Sample characteristics

Participants were recruited via e-mail and door knocking around university, city, and industrial zoned areas. As such, it is impossible to report an accurate response rate to the invitation. This method may have biased the sample somewhat. Participants completed an initial demographic questionnaire before commencing the study. The demographic questionnaire incorporated gender, age, income, and occupational title. Participants were divided into six occupational categories based on this information (see Table 1). The sample gathered differed from representative New Zealand workforce trends as it contained a high proportion of university-based workers. This differs substantially from the New Zealand-wide distribution where the majority of workers are employed in wholesale and retail trade (22.8%), followed by manufacturing trades (14.7%). Education employees comprise only 8.1% of this workforce

line with the midline of the thigh, with one pedometer on each hip. Participants were provided with instruction sheets, and encouraged not to modify their habitual activity patterns. To minimise reactivity, participants were blinded to the step readings by sealing the pedometers with cable ties or tape. Research has shown little reactivity to sealed pedometer wearing (10) with adults understanding the rationale behind sealing of the pedometers (3). One pedometer was worn for the working hours of the days only (and left at the worksite), while the other was worn for the entirety of the period (apart from sleeping, bathing, and swimming). The Digiwalker SW-700 pedometer model was selected for this study as it showed the greatest reliability and validity in pedometer field tests for objectively reporting step counts (11) and showed no step differences when worn on alternate hips (3).

The Three-Day Physical Activity Recall (3DPAR) (12) was used to determine individuals' activities over the three-day monitoring period. The 3DPAR was issued post pedometer data collection and acted as a retrospective account of activities pursued in the three days measured by the pedometers. Participants filled out the recall immediately and handed it back to the researcher. Completion of the 3DPAR was carried out by recording the dominant activity number and intensity for each 30-minute block from 5:30am until 11:30pm over the three days. The activities were selected from a pre-determined list of 34 activities which incorporated usual actions associated with work and leisure time pursuits for this population. The main purpose of the 3DPAR was to understand the activities habitually engaged in by each participant and occupational category, and to determine correlates of both workplace and non-work physical activity.

Data analysis

Pedometer step counts were collected from the two sealed pedometers to yield work (WPV) and total pedometer values (TPV) for the three-day period. Non-work pedometer values (NWPV) were calculated by subtracting the work pedometer value from the total value for each participant. Achieving 10,000 steps was the criterion measure to be considered þphysically active'. Although the dose response for the efficacy of this criterion at the

population level is limited, there is some evidence that those achieving the 30 minutes per day physical activity recommendation for many adults may also achieve 10,000 steps (13).

The primary use of the 3DPAR was not to measure physical activity, but rather to understand the types of activities participants were involved in over the three days of measurement. Activities identified in the 3DPAR were grouped into tertiles and used for analysis. Tertiles were constructed by evenly distributing the sample into three subset categories (low, medium, and high) for each activity. Work time'was the number of 30-minute blocks spent in work related activities; 'Active transport'was the number of blocks of walking and bicycling for transport; Passive recreation'incorporated sedentary leisure activities such as talking on the telephone, television viewing, computer game use, reading, listening to music, and going to the movies; 'Sport and exercise'captured the number of 30-minute blocks of individual and team-based structured physical activity sessions; and 'Television and computer viewing'was the number of 30-minute blocks of recreational television viewing and computer use occurring over the three days. Watching television and personal computer use were counted in both Passive recreation'and 'Television and computer viewing'categories, as previous literature has shown a relationship between BMI and television viewing (14).

Analysis of variance was used to identify gender differences within step categories and to understand group associations between step counts and occupational categories. Tukey post hoc comparisons were performed on the occupational categories. Odds ratios (adjusted by income, gender, age, and blocks spent in work activities) were calculated using binary logistic regression by analysing each grouped 3DPAR correlate (as above) into tertiles. Comparison

little evidence of differences between genders, although women had higher non-work step values and men had higher work step values. These differences were not significant (refer Table 2). Mean daily pedometer values for both men and women did not exceed the "10,000 steps a day" criterion (13), with reported daily averages for men and women 9,765 and 9,943 steps, respectively. Overall, 78 (43%) study participants (28 men and 50 women) averaged more than 10,000 steps per day.

Table 2: Pedometer daily step means and standard deviations defined by gender for work (WPV), non-work (NWPV), and total pedometer values (TPV).

Step counts	Men (n=60)	Women (n=121)	ANOVA results
	Daily mean *(SD)*	Daily mean *(SD)*	
WPV	5,914 *(3,347)*	5,187 *(2,616)*	$F=2.558_{(1, 179)}$, p=0.111
NWPV	3,851 *(2,322)*	4,755 *(2,700)*	$F=4.927_{(1, 179)}$, p=0.280
TPV	9,765 *(3,965)*	9,943 *(3,855)*	$F=0.084_{(1, 179)}$, P=0.772

Moderate, positive correlations between the 3DPAR and total pedometer readings were evident (Pearson's r=0.42, p<0.01). This correlation was similar to a previous 3DPAR validation study in adults (r=0.28) (15).

