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ORIGINAL RESEARCH

Physical Activity Prevalence and Correlates Among New Zealand Older Adults

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The aim of this study was to provide up-to-date information about physical activity (PA) levels in New Zealand older adults to inform the development and targeting of relevant health promotion initiatives. Nationally-representative survey ($N = 1,468$) data were analyzed to assess in people aged ≥ 60 years the prevalence of physical inactivity and meeting PA guidelines, differences between 2012 and 2014, and sociodemographic correlates. One-fifth (20.7%) of respondents were inactive; 46.2% met PA guidelines. Multivariate analyses revealed lower PA in 2014 versus 2012, and identified self-rated health and education as correlates of both PA measures. Age and socioeconomic deprivation were associated with physical inactivity only, while sex and employment were correlates of meeting PA guidelines. Low PA among older adults signals a need to promote PA engagement in that age group. This analysis aids effective intervention design by identifying specific segments of the older adult population that tailored health promotion initiatives should target.

Keywords: physical inactivity, health promotion, audience segmentation

The world's aging population has stimulated the need to investigate 'everyday' activities that can prolong independence and reduce the impact of aging on health systems and people's quality of life (World Health Organization, 2015). One example is physical activity, for which the benefits for older adults' mental, cognitive, and physical health are well-established (reviewed in Bauman, Merom, Bull, Buchner, & Fiatarone Singh, 2016). According to current evidence-based guidelines from the World Health Organization (2016) and US Department of Health and Human Services (2008), older adults (aged 65 years and over) can gain notable health benefits by engaging in as little as 2.5 hr of moderate-intensity physical activity (e.g., brisk walking) each week. Guidelines from several other jurisdictions (including New Zealand and The Netherlands) specify further that the 2.5 hr total should be achieved via bouts of at least 30 min of activity on 5 days each week (Government of the Netherlands, 2016; Ministry of Health, 2013).

Despite the well understood benefits of physical activity for all age groups, especially older adults, and clear guidelines on minimum recommended levels of physical activity, data from population surveys typically show that physical activity levels decline as adults age (e.g., Bauman et al., 2012; Bennie et al., 2016; Ministry of Health, 2015b) and that the majority of older adults do not achieve the minimum recommended level (Ministry of Health, 2015a). Thus, there is a need for health promotion initiatives aimed at increasing physical activity levels in that age group. Research on the predictors and correlates of physical activity in older adults can aid the effective design of such initiatives by helping to identify which segments of the older adult population should be targeted (Prohaska & Peters, 2007). While there are some obvious factors related to low physical activity in older adulthood, such as reduced physical capacity for exercise and functional impairment (e.g., Yorston, Kolt, & Rosenkranz, 2012), research has pointed toward a number of other correlates.

A growing body of international research has linked a wide range of sociodemographic, psychosocial, health, and physical environment factors to physical activity in older adults. The existing literature is somewhat difficult to synthesize due to inclusion of different age range definitions for 'older adults', physical activity measures, and predictor variables (discussed in Sun, Norman, & While, 2013). Nonetheless, some common themes have emerged. For example, multiple studies have indicated that, after adjusting for potential confounders, physical activity levels tend to be lower among older adults with the following characteristics: female (e.g., Azagba & Sharaf, 2014; Chad et al., 2005; Lim & Taylor, 2005), physical limitations or poor self-rated health (e.g., Espinel, Chau, van der Ploeg, & Merom, 2015; Lim & Taylor, 2005; Mooney et al., 2015; Murtagh et al., 2015), low social connectedness or support (e.g., Booth, Owen, Bauman, Clavisi, & Leslie, 2000; Kaplan, Newsom, McFarland, & Lu, 2001; McKee, Kearney, & Kenny, 2015), low self-efficacy (Bauman et al., 2012), more depressive symptoms (e.g., Clark, 1999; Kaplan et al., 2001; McKee et al., 2015; Smith, Gardner, Fisher, & Hamer, 2015), overweight (e.g., Azagba & Sharaf, 2014; Lord et al., 2011; Mesters, Wahl, & Van Keulen, 2014), and do not live in neighborhoods or environments that support physical activity (e.g., Booth et al., 2000; Mesters et al., 2014; Mooney et al., 2015). On the other hand, evidence remains equivocal for relationships between older adults' physical activity levels and their age (within the older adult population), marital status, employment status, education, socioeconomic status, and whether or not they live alone.

