



How supportive are workplace environments for sitting less and moving more? A descriptive study of Australian workplaces participating in the BeUpstanding program

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ABSTRACT

Desk-based workers are highly sedentary; this has been identified as an emerging work health and safety issue. To reduce workplace sitting time and promote physical activity it is important to understand what factors are already present within workplaces to inform future interventions. This cross-sectional study examined the prevalence of supportive environmental factors, prior to workplaces taking part in a 'sit less, move more' initiative (BeUpstanding). Participants were 291 Australian-based workplace champions (representing 230 organisations) who unlocked the BeUpstanding program's online toolkit between September 2017 and mid-November 2020, and who completed surveys relating to champion characteristics, organisation and workplace characteristics, and the availability of environmental factors to support sitting less and moving more. Factors were characterized using descriptive statistics and compared across key sectors and factor categories (spatial; resources/initiatives; policy/cultural) using mixed logistic regression models. Of the 42 factors measured, only 11 were present in > 50% of workplaces. Spatial design factors were more likely to be present than resources/initiatives or policy/cultural factors. Centralised printers were the most commonly reported attribute (94%), while prompts to encourage stair use were the least common (4%). Most workplace factors with < 50% prevalence were modifiable and/or were considered modifiable with low cost. Organisations that were public sector, not small/medium, not regional/remote, and not blue-collar had higher odds of having supportive factors than their counterparts; however, workplaces varied considerably in the number of factors present. These findings can assist with developing and targeting initiatives and promoting feasible strategies for desk-based workers to sit less and move more.

There is increasing interest in initiatives to reduce prolonged sedentary time in desk-based workers (Straker et al., 2016), a demographic that can spend over 70% of their work day sedentary (Hadgraft et al., 2016b). High volumes of daily sedentary time are associated with increased risk of non-communicable diseases (Katzmarzyk et al., 2019; Saunders et al., 2020), with high levels of occupational sitting associated with poor self-reported health and back/neck pain (Kallings et al., 2021). Conversely, regularly breaking up and reducing sedentary time, including during work time (Kallings et al., 2021), may have benefits for metabolic and musculoskeletal health (Hadgraft et al., 2020;

Kallings et al., 2021; Saunders et al., 2018). Multiple factors across the socio-ecological model (which emphasises individual-, social-, environmental- and policy-level influences) have previously been identified as potential influences on sitting and activity at work (Owen et al., 2011). In particular, organisational norms associating sitting time with work performance are perceived to act as a barrier, while supportive workplace cultures and physical environments (e.g., provision of sit-stand workstations) are perceived to facilitate lower workplace sitting time (Hadgraft et al., 2018; Mackenzie et al., 2019).

To design effective strategies to encourage desk-based workers to sit

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less and move more', there is a need to understand not only the supportive environmental factors that influence workplace sitting and physically active time, but also their availability within workplaces. Understanding what factors are likely to be already present or absent in the workplace is critical to designing widely applicable approaches with minimal barriers to adoption and successful implementation. This includes suggesting areas for improvement through identifying modifiable factors commonly absent, particularly factors considered to be 'easy wins' for the workplace — low or no-cost initiatives that can be readily implemented. This may assist to overcome one of the common perceived barriers to introducing workplace health promotion programs, namely that they will be time-consuming and costly (McCoy et al., 2014). Overcoming some of these initial barriers may also help with facilitating the broader cultural change necessary for sustained behaviour change (Owen et al., 2018; Sallis and Owen, 2015).

To date, evidence on the availability of supportive environmental factors that facilitate workers sitting less and moving more has been limited to findings from a relatively small number of organisations or sectors (Almeida et al., 2014; Hadgraft et al., 2016a), or primarily focused on one factor (e.g., availability of sit-stand workstations (Zerquigne et al., 2021)), on one industry sector (Nigg et al., 2010), or on associations with outcomes (rather than availability of supports (Dodson et al., 2018)), with little or no comparison of the availability of supports across organisations from different sectors. This gap is particularly pertinent given evidence suggesting there may be differences in the correlates of workplace sitting time according to industry (Mullane et al., 2017). Furthermore, the uptake of workplace health promotion programs more broadly has been observed to differ by sector (Mackenzie et al., 2019; McCoy et al., 2014; Such and Mutrie, 2016; Taylor et al., 2016), which may, at least in part, reflect the presence (or absence) of supportive factors enabling their uptake.

Data collected through the BeUpstanding™ program, a free online program designed to support work teams to sit less and move more (Healy et al., 2016), provides the opportunity to extend the relevant evidence base on which to build such workplace initiatives. The aim of this study was to examine the prevalence of activity-supporting factors within the workplaces signing up to BeUpstanding. Prevalence was considered overall as well as by selected key sectors (public sector, small-medium enterprise [SME], blue-collar, and regional/remote Australia), with further comparisons made based on the type of environmental factor (spatial, resources/initiatives, policy/cultural) and whether or not the factors were modifiable and represent 'easy wins'.

1. Methods

This secondary cross-sectional analyses used data collected through the BeUpstanding program (<https://www.beupstanding.com.au/>) between 1 September 2017 and 10 November 2020. As described elsewhere (Healy et al., 2020), BeUpstanding aims to support workers to sit less and move more through raising awareness and building a supportive culture for change. It is designed to be implemented within a work team by a workplace representative (the "champion"), with the toolkit resources facilitating a train-the-champion approach to guide champions through the program (Healy et al., 2020). The website and toolkit went live in September 2017 following successful pilot testing (Goode et al., 2019; Healy et al., 2018), and in June 2019, following toolkit improvements, a national implementation trial of the BeUpstanding program commenced (Healy et al., 2020).

1.1. Participants

Participation is reported at both the organisation and workplace champion level as multiple champions from existing participating organisations can participate in BeUpstanding. In this study, each champion was treated as reflecting a distinct smaller workplace from within their larger organisation. Individuals (i.e., single users without an

identified workplace) were ineligible. The study was approved by the Institutional Human Research Ethics Committee with champions providing informed online consent as part of the sign-up process. The trial was prospectively registered on 12 May 2017 (ACTRN12617000682347).

