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Title:

Adherence to national exercise guidelines by patients attending emergency departments: A multisite survey.

Running Title:

Exercise guideline adherence in Australia

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Abstract

Objective: The proportion of adults in Australia meeting or exceeding the national guidelines for physical activity has remained relatively static over the last 10 years. The research objective was to measure self-reported physical activity and sedentary behaviour among emergency department patients in accordance with Australia's current physical activity and sedentary behaviour guidelines, revised in 2014.

Methods: A convenience sample of participants was recruited from three emergency departments in Melbourne between February and May 2016. Eligible participants were administered the International Physical Activity Questionnaire-Short Form plus researcher derived questions. Participants were assessed as either meeting the physical activity guidelines or not, using pre-defined criteria.

Results: The proportion of 18-64 year olds meeting all of the physical activity guidelines was 19.0% (95%, CI 15.2-22.8). A majority of participants (63.1%, 95% CI 58.5-67.7) met the aerobic component of the guidelines although only 28.9% (95%, CI 24.5-33.3) of participants reported undertaking strength building exercises two or more times per week. Adults in the oldest age group were found to be less likely to engage in muscle strengthening exercises (23.3%, n=30) than those in the youngest age group (40.0%, n=60, p=0.005). Average daily sitting time (minutes) did not differ between males (median=300) and females (median=360, p=0.118).

Conclusions: Overall adherence with physical activity guidelines is low among adults attending the ED. All adults need to be encouraged to undertake muscle strengthening activities; especially adults in older age groups.

Keywords: Australia, exercise, guidelines and recommendations, public health

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Introduction

The benefits of regular physical activity (PA) have been well established¹. Despite this, the number of sedentary Australian adults has been gradually increasing over many years^{2,3}.

Physical inactivity is one of the major contributors to the total number of healthy years of life lost due to disability or early death in Australia⁴ but, as a modifiable risk factor, much improvement can potentially be made.

Physical inactivity might also be associated with increased expenditure in Australia's health care system and a rise in ED presentations⁵⁻⁷. Modelling shows that an increase in the number of people undertaking regular PA and adhering to the national guidelines would save the Australian healthcare system an estimated \$1.5 billion annually⁸. An Australian study that explored the link between chronic illnesses in the community and hospital admissions via the ED⁹ found that hypertension and ischaemic heart disease were significant predictors for admission. The risks associated with these are reduced with regular PA¹⁰ which highlights the importance of exercise and the corresponding decreased burden on the health system. Further evidence that regular PA is associated with fewer ED admissions is shown in another Australian study where an exercise program instituted after a hospital admission reduced ED readmissions by 25%, compared to the control group¹¹.

The most recent statistics from the 2011-12 Australian Health Survey on Physical Activity show that only 43% of Australian adults were classed as 'sufficiently active' and 60% were doing less than the recommended 30 minutes of exercise each day³. In 2014, the Australian Government released revised physical activity guidelines for adults, aged 18-64 years. These

comprise both a physical activity and sedentary behaviour component and are detailed in Box 1. The purpose of the current study was to assess self-reported PA and sedentary behaviour among ED patients in accordance with Australia's current physical activity and sedentary behaviour guidelines. To date, to the best of the authors' knowledge, this is the first study to measure adherence to the updated guidelines.

Method

This was a multi-site, cross sectional survey conducted in three hospital EDs in Melbourne, Australia. Ethical approval reference number: HREC/15/SVHM/83.

Participants

Participants were recruited between February 8th and May 25th 2016 from St Vincent's Hospital, Royal Melbourne Hospital and the Austin Hospital, all of which are tertiary centres located in Melbourne. Recruitment was conducted predominately between 08:00-18:00 Monday-Friday with occasional evening and weekend collection periods. Participants were recruited from all areas of the ED and were considered eligible if they were aged between 18-64 years and had been seen by a doctor at one of the participating EDs during the study period, while an investigator was recruiting. Australian PA guidelines differ for those aged under 18 and over 64 years. Exclusion criteria included being unable to participate due to medical reasons, severe pain, cognitive or communication difficulties, leaving the ED before being seen by a doctor or if the patient was a prisoner.