New Zealand-based research on older adults' physical activity is limited, with only a handful of studies examining relevant correlates. In one study, which used physical activity data from a 2003 nationally-representative survey with people aged 60 years and over, 18% met the physically inactive criterion (defined as engaging in no bouts of physical activity lasting at least 10 min in the last 7 days), while 51% met the New Zealand physical activity guidelines (Mummery, Kolt, Schofield, & McLean, 2007). After including sex, age, education, income, living location, marital

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status, smoking status, overweight status, and fruit and vegetable consumption in multivariate analyses, the authors found that older age and being overweight were associated with an increase in the odds of being physically inactive and a decrease in the odds of meeting the physical activity guidelines. Not eating at least five servings of fruit and vegetables per day was also associated with an increase in the odds of being physically inactive, while female sex, living in a large city (compared to a rural area or small town), and current smoking were associated with reduced odds of meeting the physical activity guidelines. The study revealed two important findings: that low physical activity was associated with other unhealthy lifestyle behaviors, and that there was only partial overlap in the correlates of being physically inactive versus meeting the guidelines.

In another New Zealand study, the authors examined the differences in health status and health-related behaviors between indigenous (Māori) and nonindigenous (non-Māori) older adults, in light of well-established ethnic health disparities (Teh et al., 2014). Rather than surveying a nationally-representative sample of older adults, the authors purposefully recruited samples of Māori and non-Māori people aged 80 to 90 years. Results indicated that, after adjusting for age, education, occupation, and socioeconomic deprivation, physical activity levels (as evidenced by scores on the Physical Activity Scale for the Elderly) were higher in men than women, but not different between Māori and non-Māori.

While these studies highlight some of the correlates of physical activity in samples of New Zealand older adults, only one study used nationally-representative data, and those data were collected over a decade ago. The aim of the current study was to provide up-to-date evidence on the physical activity habits of older adults in New Zealand using a range of predictor variables and two measures of physical activity. Data were from a nationally-representative survey conducted in 2012 and 2014. The specific aims were to assess among community-dwelling older adults: self-reported physical activity levels; changes in activity between 2012 and 2014; and sociodemographic and psychosocial correlates of (a) being physically inactive and (b) meeting the New Zealand physical activity guidelines. For this study, older adults were defined as those aged 60 years and over to facilitate comparisons with previous nationally-representative research using that age range definition (Mummery et al., 2007) and to enable a sufficient sample size for analysis. By providing up-to-date information on New Zealand older adults' physical activity levels and identifying the correlates of both physical inactivity and meeting the physical activity guidelines, the current study provides information to aid the design and targeting of relevant health promotion initiatives.

Method

Instruments

The current study used data from 2 years (2012 and 2014) of the Health and Lifestyles Survey (HLS), which is a biennial, nationally-representative survey of adults living in New Zealand. The HLS asks people aged 15 years and over about a wide range of health-related topics (for the questionnaires, see Health Promotion Agency, 2013a, 2015a). This study focused on physical activity habits of respondents aged 60 years and over. The method for the HLS has been published previously (Health Promotion Agency, 2013b, 2015b), but a summary is provided below.

The 2012 and 2014 HLS used a stratified, area-based sampling approach. First, all meshblocks (the smallest geographical units used in official population data; Statistics New Zealand, 2015) were separated into two strata: (a) a Pacific-dense stratum, in which at least 20% of the population identified as being of Pacific ethnicity (based on data from the most recent census); and (b) all others. In each survey year, 350 meshblocks, including 56 from the Pacific stratum and 294 from the other stratum, were selected with probability proportional to the number of dwellings. Between 10 and 15 households were then randomly selected from each meshblock, followed by the random selection of one eligible respondent within each household. Nonprivate dwellings (e.g., rest homes and other institutions) were excluded from the sample frame. Each survey year involved independent selection of a new sample.

Trained interviewers visited selected households up to six times to secure an interview, and people who agreed to participate provided informed written consent prior to completing the survey. Survey interviews were conducted in people's homes, via computer-assisted personal interviewing, between May and August (autumn and winter) of each survey year. The response rate was 83% in 2012 and 76% in 2014. The New Zealand Ethics Committee approved the 2012 and 2014 HLS, and the Health Promotion Agency approved access to the data for this report.

