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Evaluation of the incidental and planned activity questionnaire for older people

K Delbaere,[1,2,3] K Hauer,[4,5] S R Lord[1]

[1] Falls and Balance Research Group, Prince of Wales Medical Research Institute, University of New South Wales, Randwick, Sydney, Australia; [2] Department of Experimental-Clinical and Health Psychology, Faculty of Psychology and Educational Sciences, Ghent University, Ghent, Belgium; [3] Department of Rehabilitation Sciences and Physiotherapy, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium; [4] Bethanien-Hospital, Geriatric Centre at the University of Heidelberg, Heidelberg, Germany; [5] Robert-Bosch-Hospital, Department of Geriatric Rehabilitation, Stuttgart, Germany

Correspondence to: Professor S R Lord, Falls and Balance Research Group, Prince of Wales Medical Research Institute, University of New South Wales, Randwick, Sydney, Australia; s.lord@powmri.edu.au

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ABSTRACT

Objective: There is a need for a measure of physical activity that assesses low, basic and high-intensity activities suitable for use in ageing research including falls prevention trials. This study performed a formal validation of the incidental and planned activity questionnaire (IPAQ) by investigating its overall structure and measurement properties.

Design: Cross-sectional survey.

Setting: Community sample.

Participants: 500 older people (mean age 77.4 years, SD 6.08).

Main Outcome Measures: The IPAQ was administered as part of a longer assessment in two different postal self-completion formats; one for estimating physical activity during the past week (IPAQ-W) and one for estimating average weekly physical activity over the past 3 months (IPAQ-WA). Test–retest reliability was assessed by the re-administration of the instruments one week later in a subsample of 80 respondents.

Results: Both IPAQ versions had good measurement properties, but overall the IPAQ-WA performed better than the IPAQ-W. Rasch analyses indicated the IPAQ-WA had an excellent overall fit. Analysis of the internal structure supported the unidimensionality of the scale with an acceptable internal consistency. The content representation of the items revealed three categories (low, moderate and high levels of physical activity), with a good contribution of items by threshold. The IPAQ-WA had excellent test–retest reliability, intraclass correlation coefficient 0.87) and was able to discriminate differences in physical activity levels between groups differentiated by sex, age and fall risk factors.

Conclusions: The IPAQ has excellent psychometric properties and assesses the level of physical activity relating to both basic and more demanding activities. Further research is required to confirm sensitivity to change.

Regular physical activity has powerful positive effects on both psychological and physical well-being. An active lifestyle does not only prolong independence and a good quality of life,[1] but has also been shown to decrease the risk of falls and fractures significantly.[2] On the other hand, higher levels of physical activity can expose older people to more dangerous situations, which could lead to falls.[3] It is therefore important to document activity levels in clinical trials in both frailer and vigorous older people.[4]

A recent systematic review identified seven physical activity measures that have been used in clinical trials.[4 5–11] Of these, three questionnaires were self-report instruments,[7 8 11] five included lighter activities as well as more vigorous activities,[7–9 11] but only one was suitable for frailer populations.[9] The systematic review concluded that none of the measures were satisfactory for use in large-scale clinical trials.[4] In addition, the Prevention of Falls Network Europe (ProFaNE) came to a consensus that all available instruments are too long and too complex for routine administration.[1]

In order to address these issues, we evaluated a questionnaire that has been developed over many years of longitudinal studies. The current study comprised a formal validation of the final version of the Incidental and Planned Activity Questionnaire (IPAQ) in order to assess its relevance to the lifestyle of older people and its overall structure and measurement properties. We evaluated two different versions of the IPAQ, ie, a weekly version and an average weekly version over a period of 3 months. We hypothesised that the weekly version would be a more accurate reflection of the actual physical activities a person undertook that week, whereas the average weekly version would would be more reliable, because it allows for week-to-week variability.

METHODS

Participants

A total of 500 people aged over 70 years was recruited from a cohort of 1042 community-dwelling men and women living in eastern Sydney aged 70 years and older (study in progress, please see acknowledgements). Exclusion criteria were neurological, cardiovascular or major musculoskeletal impairments (determined at a baseline physiological assessment) that precluded participants to walk for 20 m without a walking aid. Approval for the study was obtained from the University of New South Wales Human Studies Ethics Committee.