1.2. Data collection and measures

Data were collected through two online surveys: the champion profile survey and the workplace audit. To unlock the toolkit and access the BeUpstanding resources, champions were required to register and complete a champion profile survey. Champions were also asked to complete a workplace audit as part of the program's needs assessment prior to delivering the program. The compulsory champion profile survey collects basic information about the champion, their organisation and their work team. The workplace audit asks about the workplace's pre-existing supportive factors to sit less and move more, including those related to the spatial environment and the policy/cultural environment, and the resources and initiatives provided. While highlighted as a core program component, not all users completed the audit. Only Australian-based organisations whose users completed the audit were included in the main analyses.

1.2.1. Priority sectors

Priority sectors were those identified by the policy and practice partners for participation in the national implementation trial (Healy et al., 2020): SME, regional/remote, public, and blue-collar. Champion-reported organisation size were used to classify organisations as SME (yes/no or unsure). The work team's regional/remote location and the organisation's public sector status were classified from the champion survey (yes/no/unsure), with regional/remote encompassing all areas outside of the major cities. Champion responses to the organisation's size, industry (Australian Bureau of Statistics, 2006) (and associated blue-collar status) and public sector status were checked against publicly available data for the organisation and replaced when reported inaccurately or unknown. Multiple champions from the same organisation were accordingly assigned the same status in relation to SME and public sector but could sometimes vary in terms of their blue-collar status and regional/remote location.

1.2.2. Champion characteristics

Each champion reported their sex, job classification, and if they had a health and safety role in their workplace.

1.2.3. Workplace environment characteristics

The workplace audit included 32 core questions regarding the availability of supportive factors in the workplace environment for sitting less and moving more. An expanded version of the workplace audit was provided to champions who signed up to the toolkit after April 2019. This version contained an additional 10 items, two of which were added to the original audit prior to launching the expanded version. For the purposes of this paper, the factors were grouped mutually exclusively as pertaining to the spatial environment, resources/initiatives ('resources') and the policy/cultural environment. A summary of the survey items is below (the full list is in [Supplementary Table S1](#)). Mostly questions asked whether features were present (yes/no/NA [not applicable]) with 'NA' treated as a type of no. Height-adjustable desks were counted as 'yes' to being present if all staff had access to height-adjustable desks (on an individual or shared-basis). Each characteristic was also classified by two authors as to whether they would be modifiable for practically all workplaces (yes/no), and if modifiable, whether implementation could also be free/low cost (yes/no). Consensus was reached on all items.

Spatial environment (15 core items): Questions were adapted from the Checklist of Health Promotion Environments at Worksites (CHEW) (Oldenburg et al., 2002) and pilot tested in previous studies (Healy et al.,

2018). Questions related to the office layout, facilities for physical activity and for reducing sitting time, and the surrounding workplace built environment.

Resources/initiatives (10 core items): Questions covered the provision of information/material about moving more and sitting less, supportive equipment/technology, physical activity classes, and challenges/initiatives. The two additional items added (Supplementary Table S1) concerned the provision of physical activity information/materials and availability of technology for sitting less.

Policy/cultural environment (7 core items): Questions related to the presence of specific policies around increasing physical activity and reducing sedentary behaviour and demonstrating organisational support for sitting less and moving more. The eight additional items added (Supplementary Table S1) concerned organisational commitment to sitting less and moving more and health and wellbeing generally (Hannon et al., 2017).

1.3. Analyses

The prevalence of supportive factors were reported (n, %) as well as compared using mixed logistic regression models (melogit) between key sectors and by type of environment (spatial, resources, policy/cultural), and by whether or not the factors were modifiable (yes, no) or low/no cost to implement (yes, no), with those both modifiable and low/no cost considered an “easy win”. The number of supportive factors present per workplace was also described as median (minimum, maximum). These and the regression models included only the 32 core factors. Analyses were naïve (i.e., not accounting for potential relationships between workplace champions). Missing data were excluded, with analyses of the core items focused on all participants and analyses including the additional items focused on the subset of participants who had been provided with the expanded version of the workplace audit. Significance was set at $p < 0.05$ (two-tailed). Analyses were performed in STATA 16.0 (StataCorp, TX USA).

2. Results

Between the soft launch (1 September 2017) and 10 November 2020, 757 Australian-based users unlocked the BeUpstanding toolkit by completing the champion profile survey. Of these, 291 workplace champions from 214 organisations completed the workplace audit, with 235 completing the expanded audit version. The characteristics of champions, their workplaces, and their organisations are summarised in Table 1. The study included a diverse representation across sectors, with organisations of all sizes (small to very large) included. The sample included 149 champions from 86 public-sector organisations, 74 champions from 65 blue-collar sector organisations, 85 champions from 84 SME, and 99 champions from regional and remote workplaces, noting champions could be from multiple sectors (e.g., a regional SME). Champions were predominately female and employed in mostly employee or senior management/executive job roles. Over half had a health and safety role. Most champions indicated that the majority of their team performed desk-based work ($n = 232/265$; 87.6%) and had high-sitting job roles ($n = 213/260$; 81.9%). There was some bias in the completion of the workplace audit (Supplemental Table S2). There were no large or significant differences in completion by champion characteristics but champions from the public sector, non-SME and non-blue-collar sectors were significantly more likely to complete the audit than their counterparts.

2.1. Prevalence of activity-supportive factors

Fig. 1 shows the prevalence of the 42 activity-supportive environmental factors across workplaces. The most common factor (reported by 94% of champions) was centrally-located printers, while the least common was stair prompts (4%; often reported as ‘not applicable’).

Table 1

Characteristics of champions, their workplaces and organisations participating in BeUpstanding (2017–2020).