Measures

Physical activity. Self-reported physical activity was assessed using the short form of the New Zealand Physical Activity Questionnaire (NZPAQ-SF; Sport and Recreation New Zealand, 2001), which is the New Zealand version of the International Physical Activity Questionnaire-Short Form (IPAQ-SF; IPAQ Research Committee, 2005). Both instruments have been shown to provide valid estimates of energy expenditure (Maddison et al., 2007). In the NZPAQ-SF, respondents report time in the last 7 days (number of days and average time per day) spent engaged in brisk walking, moderate intensity activity, and vigorous activity. Respondents were also asked in a separate question to report on how many of the last 7 days they engaged in at least 30 min moderate (including brisk walking) or 15 min vigorous physical activity. To assist respondents in answering, brief definitions of each intensity and showcards with examples of activities that fit into each category were provided.

The key dependent variables in this study were: (a) whether or not respondents were physically inactive, defined as engaging in a total of less than 30 min per week of physical activity (Brown, Rosenkranz, Kolt, & Berentson-Shaw, 2011; Ministry of Health, 2013); and (b) whether or not respondents met the physical activity guidelines for older adults, defined as engaging in at least 30 min of moderate-equivalent physical activity per day on at least 5 days per week (Ministry of Health, 2013). The duration of moderate-equivalent physical activity was calculated by summing the time engaged in brisk walking, moderate, and vigorous physical activity, with vigorous activity double-counted to account for the higher intensity (IPAQ Research Committee, 2005).

Respondent characteristics. Table 1 describes the 11 respondent characteristics that served as predictor variables and lists the response categories used for analysis. The predictor variables were: age, sex, ethnicity (prioritized in accordance with the Ethnicity Data Protocols for the Health and Disability Sector; Ministry of Health, 2004), socioeconomic deprivation (indicated by the New Zealand Deprivation Index; Atkinson, Salmond, & Crampton, 2014; Salmond, Crampton, & Atkinson, 2007), education, employment status, self-rated health (a good predictor of objectively-measured health outcomes; Idler & Benyamini, 1997; Lima-Costa, Cesar, Chor, & Proietti, 2012), living situation, social

Table 1 Predictor Variable Summary

Variable name	Variable description	Analysis categories
Age	Age at last birthday	Age in years
Sex	Sex	Male Female
Ethnicity	Prioritized ethnicity	Māori Non-Māori
Socioeconomic deprivation	New Zealand Deprivation Index[1] (1 to 10)	Low (1 to 3) Medium (4 to 7) High (8 to 10)
Education	Highest qualification	No qualifications Secondary school Tertiary[2]
Employment status	Whether in paid employment	Employed (full or part-time) Not employed
Self-rated health	In general, would you say that your health is excellent, very good, fair, or poor?	Good (excellent or very good) Poor (fair or poor)
Living situation	People respondent usually lives with	Live with others (any other person) Live alone
Social support	Level of agreement (5-point scale) with the statement, "I can always rely on a friend or family member for support if I need it"	Yes (strongly agree or agree) No (neutral, disagree, or strongly disagree)
Life stress	Level of agreement (5-point scale) with the statement, "The last 12 months have been among the most difficult times of my life"	Yes (strongly agree or agree) No (neutral, disagree, or strongly disagree)
Year	Survey year	2012 2014

[1]The New Zealand Deprivation Index is a composite measure of socioeconomic deprivation, derived for each meshblock from nine variables collected in the New Zealand Census (see Atkinson et al., 2014).
[2]Tertiary refers to any postsecondary school qualification, including diplomas, degrees, and professional trade certificates.

support, recent experience of life stress, and survey year (2012 or 2014). With the exception of ethnicity, these variables were chosen based on previous evidence for relationships with physical activity in older adults. Ethnicity was included in this study as it could be important in the New Zealand context, given the wide health disparities between Māori and non-Māori (Teh et al., 2014).

Analysis

Data were weighted to take into account the probability of selection at the meshblock, household, and person level, along with poststratification weights based on the New Zealand population at the last Census (2006 Census for the 2012 data and 2013 Census for the 2014 data). All analyses were conducted with STATA/IC 14.1 (STATACorp LP, Texas), using the *svy* command to incorporate the weighting and adjust for the survey design. In line with the scoring procedure and data cleaning guidelines for the IPAQ-SF (IPAQ Research Committee, 2005), respondents with missing data for any of the physical activity measures were excluded ($n = 17$). For the other measures, 'don't know' or 'refused' responses were counted as missing.