Table 3: Analysis of variance and significance for daily step count means for work (WPV), non-work pedometer values (NWPV), total pedometer values (TPV), and percentage contribution of work pedometer values (WPV) to total pedometer values (TPV), as defined by occupational category.

Step counts	Office n=63	Retail n=30	University academic n=40	University allied n=48	Nurse/aid n=11	Blue collar n=9	ANOVA results
	Daily mean *(SD)*	Daily mean *(SD)*	Daily mean *(SD)*	Daily mean *(SD)*	Daily mean *(SD)*	Daily mean *(SD)*	
WPV	5,380 *(2,730)*	8,384 *(3,123)*	4,422 *(1,380)*	4,790 *(2,038)*	5,446 *(2,707)*	10,334 *(5,553)*	$F=11.189_{(5,175)}$, p<0.001
NWPV	3,820 *(2,384)*	5,535 *(2,299)*	5,280 *(2,885)*	4,708 *(2,278)*	3,223 *(1,892)*	4,201 *(4,139)*	$F=2.596_{(5,175)}$, p=0.027
TPV	9,200 *(3,970)*	13,919 *(3,696)*	9,702 *(3,129)*	9,498 *(3,127)*	8,669 *(3,581)*	14,535 *(5,368)*	$F=6.265_{(5, 175)}$, P<0.001

Work, non-work, and total daily counts were analysed by occupational category using analysis of variance, as detailed in Table 3. In work time (WPV) there was the greatest difference in pedometer steps by occupational category. Tukey post hoc comparisons revealed significant ($p<0.05$) WPV and TPV differences for retail and blue collar workers in comparison to other occupational categories. Proportionally blue collar workers accumulated more steps in the workplace (WPV) than any other occupation (71.1%), followed by nurse/aids (62.8%).

No significant post hoc occupational group differences were identified for NWPV. It is likely that because of the post-hoc adjustments for type I error we were unable to detect the small between group differences. Pair-wise one-way analysis of variance of NWPV by occupational category, not adjusting for type I error, did identify significant ($p<0.05$) differences between the two highest NWPV groups (retail and academic) with the two lowest (office and nurse/aids). These differences were much smaller than those observed in WPV and showed occupational differences in different direction to TPV.

Correlates of physical activity

A median split (based on high and low physical activity as the dichotomous variables) of work and non-work step count data was executed to further examine the correlates of physical activity using binary logistic regression analysis. Grouped activities in the 3DPAR were collapsed into tertiles with the lowest tertile group used as a referent. Table 4 shows the odds of being classified in the most active half of the participants regarding work and non-work physical activity for grouped identified in the 3DPAR.

Table 4 : Likelihood of high activity group (based on dichotomous median split) classification of work and non-work pedometer values using odds ratios relationships relative to 30-minute block episodes of 3DPAR grouped correlates.

#30 minute blocks (3DPAR)		WPV	90% CI	NWPV	90% CI
Work time	<47	1.00	Reference	1.00	Reference
	47-55	0.76	0.26, 2.28	1.56	0.53, 4.63
	>55	1.86	0.87, 3.98	0.63	0.30, 1.33
Active trips	<1	1.00	Reference	1.00	Reference
	1-3	1.42	0.76, 2.67	0.82	0.45, 1.51
	>3	2.28**	1.30, 3.99	1.13	0.69, 1.84
Passive recreation	<9	1.00	Reference	1.00	Reference
	9-16	2.37**	1.17, 4.78	0.82	0.40, 1.67
	>16	1.06	0.71, 1.57	1.17	0.79, 1.74
Sport & exercise	<1	1.00	Reference	1.00	Reference
	1-5	1.03	0.52, 2.05	1.76	0.89, 3.47
	>5	0.87	0.62, 1.24	2.03**	1.14, 2.94
TV & computer viewing	<5	1	Reference	1.00	Reference
	5-11	0.82	0.40, 1.65	0.26**	0.12, 0.58
	>11	1.28	0.86, 1.89	0.68	0.46, 1.01

the sample was non-representative and the sample size of some occupational categories presented here is small, the results fulfil the study aims of identifying the different contributions of worksite physical activity to total physical activity for different occupational categories. Expected significant differences are observed in accumulated physical activity in the worksite, particularly between ambulatory oriented occupations and desk-based jobs. Little variation in step counts occurred in non-work physical activity. The results suggest that occupation choice has a key influence on overall physical activity accumulation. Thereby, on a population level, occupational physical activity levels may be more influential for health outcomes than leisure time pursuits.