Characteristics	n (%)
Organisations (n = 214)	
Government/public sector, yes	86 (40.2%)
Blue-collar sector, yes	65 (30.4%)
Organisation size	
Small (<20 employees)	32 (15.0%)
Medium (20–199 employees)	52 (24.3%)
Large (200–1999 employees)	68 (31.8%)
Very large (2000 + employees)	62 (29.8%)
Workplace characteristics (n = 291)	
Regional/remote sector, yes ^a	99 (34.9%)
Team does mostly desk-based work, yes ^b	232 (87.6%)
Majority of team has high-sitting job roles, yes ^c	213 (81.9%)
Champion characteristics (n = 291)	
Sex ^b	
Female	188 (72.3%)
Male	70 (26.9%)
Indeterminate/Intersex/Unspecified/Prefer not to answer	2 (0.8%)
Job classification ^b	
Employee	123 (47.3%)
Team leader/Middle management	33 (12.7%)
Senior management/Executive	104 (40.0%)
Health and Safety role in workplace, yes ^c	189 (72.7%)

^a excludes $n = 7$ with missing data; ^b excludes $n = 26$ with missing data; ^c excludes $n = 31$ with missing data. Work teams were considered blue collar sector when the organisation’s industry was largely blue collar – Accommodation and Foodservice, Agriculture Forestry and Fishing, Construction, Electricity/Gas/Water and Waste Services, Manufacturing, Mining and Quarries, Retail Trade, Transport/Postal and Warehousing or Wholesale Trade – or when the industry was considered partially blue collar (Health Care and Social Assistance; Information Media and Telecommunications; Other Services), and the champion had reported their work team to be in a blue collar sector.

There were 11 factors prevalent in more than half of work teams — mostly spatial — and 31 that were mostly absent (<50% prevalence) — mostly policy/culture or resources. Importantly, two thirds of the ‘mostly absent’ factors were modifiable (21 out of 31 items), with 16 judged ‘easy win’ options. Having height-adjustable desks accessible to all staff — not a low-cost option — was the only modifiable spatial attribute absent from most workplaces.

There was no large or significant difference in the odds that activity supportive factors were present based on whether they were modifiable (OR = 0.80, 95% CI: 0.32, 2.04) or easy wins (OR = 0.65, 95% CI: 0.26, 1.63). However, factors had much lower odds of being present when they concerned the resource (OR = 0.22, 95% CI: 0.08, 0.57) or policy/cultural (OR = 0.29, 95% CI: 0.11, 0.75) environment, relative to the spatial environment.

Table 2 shows that the presence of these activity-supporting factors significantly differed based on sector, but not always to equal degrees for each type of feature. Overall, supportive characteristics were more likely to be present in organisations that were public sector, not SME, not regional/remote, and not blue-collar relative to their respective counterparts. For instance, public-sector workplaces were 59% more likely to have supportive features overall than non-public sector ones.

The prevalence of each factor is shown within each priority sector as well as overall (Table 3). Several factors were more likely than not to be present, typically concerning the spatial environment. This was generally consistent across the key sectors. These included walkable access to healthy food and nearby public transport. Similarly, within each sector there were many modifiable factors that were mostly absent (<50% prevalence). These mostly related to resource and policy/cultural environments, including providing ‘sit less’ information/material and having strategies and policies to encourage sitting less and moving more.

The number of core activity-supporting factors per workplace (Table 4) varied widely, ranging from 1 to 30 out of 32 factors, from 1 to 17 modifiable factors, and from 0 to all 14 easy wins. Overall, and in