First, jackknife proportions (Kott, 1998) were calculated to estimate the overall prevalence of each predictor and dependent variable, as well as the proportions of respondents in each characteristic group who were physically inactive or who met the physical activity guidelines. Second, univariate logistic regression analyses were conducted to assess the basic associations between each predictor and dependent variable, without adjusting for potential confounders. As the correlates in the univariate analyses might be explained by other effects (e.g., an association between physical activity and employment status might actually be due to age, since those in the younger age groups are more likely to be employed), multivariate logistic regression analyses that included all predictor variables were then performed to assess associations between those variables and the odds of (a) being physically inactive, and (b) meeting the guidelines, after adjusting for possible confounders. To give the reader an overall picture of the correlates of physical activity, both the crude (from the univariate analyses) and adjusted odds ratios (from the multivariate analyses) are reported. The alpha level was set at $p < .05$, although marginally-significant effects ($p < .07$) are indicated and briefly described.

Results

Respondent Characteristics and Physical Activity Levels

The final sample comprised 1,468 adults aged 60 years and over ($M = 71.0$, $SE = 0.3$, range 60–97). Table 2 summarizes the respondent characteristics and the proportions of respondents in each characteristic category who were physically inactive and who met the physical activity guidelines. Overall, 20.7%, 95% CI [17.8, 23.6], were inactive, 33.0%, 95% CI [29.5, 36.6], did some physical activity but not enough to meet the guidelines, and 46.2%, 95% CI [42.2, 50.3], met the physical activity guidelines.

Factors Associated With Physical Activity

Table 3 presents the specific results of the univariate (crude odds ratio columns) and multivariate (adjusted odds ratio columns) regression analyses.

Table 2 Respondent Characteristics: Proportions in Overall Sample and in Each Physical Activity Group

	Overall % (*n*)	Physically Inactive % [95% CI]	Met Guidelines % [95% CI]
Age group	(1,468)		
60–69 years	50.8 (682)	14.2 [10.7, 17.7]	50.0 [44.6, 55.3]
70–79 years	31.7 (472)	21.2 [16.4, 26.0]	48.6 [41.9, 55.3]
80+ years	17.5 (314)	38.8 [32.0, 45.6]	31.1 [24.4, 37.8]
Sex	(1,468)		
Male	47.2 (641)	19.5 [15.8, 23.2]	52.1 [46.7, 57.5]
Female	52.8 (827)	21.9 [17.9, 25.8]	41.0 [35.8, 46.2]
Ethnicity	(1,468)		
Non-Māori	93.0 (1,272)	20.6 [17.6, 23.6]	46.9 [42.7, 51.2]
Māori	7.0 (196)	22.9 [13.5, 32.2]	37.4 [28.1, 46.7]
Socioeconomic deprivation	(1,445)		
Low (1 to 3)	33.2 (355)	13.4 [8.7, 18.1]	51.7 [43.6, 59.9]
Medium (4 to 7)	43.9 (604)	21.8 [17.1, 26.5]	45.8 [39.6, 52.0]
High (8 to 10)	22.9 (486)	29.0 [23.6, 34.4]	39.3 [32.0, 46.5]
Education	(1,431)		
No qualifications	34.0 (545)	28.4 [23.3, 33.5]	36.2 [30.8, 41.5]
Secondary school	25.4 (365)	20.6 [14.0, 27.1]	45.9 [38.6, 53.1]
Tertiary	40.6 (521)	13.7 [10.0, 17.4]	55.0 [48.5, 61.5]
Employment status	(1,466)		
Employed	71.3 (1,088)	11.5 [6.4, 16.5]	57.8 [50.3, 65.3]
Not employed	28.7 (378)	24.5 [21.1, 27.8]	41.6 [37.2, 46.1]
Self-rated health	(1,460)		
Good	71.9 (1,005)	11.4 [8.9, 13.9]	53.8 [49.0, 58.5]
Poor	28.1 (455)	43.5 [37.2, 49.8]	27.4 [21.7, 33.0]
Living situation	(1,468)		
Live with others	72.9 (624)	18.3 [14.9, 21.7]	48.3 [43.5, 53.0]
Live alone	27.1 (844)	27.3 [23.1, 31.4]	40.8 [35.5, 46.1]
Social support	(1,461)		
Yes	95.0 (1,375)	19.9 [17.0, 22.9]	46.9 [42.8, 51.1]
No	5.0 (86)	31.9 [19.9, 43.9]	34.5 [21.4, 47.5]
Life stress	(1,453)		
Yes	25.3 (387)	30.1 [23.4, 36.7]	44.0 [36.8, 51.1]
No	74.7 (1,066)	17.1 [14.3, 19.9]	47.5 [42.8, 52.1]
Year	(1,468)		
2012	49.9 (725)	17.9 [14.0, 21.7]	52.7 [47.0, 58.4]
2014	50.1 (743)	23.6 [19.3, 27.9]	39.9 [34.1, 45.6]