Questionnaire

To assess adherence to guidelines we used the International Physical Activity Questionnaire

- Short Form (IPAQ-SF) plus five researcher derived questions. The IPAQ-SF is a frequently used and validated recall questionnaire¹². It comprises 8 questions that measure the

amount of vigorous and moderate-intensity PA, as well as time spent walking and sitting, over the previous 7 days. Examples of both moderate and vigorous exercise are provided.

Since some patients attending the ED will have been unwell in the 7 days prior to

attendance, a preliminary question will be asked: "Prior to your attendance at the ED today has your health in the last 7 days been typical of your usual experience of health" (Yes/No).

For patients that respond "Yes" the standard short form IPAQ-SF was administered. For

those that respond "No" patients were asked to respond to the survey questions for "a

typical week". Five researcher derived questions were added to determine adherence to the remaining physical activity guidelines (see Appendix 1).

Procedure

Participants were initially screened by their triage notes and presenting complaint. Any

patients with obvious cognitive or communicative difficulties were deemed ineligible, as

were those incarcerated. Those deemed eligible were then approached, informed about the

study and invited to participate. Consent was implied if the participant began answering

questions. Those who declined participation, or were highly dependent on medical care or

in severe pain were also excluded but were able to be approached if their condition

improved during their ED stay. Participants were verbally administered the questionnaire and answers were recorded by the student researcher.

Sample size estimation

Sample size estimates were based on the outcome of adherence for adults. Previous Australian data reported that 60% of Australian adults did less than 30 minutes of moderate intensity physical activity per day³; which is less than that recommended in current guidelines. Approximately 70% of Australian adults were sedentary or had low levels of physical activity. Activity levels were anticipated to be even lower among adult ED patients; it was anticipated that approximately 10-20% of the ED population may meet the guidelines. A minimum sample size of 243 adults¹³ was calculated to be required in order to accurately estimate the prevalence of adherence to a precision of 5%, based on an estimated prevalence of up to 20%.

Data processing and statistical analyses

The IPAQ-SF measures PA using individual items that assess walking, moderate and vigorous intensity activities with frequency measured in days per week and duration measured in hours and minutes per day. Participants were assessed as either meeting the physical activity guidelines (see Box 1) or not using a pre-defined criteria. A participant was considered active on most days of the week if they had undertaken four or more days of moderate or vigorous intensity activity or a combination of both. Duration of activity was converted to minutes and multiplied by number of days per week to calculate total number

of minutes of moderate/vigorous-intensity activity per week (vigorous activity minutes were multiplied by 2). Participants adhered to this guideline if they had 150 minutes or more of total weekly activity. The muscle strengthening guideline was achieved with two or more days of strength building activities per week. Participants had to answer "yes", to the two researcher derived questions about sitting (Appendix 1) to be adherent to the two sedentary behaviour guidelines.

Metabolic equivalent of task (MET) minutes are a well-known unit for describing energy expended during a specific activity¹⁴. They compare the amount of energy expended to baseline energy expenditure at rest, e.g., a 4 MET task is four times as strenuous as sitting at rest, which is equivalent to 1 MET. A person who performs a 4 MET task for 20 minutes has completed 80 MET-minutes. The answers to the IPAQ-SF questions were then processed according to the IPAQ guidelines for data processing¹⁵, total MET-minutes/week were calculated for each participant and a level of physical activity (low, moderate or high) was attributed.

