not provided.
Kim and de Dear 2013 <sup>23</sup>	Analysis of database of post-occupancy surveys	42,764 (303 office buildings)	Not reported	Open-plan compared with enclosed, private offices	Overall satisfaction Amount of space Noise level Visual privacy	Mean satisfaction scores statistically significantly lower for open-plan offices.	Response proportion not reported. Standardised, validated post-occupancy survey. Regression model showed ease of interaction did not offset the negative impacts of noise and lack of privacy on open-plan occupants' workspace satisfaction.
Brennan et al 2002 <sup>1</sup>	Longitudinal field study	80	26% (to all 3 surveys)	Move from individual to open-plan offices	Satisfaction Team member relations Perceived job performance Physical stress	Declined (p<0.01) Declined (p=0.001) Declined (p<0.01) Increased (p<0.01)	Low response proportion; selection bias likely. Self-administered confidential questionnaires, prior, four weeks, and five months after move.
Fried et al 2001 <sup>24</sup>	Cross-sectional	93	Not reported	Workspace density in a US university	Job satisfaction	Inversely associated with workspace density for those with high job complexity and high tenure (p<0.05). No association for high job complexity and low tenure, or low job complexity irrespective of tenure.	Small sample. Sampling method and response proportion not reported. Selection bias may affect findings. Workspace density was measured by the researchers. Job complexity and job satisfaction were self-assessed by respondents, using validated instruments.
Blok et al 2012 <sup>25</sup>	Longitudinal	73	79% of 73 (survey 1) 87% of 60 (survey 2) 53% of 73 (both)	Move from traditional offices to a shared workspace including a variety of spaces and ability to work remotely.	Satisfaction Collaboration Knowledge sharing Flexibility in time and location of work	No change No change Decreased (but not statistically significant) Increased (greater variety of locations available)	Only 53% responded to both surveys—possible selection bias. All 73 employees of three departments moving to a new shared workspace were sent an online survey during the transition and 60 were sent the survey six months later.
Gorgievski et al 2010 <sup>26</sup>	Post-occupancy survey	266	26%	Move from individual offices to 'non-territorial' shared office space.	Satisfaction with own work situation. Working from home. Opportunities for informal conversations	Decreased (p<0.001) Increased (p<0.001) Improved (p value not provided)	Low response proportion—likely selection bias. Online survey—secure website, independent research organisation. Occupancy level in the new environment was 27%.
Seddigh et al 2014 <sup>28</sup> Seddigh et al 2015 <sup>29</sup> Seddigh et al 2016 <sup>30</sup>	Cross-sectional	1,445 (Five organisations)	66%	Open-plan compared with individual offices.	Concentration, distraction, and cognitive stress Memory test (initially in quiet conditions, then repeated in normal working conditions)	Individual offices associated with lower distraction (p<0.001) and cognitive stress (p<0.001). Performance declined (p<0.001) at repeated memory test in individual offices and large open-plan offices, but not small open-plan offices.	Moderate response proportion. Online survey (excluded employees who had recently changed workstation, spent <50% of working time in the office, or <25% at their designated workstation). Order of the memory tests not randomly allocated. Possible selection bias if workers with poor inhibition abilities avoid open-plan offices.

## Discussion

Our systematic review found that, compared with individual offices, the introduction of shared or open-plan office space is remarkably consistent in its consequences, with every study reporting deleterious effects on employees' health.<sup>1,17–30</sup> One of these studies reported that moving to a shared workspace increased flexibility in time and location of work,<sup>25</sup> and one reported improved opportunities for informal conversations.<sup>26</sup> These were the only positive outcomes reported and neither reported statistical significance, whereas other studies reported that open-plan offices were associated with a statistically significant decline in team-member relations,<sup>1</sup> statistically significantly lower friendship opportunities than individual offices<sup>21</sup> and one reported that any benefits of increased interaction were outweighed by the penalties of increased noise levels and lack of privacy.<sup>23</sup> Although the studies included in this systematic review were observational, so causation cannot be demonstrated, and some studies had small samples and/or low response proportions, the consistency of the deleterious findings is impressive. If there were no negative consequences of open-plan offices on health, such consistency in findings would be highly unlikely.

Our findings are also consistent with those of earlier reviews.<sup>2,3,31</sup> In their systematic review, De Croon et al found “strong evidence that working in open workplaces reduces privacy and job satisfaction, and limited evidence that working in open workplaces intensifies cognitive workload and worsens interpersonal relations”.<sup>2</sup> The authors of that systematic review also cautioned that open-plan offices may adversely affect an organisation's cost-efficiency as well as the work conditions and wellbeing of office workers.<sup>2</sup> Oommen et al found that “research evidence shows that employees face a multitude of problems such as the loss of privacy, loss of identity, low work productivity, various health issues, overstimulation and low job satisfaction when working in an open-plan work environment.”<sup>3</sup> In their recent review, Al Horr et al found that office layout is one of the most important factors affecting productivity, through distraction (negative effect on productivity) or interaction (positive effect

on productivity).<sup>31</sup> Avoiding distraction is more important than opportunities for interaction for workers performing complex tasks, with reported distraction frequency highest among open-plan office occupants and lowest in single-room occupants.<sup>31</sup>

Surveys of staff working in open-plan offices have found that, although most believe that open-plan work environments encourage teamwork, respondents do not prefer to work in open-plan offices. Reasons for not preferring open-plan work environments include distraction, difficulty concentrating and loss of privacy in open-plan offices<sup>32</sup> and, in a university environment, lack of privacy, lack of security of personal items and information in a shared space, reduced access for students, difficulties in providing counselling to students and negative effects of noise and distraction on the mental concentration required for preparing lectures and research applications.<sup>4,33</sup> One of the findings illustrated in the quote below was that allocation of only some staff to individual offices may send unwelcome signals about the social order of the organisation:

*“And the thing that sticks in most people's gullets is that the people who advocate open plan don't work in them themselves. To me that's double standards”.*<sup>4</sup>

Given the consistent findings that shared and open-plan work environments adversely affect the health and productivity of their occupants, the short-term financial benefits of open-plan or shared workspaces should be balanced against the harms of these types of workplace, including increased sickness absence (which may be associated with the easier transmission of infectious agents in open-plan spaces as well as impacts on psychological wellbeing), lower job satisfaction and productivity, and possible threats to recruitment and retention of staff. Employers and managers will need to consider this imbalance of benefits and harms when making decisions about workplace design, and should recognise that workplace design affects people differently according to their personal characteristics and the type of work they do, with open-plan offices particularly detrimental where work requires high levels of concentration.<sup>9,21,34,35</sup> A “one size fits all” approach does not suffice.

Where the decision to introduce shared or open-plan work environments is made, it should be acknowledged that this is a cost-based decision rather than an initiative to improve working conditions or productivity.<sup>6,8,14</sup> Employers and managers should be honest about this, and should not claim that there will be benefits to workers from changing to shared office space, because, as this and earlier reviews show, little evidence for such benefits exists. In open-plan workplaces where staff handle confidential documents; such as health records, research data with identifiable personal information,

or identifiable patient data, ways to avoid contravening ethics committee requirements and relevant health and privacy legislation are required.

The findings of this systematic review have public health implications for the New Zealand workforce. Decisions about workplace design should include weighing the short-term financial benefits of open-plan or shared workspaces against the significant harms, including increased sickness absence, lower job satisfaction and productivity, and possible threats to recruitment and retention of staff.

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**Competing interests:**

Nil.

**Acknowledgements:**

Ann Richardson receives support from the Wayne Francis Charitable Trust.

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