Physically inactive. As shown in Table 3, the univariate analyses indicated that the factors associated with higher odds of being physically inactive were: age (70 to 79 and 80+, compared to 60 to 69-year-olds), socioeconomic deprivation (high compared to low), education (no formal qualifications or a secondary school qualification [marginal], compared to a tertiary qualification), employment status (not employed compared to employed), self-rated health (poor compared to good), living situation (alone compared to with others), social support (no compared to yes), and life stress (experienced recent life stress compared to did not). There was also a marginally significant effect of survey year (inactivity higher in 2014 compared to 2012), but no effects of sex or ethnicity. After adjusting for possible confounders by including all variables in the same model for the multivariate regression, the factors that remained significantly associated with higher odds of being physically inactive were: age (80+ compared to 60 to 69-year-olds), socioeconomic deprivation, and self-rated health. The relationship with education weakened, leaving only marginally significant higher odds for physical inactivity among those with no formal qualifications compared to those with a tertiary qualification. The relationship with survey year strengthened, with physical inactivity significantly higher in 2014 than 2012. Employment status, living situation, social support, and life stress no longer approached significance.

Met the physical activity guidelines. As shown in Table 3, the univariate analyses indicated that the factors associated with lower odds of meeting the physical activity guidelines were: age (80+ compared to 60 to 69-year-olds), sex (female compared to male), socioeconomic deprivation (high compared to low), education

Table 3 Logistic Regression Results for Relationships With Physical Inactivity and Meeting the Physical Activity Guidelines

	Physically Inactive		Met PA Guidelines	
	OR [95%CI]	AOR [95%CI]	OR [95%CI]	AOR [95%CI]
Age group				
60–69 years	Ref	Ref	Ref	Ref
70–79 years	**1.62 [1.09, 2.40]**	1.34 [0.85, 2.12]	0.95 [0.69, 1.30]	1.26 [0.84, 1.90]
80+ years	**3.82 [2.59, 5.63]**	**2.47 [1.55, 3.94]**	**0.45 [0.32, 0.65]**	0.72 [0.45, 1.15]
Sex				
Male	Ref	Ref	Ref	Ref
Female	1.16 [0.85, 1.58]	1.23 [0.81, 1.86]	**0.64 [0.48, 0.84]**	**0.61 [0.43, 0.85]**
Ethnicity				
Non-Māori	Ref	Ref	Ref	Ref
Māori	1.14 [0.66, 2.00]	1.00 [0.54, 1.86]	0.68 [0.44, 1.03]	0.74 [0.46, 1.21]
Socioeconomic deprivation				
Low	Ref	Ref	Ref	Ref
Med	1.80 [1.09, 2.97]	1.42 [0.79, 2.55]	0.79 [0.52, 1.20]	0.88 [0.56, 1.39]
High	**2.65 [1.61, 4.34]**	**1.89 [1.05, 3.40]**	**0.60 [0.38, 0.95]**	0.75 [0.44, 1.27]
Education				
No qualifications	**2.49 [1.66, 3.75]**	*1.62 [0.98, 2.67]*	**0.46 [0.33, 0.65]**	**0.63 [0.42, 0.94]**
Secondary school	*1.63 [0.99, 2.67]*	1.52 [0.88, 2.65]	**0.69 [0.48, 1.00]**	0.76 [0.51, 1.13]
Tertiary	Ref	Ref	Ref	Ref
Employment status				
Employed	Ref	Ref	Ref	Ref
Not employed	**2.50 [1.45, 4.30]**	1.65 [0.88, 3.08]	**0.52 [0.37, 0.73]**	**0.60 [0.39, 0.91]**
Self-rated health				
Good	Ref	Ref	Ref	Ref
Poor	**5.98 [4.18, 8.54]**	**5.30 [3.51, 8.00]**	**0.32 [0.23, 0.45]**	**0.31 [0.21, 0.44]**
Living situation				
Live with others	Ref	Ref	Ref	Ref
Live alone	**1.67 [1.25, 2.24]**	1.10 [0.75, 1.62]	**0.74 [0.57, 0.96]**	1.05 [0.76, 1.44]
Social support				
Yes	Ref	Ref	Ref	Ref
No	**1.88 [1.06, 3.34]**	1.53 [0.74, 3.18]	0.59 [0.33, 1.07]	0.61 [0.34, 1.10]
Life stress				
Yes	**2.08 [1.46, 2.97]**	1.28 [0.85, 1.92]	0.87 [0.62, 1.21]	1.31 [0.90, 1.88]
No	Ref	Ref	Ref	Ref
Year				
2012	Ref	Ref	Ref	Ref
2014	*1.42 [0.99, 2.03]*	**1.73 [1.17, 2.57]**	**0.60 [0.43, 0.83]**	**0.52 [0.36, 0.76]**