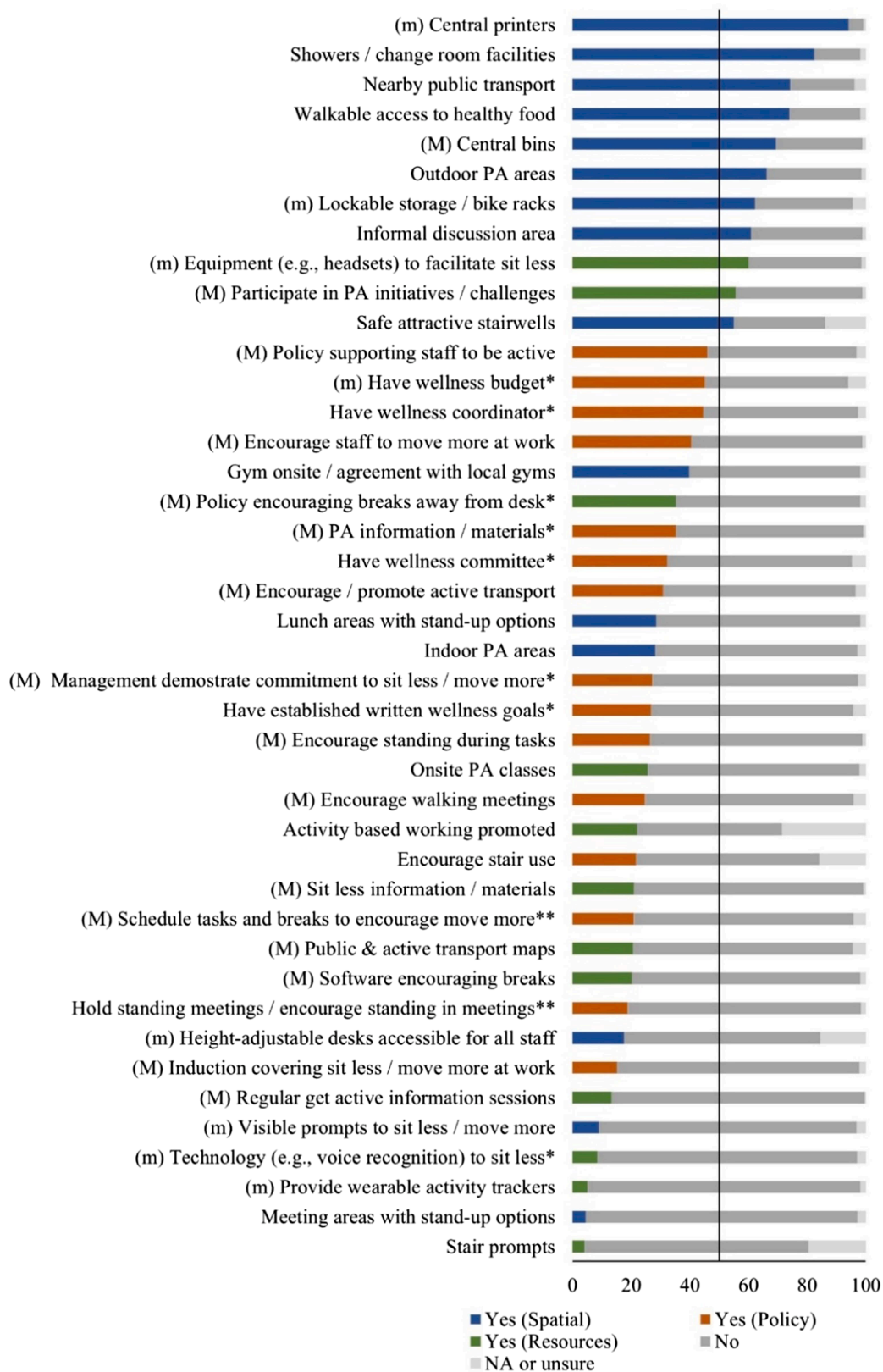


Fig. 1. Supportive environmental characteristics (spatial, resources and policy/cultural) in workplaces signed up to the BeUpstanding program (2017–2020) as reported by 291 workplace champions.

Table 2

The odds that activity-supportive environmental factors are present for those within versus outside of each key sector (n = 291 BeUpstanding workplace champions, 2017–2020).

	Odds Ratio (95% CI)	p	p for interaction ^a
Public sector (n = 149 yes vs 124 no)			
All	1.59 (1.44, 1.75)	<0.001	
Spatial	1.55 (1.34, 1.78)	<0.001	(ref)
Resources	2.13 (1.74, 2.61)	<0.001	0.010
Policy/culture	1.31 (1.10, 1.57)	0.003	0.164
			<i>0.002</i>
Small-medium enterprise (n = 85 yes vs 206 no)			
All	0.61 (0.55, 0.68)	<0.001	
Spatial	0.58 (0.50, 0.67)	<0.001	(ref)
Resources	0.47 (0.37, 0.59)	<0.001	0.142
Policy/culture	0.83 (0.68, 1.02)	0.075	0.005
			<i><0.001</i>
Blue collar (n = 74 yes vs 217 no)			
All	0.75 (0.67, 0.84)	<0.001	
Spatial	0.77 (0.65, 0.90)	0.001	(ref)
Resources	0.68 (0.54, 0.86)	0.001	0.407
Policy/culture	0.78 (0.63, 0.96)	0.019	0.923
			<i>0.655</i>
Regional/remote (n = 99 yes vs 192 no or unknown)			
All	0.89 (0.80, 0.98)	0.021	
Spatial	0.77 (0.66, 0.89)	<0.001	(ref)
Resources	1.19 (0.97, 1.46)	0.100	0.001
Policy/culture	0.88 (0.73, 1.07)	0.207	0.250
			<i>0.003</i>

Table shows the Odds Ratios with 95% confidence interval (CI) and p value from unadjusted mixed logistic regression models, with random intercept to account for data repeated across 32 core items.

^a p for interaction sector × type (referent = spatial), with overall p value for interaction from chi-square test (2 df) shown in italics.

every sector, almost all workplaces had some room for improvement. A large percentage (44.4% to 52.0%) of champions from every sector except for the public sector (26.9%) reported their workplace to have less than a third of the measured activity-supportive factors present. Only 1.2% (blue-collar sector) to 8.7% (public sector) of champions reported their workplace had over two-thirds of the measured factors present. When considering only attributes characterised as easy wins, in every sector very few champions (<15%) reported their workplace already possessed two-thirds of these factors and many (consistently over 40%) indicated their workplace had less than a third of these attributes present.

3. Discussion

This study described the prevalence of environmental factors supportive of sitting less and moving more in Australian workplaces who had signed up for a workplace program targeting these behaviours (BeUpstanding), as reported by the workplace champions. Overall, 11 environmental supports were reportedly present in most workplaces, mostly features of the spatial environment, and notably including some physical environment characteristics that may be difficult to modify (e.g., having showers/change room facilities, access to nearby public transport). These types of features appear likely to reflect the location and size of the physical workplace environment (e.g., proximity to public transport, stair availability, sufficient physical space for showers), rather than necessarily being supports implemented by employers from a health and wellbeing perspective. From a health promotion perspective, the supportive factors commonly present can be considered as potential assets workplaces are likely to possess for the purpose of making suggestions for intervention change strategies in the absence of detailed knowledge of the specific workplace. For example, messaging that encourages staff to use active transport is appropriate given the common availability of showers and change room facilities, while suggestions to perform physical activity onsite may need to focus

Table 3

Prevalence of activity-supportive environmental factors overall and within key sectors reported by BeUpstanding workplace champions (2017–2020).