Data were analysed using Statistical Package for the Social Sciences (version 19; IBM). Descriptive statistics (percentages, mean and standard deviations) and frequencies (median and interquartile range) were calculated for all variables, where appropriate. Age groups were based on equal percentiles in each group. Chi-square test was used to compare the differences between males and females in guideline adherence and muscle strengthening, and to compare the differences between older and younger participants and their IPAQ category. Mann-Whitney U tests were used to compare the difference between males and females according to total sitting time and weekly MET-minutes. Spearman's Rank-Order

Correlation was used to assess the relationship between weekly MET-minutes and age, and weekly sitting time and age. In all instances the significance level was set at $p < 0.05$, and two-tailed tests were used.

Results

415 ED patients aged between 18-64 years were recruited to the study of whom 234 (56.4%) were male and 181 (43.6%) were female. Further demographic information is available in Table 1. The participation rate of the study was 33.0% (Figure 1). This was calculated as the proportion of patients participating out of those recorded as being present on the computerised ED patient report, while a study investigator was present. Patients were often indicated as being present in the ED but were away from their bed for a variety of reasons (see Figure 1).

Adherence to Guidelines

The proportion of respondents classified as adhering to all of Australia's physical activity and sedentary behaviour guidelines was 19.0% (79/415). There was no statistically significant difference between males and females who met the guidelines (21.4% vs 16.0%, $p=0.211$). Table 2 shows the proportion of males and females that adhered to each of the 5 guidelines by age while Table 3 shows total number of guidelines adhered to, from 0-5. The number of guidelines adhered to did not appear different for males (median=3.0) and females (median=3.0, $p=0.399$). Meeting the guidelines was not associated with age.

Moderate-vigorous activity and walking

Males self-reported a higher number of days of vigorous activity in the previous week than females (median=2.0 vs median=1.0, $p=0.019$). There was however, no difference in minutes spent doing moderate activity or walking, between the sexes.

Muscle strengthening

While the proportion of adults adhering to the twice per week muscle strengthening guideline was low (28.9%, 120/415), there was no difference between males and females who did any amount of muscle strengthening (males 36.8%, females 31.5%, $p=0.311$). Adults in the oldest age group (47-64 years) were found to be less likely to lift weights than those in the youngest age group (23.3% vs 40.0%, $p=0.005$).

Sitting Time

There was no difference between the daily sitting time (minutes) of males and females (median=300 vs median=360, $p=0.118$). Spearman's Rank-Order Correlation also found no association between age and minutes spent sitting/day ($r=0.006$, $n=414$, $p=0.900$).

Weekly MET-minutes

Males were found to have higher weekly MET-minute totals than females (median=3345 vs median=2772, $p=0.012$). There was a weak to moderate negative correlation between age

and weekly MET-minutes, with older age associated with fewer MET-minutes/week ($r = -0.210$, $n=415$, $p<0.001$).

IPAQ Category

There were 408 participants eligible to be classified under the IPAQ scoring protocol. Of these 53.4% (218/408) were classed as having high levels of physical activity, 33.3% (136/408) as moderate and 13.2% (54/408) as having low levels of physical activity. There was no statistically significant difference between males and females being classified as high, medium or low but a chi-square test showed that adults aged 47-64 were more likely to be classed as having a low or moderate level of PA (75/127, 59.1%) compared to the youngest group of adults, aged 18-30 (50/150, 33.3%, $\chi^2_{(4)}$, $n=408$, $p < 0.001$).

Discussion

To our knowledge this is the first study to examine the prevalence of ED patients meeting the revised Australian physical activity guidelines. The most important finding is that although 63% of participants are accumulating enough minutes of moderate-vigorous PA per week, only 19% meet all the guidelines. This is largely because adherence to the muscle strengthening guideline was low, at 28.9%. However, this is still higher than a recent Australian study, which found that the prevalence of sufficient muscle strengthening activity (defined as two or more sessions per week) in adults in the previous 2 weeks was only 10.4%¹⁶.