Note. OR = crude odds ratio (univariate); AOR = adjusted odds ratio (multivariate); Ref = reference group; **bolding** indicates significance ($p < .05$); *italics* indicate marginal significance ($p < .07$).

(no qualifications or a secondary school qualification, compared to tertiary), employment status (not employed compared employed), self-rated health (poor compared to good), living situation (alone compared to with others), and survey year (2014 compared to 2012). There were no effects of ethnicity, social support, or life stress. After adjusting for possible confounders by including all variables in the same multivariate regression model, the factors that remained significantly associated with lower odds of meeting the physical activity guidelines were sex, education (except the difference between those with a secondary compared to tertiary qualification was no longer significant), employment status, self-rated health, and survey year. Age, socioeconomic deprivation, and living situation no longer approached significance.

Discussion

The purpose of this study was to extend and update the limited existing literature on the prevalence and correlates of physical activity in New Zealand older adults, with the aim of informing the design and targeting of relevant health promotion initiatives. First, the findings signal an urgent need for the promotion of physical activity in older adults in New Zealand, given that one-fifth

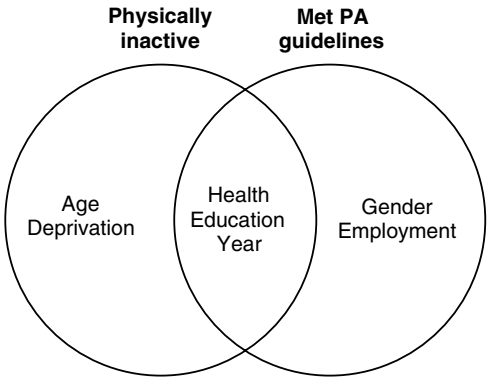

Figure 1 — Correlates of being physically inactive and meeting physical activity guidelines (multivariate analysis results). *Notes.* PA = physical activity; Deprivation = socioeconomic deprivation; Health = self-rated health; Year = survey year. Education was only marginally significantly related to physical inactivity ($p < .06$). Ethnicity, living situation, social support, and life stress were also included in the multivariate analyses but were not statistically significant correlates.

(20.7%) were physically inactive, less than half (46.2%) achieved the minimum recommended level of physical activity, and between 2012 and 2014 the prevalence of physical inactivity increased by 5.7% while the proportion of older adults who met the guidelines decreased by 12.8%. Second, findings from the multivariate regression analyses point to the specific target populations of relevant health promotion activities by linking: (a) self-rated health and education to both physical inactivity and meeting physical activity guidelines (although the education and physical inactivity relationship was only marginal), (b) age and socioeconomic deprivation to physical inactivity only, and (c) sex and employment status to meeting physical activity guidelines only (see Figure 1 for a summary of these relationships). There were no statistically significant relationships with ethnicity, living situation, social support, or life stress for either outcome variable in the multivariate analyses.