	All (n = 291)	SME (n = 85)	Regional / remote (n = 99)	Public Sector (n = 149)	Blue Collar Sector (n = 74)
Spatial					
(m) Central printers	274 (94.2%)	78 (91.8%)	92 (92.9%)	142 (95.3%)	69 (93.2%)
Showers/change room facilities	240 (82.5%)	63 (74.1%)	74 (74.7%)	128 (85.9%)	67 (90.5%)
Nearby public transport	216 (74.2%)	54 (63.5%)	55 (55.6%)	118 (79.2%)	42 (56.8%)
Walkable access to healthy food	215 (73.9%)	57 (67.1%)	67 (67.7%)	115 (77.2%)	41 (55.4%)
(M) Central bins	202 (69.4%)	51 (60.0%)	63 (63.6%)	113 (75.8%)	50 (67.6%)
Outdoor PA areas	193 (66.3%)	50 (58.8%)	62 (62.6%)	98 (65.8%)	45 (60.8%)
(m) Lockable storage / bike racks	181 (62.2%)	45 (52.9%)	56 (56.6%)	110 (73.8%)	43 (58.1%)
Informal discussion area	177 (60.8%)	53 (62.4%)	59 (59.6%)	85 (57.0%)	48 (64.9%)
Safe attractive stairwells	160 (55.0%)	34 (40.0%)	54 (54.5%)	94 (63.1%)	40 (54.1%)
Gym onsite / agreement with local gyms	116 (39.9%)	14 (16.5%)	52 (52.5%)	82 (55.0%)	25 (33.8%)
Lunch areas with stand-up options	83 (28.5%)	23 (27.1%)	28 (28.3%)	40 (26.8%)	22 (29.7%)
Indoor PA areas	82 (28.2%)	22 (25.9%)	28 (28.3%)	49 (32.9%)	15 (20.3%)
(m) Height-adjustable desks accessible for all staff	51 (17.5%)	14 (16.5%)	10 (10.1%)	31 (20.8%)	6 (8.1%)
(m) Visible prompts to sit less/move more	26 (8.9%)	5 (5.9%)	7 (7.1%)	18 (12.1%)	4 (5.4%)
Meeting areas with stand-up options	13 (4.5%)	5 (5.9%)	3 (3.0%)	5 (3.4%)	4 (5.4%)
Resources					
(m) Equipment (e.g., headsets) to facilitate sit less	175 (60.1%)	38 (44.7%)	65 (65.7%)	100 (67.1%)	44 (59.5%)
(M) Participate in PA initiatives/challenges	162 (55.7%)	37 (43.5%)	56 (56.6%)	99 (66.4%)	33 (44.6%)
(M) PA information/materials ^a	83 (35.3%)	19 (25.0%)	35 (39.8%)	42 (39.3%)	18 (27.3%)
Onsite PA classes	75 (25.8%)	13 (15.3%)	26 (26.3%)	53 (35.6%)	9 (12.2%)
Activity based working promoted	64 (22.0%)	17 (20.0%)	22 (22.2%)	39 (26.2%)	13 (17.6%)
(M) Sit less information/materials	61 (21.0%)	15 (17.6%)	22 (22.2%)	30 (20.1%)	13 (17.6%)
(M) Public & active transport maps	60 (20.6%)	10 (11.8%)	27 (27.3%)	46 (30.9%)	13 (17.6%)

(continued on next page)

Table 3 (continued)

	All (n = 291)	SME (n = 85)	Regional / remote (n = 99)	Public Sector (n = 149)	Blue Collar Sector (n = 74)
(M) Software encouraging breaks	59 (20.3%)	9 (10.6%)	21 (21.2%)	43 (28.9%)	10 (13.5%)
(M) Regular get active information sessions	39 (13.4%)	7 (8.2%)	15 (15.2%)	25 (16.8%)	10 (13.5%)
(m) Technology (e.g., voice recognition) to sit less ^a	20 (8.5%)	1 (1.3%)	11 (12.5%)	17 (15.9%)	2 (3.0%)
(m) Provide wearable activity trackers	15 (5.2%)	4 (4.7%)	5 (5.1%)	8 (5.4%)	5 (6.8%)
Stair prompts	12 (4.1%)	1 (1.2%)	3 (3.0%)	7 (4.7%)	2 (2.7%)
Policy/culture					
(M) Policy supporting staff to be active	134 (46.0%)	27 (31.8%)	47 (47.5%)	80 (53.7%)	28 (37.8%)
(m) Have wellness budget ^a	106 (45.1%)	18 (23.7%)	39 (44.3%)	57 (53.3%)	26 (39.4%)
Have wellness coordinator ^a	105 (44.7%)	19 (25.0%)	43 (48.9%)	59 (55.1%)	29 (43.9%)
(M) Encourage staff to move more at work	118 (40.5%)	42 (49.4%)	43 (43.4%)	53 (35.6%)	36 (48.6%)
(M) Policy encouraging breaks away from desk ^a	83 (35.3%)	25 (32.9%)	34 (38.6%)	44 (41.1%)	22 (33.3%)
Have wellness committee ^a	76 (32.3%)	14 (18.4%)	29 (33.0%)	50 (46.7%)	16 (24.2%)
(M) Encourage/promote active transport	90 (30.9%)	21 (24.7%)	28 (28.3%)	59 (39.6%)	18 (24.3%)
(M) Management demonstrate commitment to sit less/move more*	64 (27.2%)	25 (32.9%)	27 (30.7%)	34 (31.8%)	15 (22.7%)
Have established written wellness goals*	63 (26.8%)	9 (11.8%)	27 (30.7%)	40 (37.4%)	16 (24.2%)
(M) Encourage standing during tasks	77 (26.5%)	23 (27.1%)	22 (22.2%)	40 (26.8%)	15 (20.3%)
(M) Encourage walking meetings	72 (24.7%)	16 (18.8%)	21 (21.2%)	40 (26.8%)	15 (20.3%)
Encourage stair use	63 (21.6%)	17 (20.0%)	22 (22.2%)	29 (19.5%)	18 (24.3%)
(M) Schedule tasks and breaks to encourage move more ^b	50 (20.9%)	12 (15.8%)	17 (19.1%)	28 (25.5%)	14 (20.9%)
Hold standing meetings/encourage standing in meetings ^b	45 (18.8%)	10 (13.2%)	14 (15.7%)	23 (20.9%)	10 (14.9%)
(M) Induction covering sit less/move more at work	44 (15.1%)	14 (16.5%)	12 (12.1%)	24 (16.1%)	7 (9.5%)

m = modifiable and M = modifiable at low or no cost (easy win)

Bold indicates mostly absent (<50% prevalence) and modifiable

^a n = 235 (added partway through data collection)

^b n = 239 (added partway through data collection)

on outdoor activities, as only a minority of workplaces had spaces for indoor physical activity while many had space availability outdoors.