Another important finding was that only 20.2% of adults in the oldest age group (47-64 years) met the muscle strengthening guideline. The reasons for this finding are unclear but it does follow the general pattern of less physical activity as age increases. This is significant as loss of muscle strength is associated with an increased risk of falls as age increases^{17, 18} and this has a negative impact, both on quality of life and economically. One Australian study estimated the total cost per patient fall at approximately \$4500 with hospital inpatient costs accounting for 80% of that figure¹⁹. This is where the most improvement can be made in levels of PA as age-related muscle loss is a concern as people age.

The ED has been suggested as a practical setting in which to modify patient behaviour. However, emergency physicians have been found to ask about physical activity routinely only 12% of the time, as compared to cigarette smoking (91%) and alcohol (54%)²⁰. It has been shown that patient satisfaction in the ED is improved when health promotion interventions about exercise and weight control are carried out²¹, and a further study showed that over half of patients attending the ED are interested in obtaining information about exercise programs²². Brief interventions in primary care settings have been shown to increase levels of PA^{23, 24} so there is an opportunity to make physical activity a routine part of a patient's medical history and to both increase levels of PA as well as patient satisfaction in the ED.

Caution must be exercised when generalising the results of this study to a broader population. ED patients tend to be sicker than the public generally and therefore may exercise less than a healthy population, however the results are still consistent with similar studies in other settings and countries²⁵⁻²⁷.

Strengths and Limitations

The strengths of this study include the use of a validated tool (the IPAQ-SF) and that participants were recruited from multiple sites, which allowed a more representative sample. Although the participation rate was low at 33.0%, the age and gender of those who participated in the study were similar to the overall ED population.

The use of a self-reporting tool to measure PA may have limited this study. Physical activity is often over-reported and this could be due to a number of reasons: a reporting bias due to social desirability, the possibility of misclassifying lower intensity PA as more vigorous or the cognitive challenge of accurately recalling the amount of PA undertaken. Participants would often report their perceived total duration of physical activity in a single session, but not consider the fragmentation of individual episodes²⁸, e.g. a person with a physically demanding job would report their full shift as vigorous activity but not consider breaks or other time spent standing still or doing less intense work. In cases such as this perceived PA is greater than objectively measured activity. In this study, occupational data were not routinely collected, so the degree of overestimation of PA in these cases is difficult to quantify.

Although the results vary substantially to studies that use objective measures (accelerometer, etc) to measure PA, the similar sets of PA guidelines that are used in many countries around the world were created using self-reported physical activity in cohort

studies²⁹. Therefore, even though tools such as the IPAQ-SF are known to overestimate PA levels, perhaps it is still an appropriate way to measure adherence to guidelines.

Conclusion

The current study showed that there is still much **potential** improvement to be made when it comes to physical activity in patients attending EDs. Although 63.1% of adults achieved the minimum amount of moderate-vigorous physical activity, only 28.9% did sufficient muscle strengthening exercises and this dropped further to 20.2% in the oldest age group. Further research is required in other settings to generalise these findings.

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Appendix 1. Researcher derived questions.

- Do you do any activities that involve lifting weights, or specific gym based weight training or other activities that may build muscle either as part of exercise or your day-to-day lifestyle?
- If yes, on how many days a week do you do these strength building exercises?
- Do you try to minimise time spent sitting for lengthy periods (e.g. several hours)
- Do you break up long periods of sitting by getting up and walking around?
- If yes, after approximately how long would you get up?

Box 1. Australia's physical activity & sedentary behaviour guidelines for adults (18-64 years).

Physical Activity

1. Be active on most, preferably all, days every week.
2. Accumulate 150-300 minutes of moderate intensity physical activity or 75-150 minutes of vigorous intensity physical activity or an equivalent combination of both moderate and vigorous activities, each week.
3. Do muscle strengthening activities on at least 2 days each week.

Sedentary Behaviour

4. Minimise the amount of time spent in prolonged sitting.
5. Break up long periods of sitting as often as possible.

Table 1: Demographics of ED population during study period compared to study participants.