Measures

The physical activity questionnaire

The IPAQ is a self-report questionnaire that covers the frequency and duration of several levels of planned and incidental physical activity in older people (Appendix A). This paper addresses two different formats; one for estimating physical activity during the past week (IPAQ-W, N = 270) and one for estimating average weekly physical activity over the past 3 months (IPAQ-WA, N = 230). The questions for the IPAQ have been used in several previous studies of falls risk factors and prevention strategies in older people over a period of 20 years, and similar algorithms to those described in Appendix B have been used to estimate levels of planned sports and activity and the amount of walking and total physical activity

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per week.[12–16] There are two levels of physical activity, ie, planned activities that focus on planned exercise and planned walks (Q1–Q6) and incidental activities that focus on more casual day-to-day activities (Q7–Q10) (table 1). The questions have high face validity but have not undergone a formal validation till now. The IPAQ was administered by postal survey as part of a longer assessment. Test–retest reliability was assessed by the re-administration of the instrument one week later in a subsample of 80 respondents.

Other measures

Levels of disability were assessed using the 12-item World Health Organization disability assessment schedule (WHODAS II, total score range 0–36).[17] Overall balance was assessed with the timed up-and-go test, which measures the time it takes a person to rise from a standard chair with armrests, walk a distance of 3 m, turn, walk back to the chair and sit down as quickly as possible.[18]

Analyses

The IPAQ structure was evaluated by using item response theory, ie, Rasch modelling (Winsteps; John M Linacre). The main motivation to employ the Rasch model is its ability to create assessments for the population for which they are intended. Rasch modelling concentrates on the probability that an individual with a certain physical activity level will answer each item in a given way to match this physical activity level.[19] To take into account different scoring possibilities for each question, the partial credit model was used to analyse the data.[20] First, fit statistics were used to examine how well the data from people and items met the model assumptions. The internal structure of the IPAQ was examined by factor analysis using an unrotated principal component analysis. Internal consistency (Cronbach's alpha) of the IPAQ was evaluated by calculating the reproducibility of the responses of each person on the IPAQ.[20] Second, the item-respondent map was inspected to evaluate content representation of each item to ensure items and respondents were appropriately targeted.[20] Third, the functioning of the response format was evaluated with category function analysis, which evaluates whether average measures for the rating scale categories advance along a logical continuum.[20 21]

Further reliability and validity analyses were performed using SPSS.15. Test–retest reliability was assessed by the intraclass correlation coefficient (ICC; two-way mixed) between scores obtained in the initial survey and at one week follow-up. The criteria suggested by Landis and Koch were used for interpretation; low (ICC <0.40), moderate (ICC 0.40–0.59), substantial (ICC 0.60–0.79) and outstanding (ICC ⩾0.80).[22] Non-parametric Spearman ρ correlations were calculated to compare the different versions of the IPAQ. Concurrent validity was assessed by using independent t tests to examine between-group differences in total scores according to age (cutoff 75 years), gender, WHODAS (cutoff 20) and timed up-and-go (cutoff 10 s).[23]

RESULTS

Participants

The mean age of participants was 77.4 years (SD 6.08) and 279 (55.8%) were women. A small majority of the participants (N = 269, 53.8%) completed high school, and 208 (41.6%)

Table 1 Means, standard deviations and ICC on planned, incidental and total activity for IPAQ-WA and IPAQ-W and Spearman correlations between both