The findings also highlighted several initiatives that workplace interventions such as BeUpstanding could promote to workplaces to encourage sitting less and moving more. Among the 31 factors that were commonly absent from workplaces, a large number (n = 21) were modifiable, many at low or no cost to the workplace (n = 16). The factors were typically in the domain of resources or workplace culture and policies. The wide variety of modifiable factors could be suggested as potentially unexploited targets that can make the workplace environment more activity supportive. Examples of easy wins include creating policies that support staff to be active at work, providing information about sitting less and moving more (e.g., through information sessions or staff inductions,) and visible prompts to encourage activity throughout the working day. Pragmatically, this information could be used by a health promotion agency to invest in developing a freely-available communications kit to promote sitting less/moving more in the workplace, knowing that such a resource would likely be beneficial for several organisations.

Workplaces were highly varied in the extent to which their environment was activity supportive, with workplaces reportedly possessing almost none to almost all attributes. Very few workplaces possessed a high number of attributes, but a large proportion of workplaces possessed very few. This suggests that interventions should be developed on the assumption of minimal existing supportive environmental factors. Conducting environmental audits of workplaces prior to commencing an intervention may be a useful starting point to gauge readiness. Such information would provide an indication of the number and type of available assets that can be harnessed and could help guide the selection of suitable intervention strategies.

While these findings and suggestions were generally applicable across all priority sectors, activity-supportive factors were more likely to be present in public sector workplaces compared with private/not-for-profit workplaces, and were less likely to be present in SMEs, blue collar, and regional/remote workplaces than their counterparts. These findings support previous literature (Harris et al., 2014; McCoy et al., 2014; Taylor et al., 2016) that has found that SMEs tend to offer fewer workplace health promotion opportunities, including physical activity supports (Onufrak et al., 2018), than large organisations, with rural/remote and blue collar workplaces tending to prioritise occupational health and safety (i.e., injury prevention) over health promotion initiatives (Pescud et al., 2015). Cost, resourcing and perceived lack of benefit are often cited as reasons for this discrepancy (Harris et al., 2014; McCoy et al., 2014). This highlights the potential for promoting easy-win strategies within these organisations, particularly as small businesses may have strengths for implementing such programs as a result of being less hierarchical, having more accessible and engaged senior leaders, and having greater co-worker support (Dale et al., 2019; Harris et al., 2014). The public sector workplaces also appeared to outperform their private and not-for-profit counterparts in the provision of environmental supports to sit less and move more. While previous qualitative research has suggested that cost pressures associated with public funding may act as a barrier to government agencies investing in health promotion (Mackenzie et al., 2019; Such and Mutrie, 2016), the same issue applies to not-for-profit organisations (Hadgraft et al., 2018; Hadgraft et al., 2016a) and in the public sector may be offset to an extent by the effects of a larger organisation size. Future studies with larger sample sizes, or deliberately recruiting from specific combinations of sectors, might be able to tease apart the independent predictors of supportive characteristics in workplaces, such as the relative contribution of organisation ownership and organisational size.

Table 4
Number of supportive environmental factors per workplace, overall and within priority sectors.^a

	Overall (n = 291)	Public Sector (n = 149)	SME (n = 85)	Blue-collar sector (n = 74)	Regional / remote sector (n = 99)
All characteristics (/32)					
Median (min, max)	12 (1, 30)	13 (1, 30)	10 (1, 22)	11 (5, 24)	11 (4, 30)
Low (<33%, 0–10)	105 (36.1%)	40 (26.9%)	44 (52.0%)	33 (44.6%)	44 (44.4%)
Moderate (33–67%, 11–21)	167 (57.4%)	96 (64.4%)	40 (47.1%)	40 (54.0%)	49 (49.5%)
High (>67%, 22–32)	19 (6.5%)	13 (8.7%)	1 (1.2%)	1 (1.4%)	6 (6.1%)
Modifiable characteristics (/19)					
Median (min, max)	6 (1, 17)	7 (1, 17)	5 (1, 14)	6 (2, 14)	6 (1, 17)
Low (<33%, 0–6)	153 (52.6%)	65 (43.6%)	57 (67.1%)	46 (62.1%)	55 (55.6%)
Moderate (33–67%, 7–12)	117 (40.2%)	66 (44.3%)	24 (28.2%)	26 (35.1%)	36 (36.4%)
High (>67%, 13–19)	21 (7.2%)	18 (12.1%)	4 (4.7%)	2 (2.7%)	8 (8.1%)
Easy wins (/14)					
Median (min, max)	4 (0, 14)	5 (0, 14)	3 (0, 11)	3.5 (1, 10)	4 (0, 14)
Low (<33%, 0–4)	161 (55.3%)	71 (47.7%)	54 (63.5%)	47 (63.5%)	58 (58.6%)
Moderate (33–67%, 5–9)	109 (37.5%)	61 (40.9%)	28 (32.9%)	26 (35.1%)	33 (33.3%)
High (>67%, 10–14)	21 (7.2%)	17 (11.4%)	3 (3.5%)	1 (1.4%)	8 (8.1%)

Table displays median (min, max) or n(%).

^a as reported by workplace champions participating in BeUpstanding (2017–2020)