Compared with other pedometer studies of workers, we found slightly higher step counts with little gender difference. A representative sample of 493 Swiss workers indicated sitting workers accumulated 8,900 $\pm$ 3,350, standing occupations accrued 9,450 $\pm$ 3,700, and moderate effort workers achieved 11,650 $\pm$ 4,050 step counts per day (8). Although not directly comparable, the average daily step counts presented in this study were higher (office workers, 9,200 $\pm$ 3,970; retail, 13,920 $\pm$ 3,696; and blue-collar, 14,535 $\pm$ 5,368). Also, daily worksite steps were recorded for an Australian University sample (n=90) of professional (2,835 $\pm$ 945), white collar (3,617 $\pm$ 1,519), and blue collar occupations (8,757 $\pm$ 2,540) (6). Again, the findings presented here for equivalent occupational categories are higher by approximately 1,000 - 2,000 steps per day in each category. Previous research has also detailed associations between gender, work, and leisure-time activity, with men more active during work time (6) and women more active during recreational time (8). Our data are consistent with this direction.

Compared with representative New Zealand population physical activity data, our objective measurement shows some notable differences. The 10,000 steps criterion classifies more than half of the New Zealanders in this sample as inactive. This differs considerably from the 68% classified as sufficiently active for health benefits in the latest national representative survey (1). However, we believe that the present New Zealand classification survey may be problematic. The sufficiently active classification is calculated using the self-reported criterion

of achieving 150 minutes of moderate activity over a week. When the same data are exposed to the stricter and more usual international criterion of 150 minutes in at least five separate bouts over one week, the percentage classified as sufficiently active drops to 44% (1). This figure more closely resembles the objective findings presented in this study.

Correlates of physical activity

The binary logistic analysis provides an interesting view of correlates of objectively-measured physical activity. Of note, the number of hours spent at work is not related to total physical activity levels. This is contrary to the notion that increasing work hours may be a risk factor for decreased physical activity. Not unexpectedly, this study shows that television and computer use is a risk for being inactive. Previous literature has shown a relationship between BMI, physical activity, and number of hours spent watching television (15). Little work has been done to date to understand how to reduce the amount of television watching in adults. This is certainly an area future interventions might target.

Active transportation is associated with an increased likelihood of high workplace physical activity but not leisure-time activity, and has been shown to be an important factor in accumulating health-related physical activity (16). More research needs to be carried out in this area for two reasons. Firstly, engagement in active transportation is very low; therefore we need more understanding of the barriers for active transportation. Secondly, interventions to increase active transportation have been limited. Successful active transportation interventions may be an effective means of increasing physical activity. It may be especially appealing to employers as wellness initiatives because of low costs. However

activity in the most sedentary employees. Such programs may only benefit those who are already active or at least do not face significant barriers in becoming active (17). Potentially there is also a considerable cost involved for the employer when implementing a sport or exercise program.

Future directions

The relationship between objectively-measured physical activity, especially pedometer steps and health outcomes, needs investigation. This dose-response relationship between pedometer steps and chronic disease risk remains under investigated. One large cross-sectional study exists (18), but more work needs to done, especially to establish the efficacy in risk reduction of the widely cited 10,000 steps per day criterion at the population level.

Also, the differential utility of workplace and leisure-time physical activity in conferring health benefits is unknown. At present, most physical activity guidelines do not discriminate between work and non-work physical activity for health. Two studies show equivocal results for weight status and workplace physical activity. Spanish research found no relationship between workplace physical activity and obesity in a representative sample of 12,044 employees (19). In another study, obesity status was related to both workplace and leisure-time physical activity (20). Based on our findings, we suggest that physical activity accumulation is associated with occupation. Further investigation is required on the contribution of occupational physical activity to overall activity levels, and on additional associated health benefits.

Limitations

This cross-sectional study has several limitations. Firstly, there may have been some reactivity to simply wearing the pedometers. Secondly, although the overall sample size is reasonable, some of the occupational categories do have small numbers that limit the utility of between-category comparisons. Despite our best efforts we had difficulty recruiting members of some occupational categories into the study. Thirdly, the sample is cross-sectional and not representative of New Zealand workers. As such, caution should be used in generalising

the results of this study to all workers. There may have also been some self-selection bias in the participant recruitment where more active people volunteered to participate. However, the cross-sectional design does give us an understanding of factors related to work and leisure-time activities. Lastly, we acknowledge that the 3DPAR 30-minute activity time frame may not have been sensitive enough to detect incidental physical activity. This problem was somewhat overcome using pedometers as the primary measurement tool.

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