	On average per week over past 3 months (N = 230)			During past week (N = 270)			IPAQ-WA versus IPAQ-W
	Mean	SD	ICC (N = 30)	Mean	SD	ICC (N = 50)	Spearman correlations (N = 50)
Planned activity							
1. Activity 1: How many times per week did you do planned activity?	1.21	1.48	0.954	0.94	1.36	0.719	0.732
2. Activity 1: How long did you spend doing planned activity? (total minutes per week)	78.26	92.19	0.957	22.66	40.22	0.704	0.757
3. Activity 2: How many times per week did you do planned activity?	0.53	1.16	0.979	0.39	1.00	0.497	0.784
4. Activity 2: How long did you spend doing planned activity? (total minutes per week)	37.56	69.48	0.996	11.30	34.76	0.998	0.998
5. How often have you been on walks specifically for exercise? (ie, walking in the park, in the streets, cross-country walking, walking the dog, etc)	2.57	1.05	0.972	2.88	2.63	0.895	0.885
6. In these walks for activity, how long did you walk for? (total minutes per week)	154.40	63.26	0.881	41.30	49.18	0.266	0.744
Total (hours per week)	11.92	10.74	0.970	6.56	8.02	0.931	0.701
Incidental activity							
7. How often have you been on other walks? (ie, walk to general practitioner, pharmacy or store)	2.86	1.27	0.822	4.09	2.46	0.815	0.680
8. In these other walks, how long did you walk for? (total minutes per week)	146.51	65.60	0.561	47.47	56.05	0.754	0.757
9. In addition to the walking you mentioned above, how much time did you spend each day out of your house doing other physical activity such as house maintenance and gardening? (excluding housework and activities inside the house) (total minutes per week)	159.82	86.20	0.708	354.09	502.76	0.445	0.748
10. How many hours did you spend on your feet each day indoors at home doing tasks like housework, self-care or care for another person? (total hours per week)	4.69	1.22	0.856	16.44	11.56	0.612	0.672
Total (hours per week)	14.32	5.55	0.864	26.00	18.85	0.812	0.666
Total (hours planned and incidental per week)	25.70	12.57	0.844	32.38	20.77	0.773	0.726

ICC, intraclass correlation coefficient; IPAQ-W, incidental and planned activity questionnaire, for estimating activity over the past week; IPAQ-WA, incidental and planned activity questionnaire, for estimating activity over the past 3 months.

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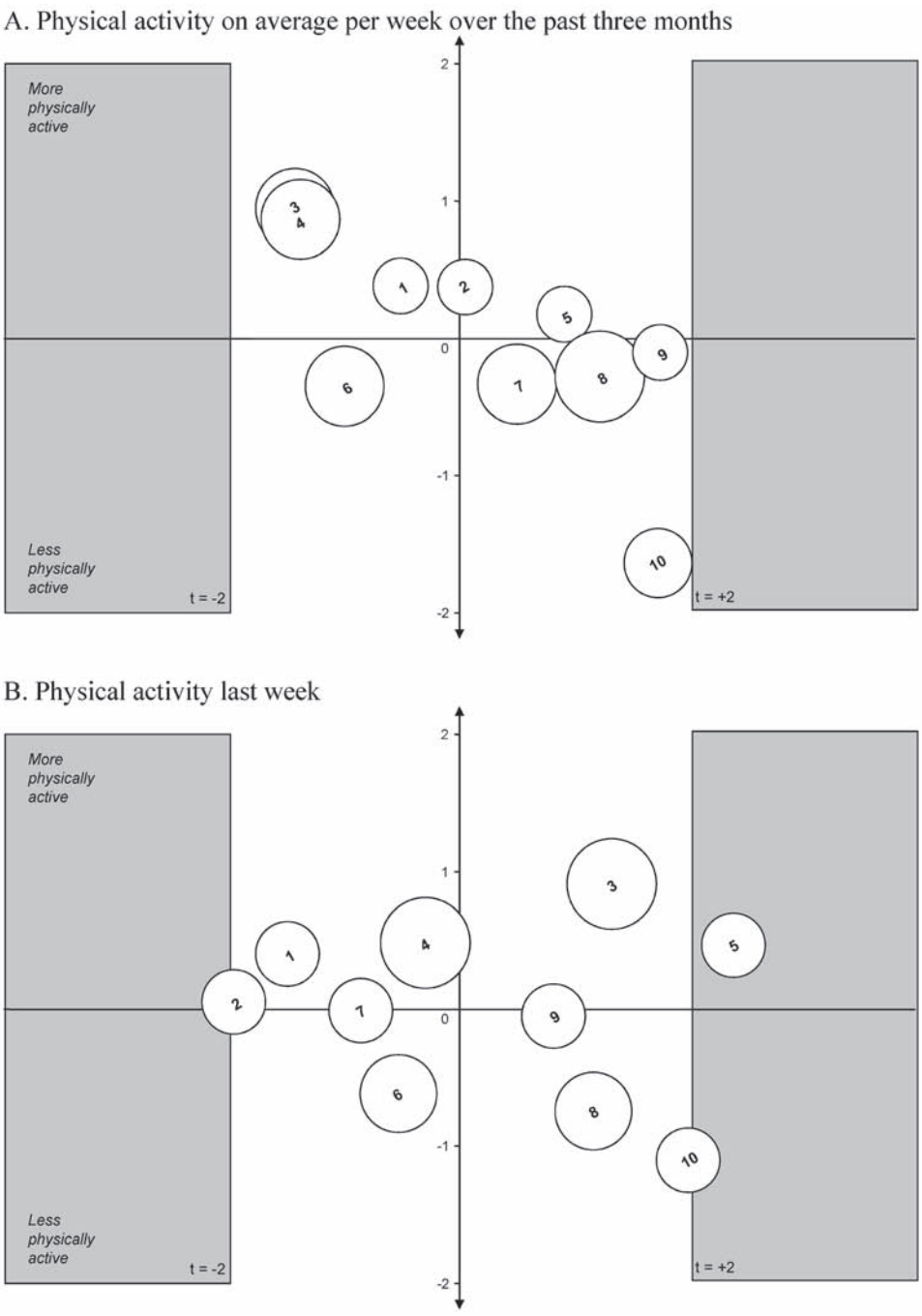