The findings from this study are novel as they provide a snapshot of the reported availability of a range of environmental supports to sit less and move more in a broad range of Australian organisations. It is important to recognise that this study was not a random sample of workplaces, but pre-intervention data from a diverse range of self-designated workplace champions signing up to a free online ‘sit less, move more’ program. Arguably, this is the appropriate population to inform the design of sit less, move more interventions, but it should be noted that the sample may not be representative of Australian workplaces in general. All respondents were treated as independent, despite some respondents being from the same organisation, as the relationships between champions within an organisation were not known for all organisations. This may have skewed the findings, particularly for the larger organisations (which were more likely to have more than one champion). There was also some evidence of participation biases, with the provision of workplace audit data being associated positively with respondents being from the public sector, and not being from the SME and blue-collar sectors. The workplaces that signed up because they were interested in sit less/move more initiatives might have more supportive environments than other workplaces who did not sign up. If so, then there should be some caution in assuming commonly present attributes here are commonplace. However, it might be safe to assume that the potential suggested improvements in attributes that were low prevalence and modifiable is still relevant for Australian organisations more generally. A further study strength was the extensive and diverse range of activity-supportive environmental factors measured, across multiple categories. While these characteristics have been termed activity-supportive from their expected role previously identified in the workplace health literature, their empirical associations with changes in worker sitting, standing and moving in this study population can be verified after data collection for the BeUpstanding implementation trial is complete (Healy et al., 2020). This includes evaluating which characteristics matter, as well as the minimum number of supports required for behavioural and cultural change. Such information has been identified as important (Dodson et al., 2018) and it could inform future screening of suitable workplaces for specific interventions if there are any non-modifiable prerequisites for success (e.g., availability of stairs). The long-term (12 month) follow-up (Healy et al., 2020) of BeUpstanding includes a post-program workplace audit, which will provide insight into whether changes (including cultural) were observed in the prevalence of modifiable characteristics in participating workplaces.

In addition to the aforementioned limitations, the organisational characteristics examined were those identified by the policy and practice partners for the national implementation trial of BeUpstanding (Healy et al., 2020). Depending on what workplaces sign up for BeUpstanding, a more in-depth evaluation may become possible, including

evaluating a wider range of attributes, independent predictors, assessing changes in environmental factors (i.e., determining which were modified not just believed to be modifiable), and possible associations with behaviour changes (i.e., verifying which showed evidence of being activity supportive). All statistical testing was exploratory, not powered *a priori*, so the study may have been underpowered.

4. Conclusion

This study provides insight into the presence of resources, spatial and policy/cultural environment factors facilitating sitting less and moving more amongst workplaces signing up to a workplace initiative, and how this varied by organisational size, location and industry/sector. Given the low prevalence of many strategies and supports considered both modifiable and low cost, workplace health programs such as BeUpstanding can play a key role in helping organisations to identify relevant and feasible strategies and initiatives to create the cultural change needed to reduce sitting and increase moving amongst their desk-based workforce.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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References