The current findings indicate that already low levels of physical activity among New Zealand older adults reduced further between 2012 and 2014. The current data do not provide insight into the reasons for this reduction, but it is generally consistent with long-term international trends of declining physical activity, which have been attributed to factors such as more sedentary occupations, technological development, and reductions in active transport (e.g., Ng & Popkin, 2012). In the current study, the markedly lower population-level physical activity in 2014 compared to 2012 is more surprising given the relatively short 2-year timeframe, but some of the same factors may nevertheless underpin the effects. Importantly, the differences cannot be attributed to changes in the methodological approach across survey years, given that the same data collection company and procedures were used in both years. Regardless of the specific reasons behind the decline, it is clear that public health initiatives targeting older adults are needed, as increasingly sedentary lifestyles among this growing demographic group will impose even greater adverse health and social impacts.

The significant correlates that emerged in the current study are generally consistent with previous New Zealand and international research. Setting aside the methodological and definitional differences, synthesis of the current findings with the two previous New Zealand studies indicates that older age and female sex are relatively consistent correlates of low physical activity in older adults, and that there does not appear to be a strong relationship between physical activity levels and ethnicity (Mummery et al., 2007; Teh et al., 2014). The current findings are also consistent with international evidence that older adult physical activity levels are lower among females (e.g., Azagba & Sharaf, 2014; Chad et al., 2005; Lim & Taylor, 2005) and those with poor physical health (e.g., Espinel et al., 2015; Lim & Taylor, 2005; Mooney et al., 2015; Murtagh et al., 2015). Further, they align with evidence linking low physical activity in older adulthood with more advanced age (e.g., Booth et al., 2000; Kaplan et al., 2001), lower socioeconomic status (e.g., Smith et al., 2015), lower education levels (Chad et al., 2005), and not being in paid employment (e.g., McKee et al., 2015), although it should be noted that these factors emerge somewhat inconsistently across the older adult physical activity literature.

In line with other studies, the strongest and most consistent predictor of both physical activity measures was self-rated health, indicating that those older adults who perceive their health to be poor might be an important target for physical activity initiatives. While it could be argued that such targeting would be misguided due to reduced capacity for exercise in those individuals, there is evidence that older adults with chronic health conditions are less physically active than their objectively-measured exercise capacity allows (Ashe, Eng, Miller, & Soon, 2007). Qualitative research has also shown that some older adults believe that age-related ailments are inevitable and that it is not worthwhile engaging in physical activity as it is unlikely to confer any benefits for them (Franco et al., 2015). Thus, rather than automatically excluding older adults with below-optimal health from physical activity promotions and initiatives, programs should seek to promote activities that are achievable for people with poorer health, ensure systems are in place to enable those people to engage safely in physical activity, and address misconceptions that poor perceived health necessarily prevents physical activity.

The relationships between physical activity and the socioeconomic variables (deprivation and education) are also important to note, as they signal the need to ensure that physical activity initiatives are relevant to, and easily accessible for, older adults living in more disadvantaged areas and/or with lower education levels. While research has not yet fully explained the relationship between socioeconomic status and physical activity, there are several possible accounts. For example, research with general adult samples has shown that individual, social, and environmental factors such as lower self-efficacy, social support for physical activity, neighborhood walkability, and social participation mediate the relationship between low socioeconomic status and low physical activity (Cerin & Leslie, 2008; Lindström, Hanson, & Ostergren, 2001). Similarly, other studies have indicated that people with low socioeconomic status might have less opportunity to engage in safe physical activity due to reduced access to affordable physical activity facilities in more deprived neighborhoods (Panter, Jones, & Hillsdon, 2008) and greater concerns about neighborhood safety (Gray, Murphy, Gallagher, & Simpson, 2016). Regardless of the specific reasons for the effects seen in the current study, attention to the barriers specific to different socioeconomic groups is needed to ensure physical activity initiatives do not inadvertently widen health disparities.

Another important finding from the current study, which is consistent with previous New Zealand research (Mummery et al., 2007), is that the correlates of physical inactivity and meeting the guidelines were not necessarily the same. Given the importance of audience and behavior segmentation to the design of effective social marketing campaigns and health promotion efforts

(Donovan & Henley, 2010), this finding suggests that while all physical activity initiatives for older adults should focus on those with poorer self-rated health and a lower education level (as those correlates were consistent across outcomes), programs designed to reduce the proportion of physically inactive older adults should also target, and ensure their program accommodates, those of older age and who live in more socioeconomically deprived areas. In contrast, programs designed to increase the proportion of older adults who meet physical activity guidelines should also target and accommodate females and those not in paid employment.