Figure 1 Bubble charts for the incidental and planned activity questionnaire for estimating activity over the past 3 months (IPAQ-WA) (A) and for estimating activity over the past week (IPAQ-W) (B) as a graphic representation of measures and fit values. Bubbles are named after the item as presented in table 1 and sized by their standard errors. Items assessing "high physical activity levels" are at the top of the physical activity continuum (positive logits) and items assessing "lower physical activity levels" are at the bottom (negative logits).

reported that they had been in managerial or professional occupations. The mean disability score on the WHODAS was 18.0 (SD 5.9). With respect to falls information, 28.3% (N = 150) of the participants reported one or more falls in the previous year. There were no significant differences between the participants who completed the IPAQ-WA (N = 230) and participants who completed the IPAQ-W (N = 270). Means and standard deviations for each item, and subscale and total scale scores are presented in table 1.

Questionnaire structure

Overall fit

A bubble chart was inspected to ascertain the fit of each version of the IPAQ. In the IPAQ-WA, the item fit indices revealed that all items were good measures of physical activity for our population (weighted mean square values between 0.60 and 1.40).[20] However, the overall fit was improved after removing the third and fourth option from the planned activities (with two options still remaining) (weighted t statistic values between −2.00 and 2.00)[20] (fig 1). In the IPAQ-W, the weighted t statistic was not acceptable for the item asking about the frequency of planned walks (t Outfit Zstd 2.41; fig 1).

Internal structure

The principal component analysis revealed the greatest eigenvalue was less than 3 for both scales (2.4 and 2.5), supporting the unidimensionality of the scale, with 54.8% (48.1%) of the variance in the data explained by the model (54.6% and 47.5%

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Table 2 Means and standard deviations on planned and incidental activity on IPAQ-WA and IPAQ-W for subgroups based on demographic characteristics and falls risk factors