- Almeida, F.A., Wall, S.S., You, W., Harden, S.M., Hill, J.L., Krippendorff, B.E., Estabrooks, P.A., 2014. The association between worksite physical environment and employee nutrition, and physical activity behavior and weight status. *J Occup Environ Med* 56, 779–784.
- Australian Bureau of Statistics, 2006. Australia and New Zealand Standard Industrial Classification.
- Dale, A.M., Enke, C., Buckner-Petty, S., Hipp, J.A., Marx, C., Strickland, J., Evanoff, B., 2019. Availability and use of workplace supports for health promotion among employees of small and large businesses. *Am J Health Promot* 33 (1), 30–38.
- Dodson, E.A., Hipp, J.A., Lee, J.A., Yang, L., Marx, C.M., Tabak, R.G., Brownson, R.C., 2018. Does Availability of Worksite Supports for Physical Activity Differ by Industry and Occupation? *Am J Health Promot* 32 (3), 517–526.
- Goode, A.D., Hadgraft, N.T., Neuhaus, M., Healy, G.N., 2019. Perceptions of an online 'train-the-champion' approach to increase workplace movement. *Health Promot Int* 34 (6), 1179–1190.
- Hadgraft, N.T., Brakenridge, C.L., Dunstan, D.W., Owen, N., Healy, G.N., Lawler, S.P., 2018. Perceptions of the acceptability and feasibility of reducing occupational sitting: review and thematic synthesis. *Int J Behav Nutr Phys Act* 15, 90.
- Hadgraft, N.T., Brakenridge, C.L., LaMontagne, A.D., Fjeldsoe, B.S., Lynch, B.M., Dunstan, D.W., Owen, N., Healy, G.N., Lawler, S.P., 2016a. Feasibility and acceptability of reducing workplace sitting time: a qualitative study with Australian office workers. *BMC Public Health* 16, 933.
- Hadgraft, N.T., Healy, G.N., Owen, N., Winkler, E.A.H., Lynch, B.M., Sethi, P., Eakin, E.G., Moodie, M., LaMontagne, A.D., Wiesner, G., Willenberg, L., Dunstan, D.W., 2016b. Office workers' objectively assessed total and prolonged sitting time: Individual-level correlates and worksite variations. *Prev Med Rep* 4, 184–191.
- Hadgraft, N.T., Winkler, E., Climie, R.E., Grace, M.S., Romero, L., Owen, N., Dunstan, D., Healy, G., Dempsey, P.C., 2020. Effects of sedentary behaviour interventions on biomarkers of cardiometabolic risk in adults: systematic review with meta-analyses. *Br J Sports Med* 55 (3), 144–154.
- Hannon, P.A., Helfrich, C.D., Chan, K.G., Allen, C.L., Hammerback, K., Kohn, M.J., Parrish, A.T., Weiner, B.J., Harris, J.R., 2017. Development and Pilot Test of the Workplace Readiness Questionnaire, a Theory-Based Instrument to Measure Small Workplaces' Readiness to Implement Wellness Programs. *Am J Health Promot* 31 (1), 67–75.
- Harris, J.R., Hannon, P.A., Beresford, S.A.A., Linnan, L.A., McLellan, D.L., 2014. Health promotion in smaller workplaces in the United States. *Annu Rev Public Health* 35 (1), 327–342.
- Healy, G.N., Eakin, E.G., Winkler, E.A.H., Hadgraft, N., Dunstan, D.W., Gilson, N.D., Goode, A.D., 2018. Assessing the feasibility and pre-post impact evaluation of the beta (test) version of the BeUpstanding champion toolkit in reducing workplace sitting: Pilot study. *JMIR Form Res* 2 (2), e17. <https://doi.org/10.2196/formative.9343>.
- Healy, G.N., Goode, A., Schultz, D., Lee, D., Leahy, B., Dunstan, D.W., Gilson, N.D., Eakin, E.G., 2016. The BeUpstanding Program: Scaling up the Stand Up Australia Workplace Intervention for Translation into Practice. *AIMS Public Health* 3, 341–347.
- Healy, G.N., Goode, A.D., Abbott, A., Burzic, J., Clark, B.K., Dunstan, D.W., Eakin, E.G., Frith, M., Gilson, N.D., Gao, L., Gunning, L., Jetann, J., LaMontagne, A.D., Lawler, S.P., Moodie, M., Nguyen, P., Owen, N., Straker, L., Timmins, P., Ulyate, L., Winkler, E.A.H., 2020. Supporting workers to sit less and move more through the web-based BeUpstanding program: Protocol for a single-arm, repeated measures implementation study. *JMIR Res Protoc* 9 (5), e15756. <https://doi.org/10.2196/15756>.
- Kallings, L.V., Blom, V., Ekblom, B., Holmlund, T., Eriksson, J.S., Andersson, G., Wallin, P., Ekblom-Bak, E., 2021. Workplace sitting is associated with self-reported general health and back/neck pain: a cross-sectional analysis in 44,978 employees. *BMC Public Health* 21, 875.
- Katzmarzyk, P.T., Powell, K.E., Jakicic, J.M., Troiano, R.P., Piercy, K., Tennant, B., Advisory, P.A.G., C., 2019. Sedentary Behavior and Health: Update from the 2018 Physical Activity Guidelines Advisory Committee. *Med Sci Sports Exerc* 51, 1227–1241.
- Mackenzie, K., Such, E., Norman, P., Goyder, E., 2019. Sitting less at work: a qualitative study of barriers and enablers in organisations of different size and sector. *BMC Public Health* 19, 884.
- McCoy, K., Stinson, K., Scott, K., Tenney, L., Newman, L.S., 2014. Health promotion in small business: a systematic review of factors influencing adoption and effectiveness of worksite wellness programs. *J Occup Environ Med* 56, 579–587.
- Mullane, S.L., Toledo, M.J.L., Rydell, S.A., Feltes, L.H., Vuong, B., Crespo, N.C., Pereira, M.A., Buman, M.P., 2017. Social ecological correlates of workplace sedentary behavior. *Int J Behav Nutr Phys Act* 14, 117.
- Nigg, C.R., Albright, C., Williams, R., Nichols, C., Renda, G., Stevens, V.J., Vogt, T.M., 2010. Are physical activity and nutrition indicators of the checklist of health promotion environments at worksites (CHEW) associated with employee obesity among hotel workers? *J Occup Environ Med* 52 (Suppl 1), S4–S7.
- Oldenburg, B., Sallis, J.F., Harris, D., Owen, N., 2002. Checklist of Health Promotion Environments at Worksites (CHEW): development and measurement characteristics. *Am J Health Promot* 16 (5), 288–299.
- Onufrak, S.J., Watson, K.B., Kimmons, J., Pan, L., Khan, L.K., Lee-Kwan, S.H., Park, S., 2018. Worksite food and physical activity environments and wellness supports reported by employed adults in the United States, 2013. *Am J Health Promot* 32 (1), 96–105.
- Owen, N., Goode, A., Sugiyama, T., Koohsari, J., Healy, G.N., Fjeldsoe, B., Eakin, E., 2018. Designing for dissemination in chronic disease prevention and management, Dissemination and Implementation Research in Health: Translating Science to Practice, 2nd, Edition ed. Oxford University Press, New York, pp. 107–120.
- Owen, N., Sugiyama, T., Eakin, E.E., Gardiner, P.A., Tremblay, M.S., Sallis, J.F., 2011. Adults' sedentary behavior determinants and interventions. *Am J Prev Med* 41 (2), 189–196.
- Pescud, M., Teal, R., Shilton, T., Slevin, T., Ledger, M., Waterworth, P., Rosenberg, M., 2015. Employers' views on the promotion of workplace health and wellbeing: a qualitative study. *BMC Public Health* 15, 642.
- Sallis, J.F., Owen, N., 2015. Ecological models of health behavior. In: Glanz, K., Rimer, B. K., Viswanath, K. (Eds.), *Health Behavior Theory Research and Practice*. Jossey-Bass, San Francisco, pp. 43–64.
- Saunders, T.J., Atkinson, H.F., Burr, J., MacEwen, B., Skeaff, C.M., Peddie, M.C., 2018. The Acute Metabolic and Vascular Impact of Interrupting Prolonged Sitting: A Systematic Review and Meta-Analysis. *Sports Med* 48 (10), 2347–2366.
- Saunders, T.J., McIsaac, T., Douillette, K., Gaulton, N., Hunter, S., Rhodes, R.E., Prince, S.A., Carson, V., Chaput, J.-P., Chastin, S., Giangregorio, L., Janssen, I., Katzmarzyk, P.T., Kho, M.E., Poitras, V.J., Powell, K.E., Ross, R., Ross-White, A., Tremblay, M.S., Healy, G.N., 2020. Sedentary behaviour and health in adults: an overview of systematic reviews. *Appl Physiol Nutr Metab* 45 (10 (Suppl. 2)), S197–S217.
- Straker, L., Coenen, P., Dunstan, D., Gilson, N., Healy, G., 2016. Sedentary work - evidence on an emergent work health and safety issue - final report. Safe Work Australia, Canberra.
- Such, E., Mutrie, N., 2016. Using organisational cultural theory to understand workplace interventions to reduce sedentary time. *International Journal of Health Promotion and Education* 55 (1), 18–29.
- Taylor, A.W., Pilkington, R., Montgomerie, A., Feist, H., 2016. The role of business size in assessing the uptake of health promoting workplace initiatives in Australia. *BMC Public Health* 16, 353.
- Zerguine, H., Johnston, V., Healy, G.N., Abbott, A., Goode, A.D., 2021. Usage of sit-stand workstations: Benefits and barriers from decision makers' perspective in Australia. *Appl Ergon* 94, 103426. <https://doi.org/10.1016/j.apergo.2021.103426>.