Limitations and Recommendations

The main limitations of the current analysis stem from its cross-sectional design. First, causation cannot be inferred: the correlates identified here are not necessarily determinants of physical activity. For example, although sex, education, employment status, and self-rated health were all associated with likelihood of meeting the physical activity guidelines, a recent review of international longitudinal and intervention studies conducted in healthy older adults found somewhat equivocal evidence that those factors were *determinants* of physical activity (Koeneman, Verheijden, Chinapaw, & Hopman-Rock, 2011). Second, the current study does not elucidate what is needed to motivate changes in New Zealand older adults' physical activity habits. Future research should seek to fill this knowledge gap by asking the identified 'at risk' subgroups of older adults what they perceive the barriers and motivators of exercise to be (for examples, see Crombie et al., 2004; Franco et al., 2015) and what types of physical activity they would be willing to engage in (e.g., Chong et al., 2014). While a handful of international reviews have sought to identify effective components of physical activity promotions and interventions for older adults, none have identified highly successful approaches (Bauman et al., 2016; King, 2001). It may be that interventions focusing directly on exercise engagement do not appeal to less active older adults, but that other activities done mostly for social and wellbeing reasons could be more attractive and lead to incidental increases in physical activity. For example, research shows that volunteering in the community can increase older adults' habitual physical activity (Parisi et al., 2015; Tan, Xue, Li, Carlson, & Fried, 2006). Future research should investigate the potential of these alternative intervention approaches to increase physical activity in older adults.

Another important limitation is the reliance on self-reported measures of physical activity, which could be subject to recall and social desirability biases. Previous research has validated NZPAQ-SF estimates against objectively-measured physical activity, but there is evidence that the IPAQ-SF (from which the NZPAQ-SF is derived) can produce overestimates (reviewed in Lee, Macfarlane, Lam, & Stewart, 2011). The use of self-reported physical activity data is a practical and cost-effective method for nationally-representative studies that cover large, geographically dispersed samples, but the potential for inaccurate reporting does raise two issues for interpretation of the current results. First, it is possible that physical activity levels were exaggerated, leading to underestimation of the prevalence of physical inactivity and overestimation of the proportion who met the guidelines. Second, reporting accuracy might differ across the older adult population (e.g., accuracy might decrease with advancing age due to reduced recall capability), thereby introducing potential error into our assessment of the correlates of physical inactivity and meeting the guidelines (with the exception of survey year as any bias should have been similar across the years).

Other limitations include the focus on mostly individual-level factors, reliance on self-report predictors, and the inclusion of only community-dwelling older adults. The focus on mostly individual-level factors precludes discussion of other important correlates at the social, environmental, and policy levels (Bauman et al., 2012). As mentioned above in relation to the physical activity measures, the use of self-reported predictors means that recall and social desirability biases could have affected the results. However, the impact of such biases in relation to the sociodemographic information might have been mitigated somewhat by the use of largely straightforward questions. The inclusion of only community-dwelling older adults means that the data presented here may not represent the physical activity levels of people living in nonprivate residences such as rest homes and other care facilities. This design feature could have led to an overestimation of physical activity levels among older adults in New Zealand because only people with some level of functional independence would have answered the questionnaire. Nevertheless, for the development of general-population health promotion initiatives, the sample reported on here provides useful information.

Conclusion

The main strength of the current analysis is the use of recent nationally-representative data to identify factors that could help tailor the design and targeting of health promotion initiatives such as social marketing campaigns and community-based interventions aimed at increasing physical activity in New Zealand older adults. The results highlight the urgent need to promote physical activity engagement in that age group and support attention to the barriers to physical activity for different socioeconomic groups. Further, they indicate that the specific target populations of physical activity initiatives for older adults depend on whether the goal is to move people from being inactive to doing at least some exercise, or to increase physical activity levels to the point where they meet the minimum guidelines. While all initiatives should focus on and accommodate those with poorer self-rated health and a lower education level, programs designed specifically to reduce physical inactivity should additionally target those of older age and who live in more socioeconomically deprived areas, whereas programs designed to increase the proportion who meet physical activity guidelines should additionally target females and those not in paid employment. With these targets identified, public health practitioners and policy makers can develop more effective physical activity promotion campaigns and interventions by seeking to address the barriers to physical activity specific to those subgroups most at risk.

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