	ED Population	Study Participants
Male %	52.9	56.4
Female %	47.1	43.6
Male Mean Age $\pm$ Std dev	39.0 $\pm$ 13.2	38.5 $\pm$ 13.0
Female Mean Age $\pm$ Std dev	38.1 $\pm$ 13.5	38.6 $\pm$ 13.8
Age 18 - 30 %	35.8	36.1
Age 31 - 46 %	36.3	32.8
Age 47 - 64 %	27.9	31.1
Triage Category 1 %	0.8	0.2
Triage Category 2 %	7.9	6.7
Triage Category 3 %	31.9	37.8
Triage Category 4 %	50.5	49.2
Triage Category 5 %	8.9	6.0

Table 2: Proportion of males and females adhering to each guideline - see Box 1 for guidelines.

Sex (n)	Age Group Years (n)	Guideline 1 % (n)	Guideline 2 % (n)	Guideline 3 % (n)	Guideline 4 % (n)	Guideline 5 % (n)	All 5 Guidelines % (n)
Male (234)	18 - 30 (80)	67.5 (54)	75.0 (60)	42.5 (34)	75.0 (60)	85.0 (68)	23.8 (19)
	31 - 46 (83)	55.4 (46)	62.7 (52)	32.5 (27)	84.3 (70)	91.6 (76)	22.9 (19)
	47 - 64 (71)	46.5 (33)	60.6 (43)	22.5 (16)	77.5 (55)	88.7 (63)	16.9 (12)
	Total	56.8	66.2	32.9	79.1	88.5	21.4
	Male	(133)	(155)	(77)	(185)	(207)	(50)
Female (181)	18 - 30 (70)	50.0 (35)	64.3 (45)	27.1 (19)	88.6 (62)	91.4 (64)	18.6 (13)
	31 - 46 (53)	50.9 (27)	66.0 (35)	26.4 (14)	92.5 (49)	94.3 (50)	17.0 (9)
	47 - 64 (58)	41.4 (24)	46.6 (27)	17.2 (10)	91.4 (53)	94.8 (55)	12.1 (7)
	Total	47.5	59.1	23.8	90.6	93.4	16.0
	Female	(86)	(107)	(43)	(164)	(169)	(29)
Total		52.8 (219)	63.1 (262)	28.9 (120)	84.1 (349)	90.6 (376)	19.0 (79)

Table 3: Total number of guidelines adhered to by males and females.

Sex (n)	Age Group Years (n)	0 Guidelines % (n)	1 Guideline % (n)	2 Guidelines % (n)	3 Guidelines % (n)	4 Guidelines % (n)	5 Guidelines % (n)
Male (234)	18 - 30 (80)	2.5 (2)	3.8 (3)	18.8 (15)	20.0 (16)	31.3 (25)	23.8 (19)
	31 - 46 (83)	3.6 (3)	4.8 (4)	26.5 (22)	14.5 (12)	27.7 (23)	22.9 (19)
	47 - 64 (71)	1.4 (1)	11.3 (8)	29.6 (21)	22.5 (16)	18.3 (13)	16.9 (12)
	Total Male	2.6 (6)	6.4 (15)	24.8 (58)	18.8 (44)	26.1 (61)	21.4 (50)
Female (181)	18 - 30 (70)	2.9 (2)	4.3 (3)	30.0 (21)	12.9 (9)	31.4 (22)	18.6 (13)
	31 - 46 (53)	1.9 (1)	1.9 (1)	28.3 (15)	17.0 (9)	34.0 (18)	17.0 (9)
	47 - 64 (58)	1.7 (1)	5.2 (3)	41.4 (24)	15.5 (9)	24.1 (14)	12.1 (7)
	Total Female	2.2 (4)	3.9 (7)	33.1 (60)	14.9 (27)	29.8 (54)	16.0 (29)
Total		2.4 (10)	5.3 (22)	28.4 (118)	17.1 (71)	27.7 (115)	19.0 (79)

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