	IPAQ-WA			IPAQ-W		
		Planned	Incidental		Planned	Incidental
	N	Mean (SD)	Mean (SD)	N	Mean (SD)	Mean (SD)
Sex						
Male	106	11.54 (10.46)	13.49 (5.31)	115	6.97 (8.38)	24.84 (22.09)
Female	124	12.42 (11.06)	15.16 (5.69)*	155	6.15 (7.63)	26.84 (16.12)*
Age, years						
⩽75	48	15.42 (12.81)	13.76 (4.61)	73	7.12 (8.15)	25.93 (18.28)
>75	182	11.16 (10.06)*	14.49 (5.76)	197	4.91 (7.23)*	26.14 (20.47)
Health (WHODAS)						
⩽20	147	13.27 (10.85)	14.56 (5.48)	182	7.82 (8.97)	28.18 (20.24)
>20	83	10.04 (10.40)*	14.12 (5.73)	87	3.98 (4.56)*	22.21 (15.55)*
Timed up-and-go						
⩽10 s	150	12.74 (11.01)	14.27 (5.20)	175	7.74 (8.35)	27.82 (18.44)
>10 s	80	9.92 (10.23)*	14.22 (6.38)	95	4.73 (7.20)*	23.71 (20.21)

*$p<0.05$. IPAQ-W, incidental and planned activity questionnaire, for estimating activity over the past week; IPAQ-WA, incidental and planned activity questionnaire, for estimating activity over the past 3 months; WHODAS, World Health Organization disability assessment schedule.

empirical).[20] Internal consistency of the IPAQ as a whole was low but acceptable with Cronbach's alpha of 0.60 and 0.61. Previous studies indicated that the Cronbach's alpha should be above 0.70 without exceeding 0.90.[24]

Content representation of the items

The item-respondent maps of both scales showed that all items and respondents are located between −3 and +3 logits. The respondents' distribution shows those who have "high physical activity levels" at the top of the physical activity continuum (positive logits) and those who have "lower physical activity levels" at the bottom (negative logits). The respondents' distribution is followed by the location of the items on the physical activity continuum and the location of the items by thresholds. Given that the partial credit model fitted the data, it is most appropriate to compare the respondents' distribution with the items by thresholds. Approximately a quarter of the items by thresholds assessed low physical activity, half moderate physical activity and a quarter high physical activity. Such a good distribution of items by thresholds indicates that the scale has a good content representation of the construct, and it will allow scoring of both higher functioning older people and older people who are mainly sedentary. Further examination of the item locations revealed that items addressing moderate to high levels of physical activity were mainly focussed on planned activity. Walking activities, either planned or incidental walks, mainly addressed low levels of physical activity. Planned activity (low thresholds) and walking activities (high thresholds) overlapped around 0. For purposes of using this scale in more sedentary populations, we explored adding one more question to the scale, ie, daily activities while sitting. As expected, the item fitted at the bottom end of the physical activity continuum, but within our population the weighted t statistic was not acceptable (IPAQ-WA: weighted mean square −1.42, t outfit Zstd 3.24, SE 0.06; IPAQ-W: weighted mean square −1.09, t outfit Zstd 2.71, SE 0.06). This means people answer this question in an unpredictable way. The item fitted slightly better in the IPAQ-W, which would indicate that the item is slightly more reliable when the person is not trying to recall over a long time period. Overall fit and unidimensionality stayed similar. We also measured the level of exertion for each activity on a three-point scale (low, moderate and high) to allow us to estimate energy expenditure. However, it increased the complexity without improving the overall scale.

Response format

Category function analyses showed that the thresholds for the rating scale categories mostly advanced on a logical continuum. Some categories were chosen by a small percentage of our population, resulting in minimal advancement. However, these categories would probably be useful in intervention studies to allow for an acceptable sensitivity to change.

Reliability and validity

Reproducibility

Test–retest reliability was assessed by the ICC between scores obtained in the initial survey and at one week follow-up (table 1). The ICC comparing the total score of the IPAQ-WA was 0.84, with only two items below 0.80. The ICC comparing the total score of the IPAQ-W was 0.77, with seven items below 0.80. Overall, the test–retest reliability of the IPAQ-WA was better than the IPAQ-W.

Concurrent validity

Separate planned and incidental activity scores on the IPAQ-WA and IPAQ-W in different subgroups are shown in table 2, which demonstrates that the questionnaire was sensitive to group differences relating to demographic characteristics and fall risk factors. Women do more incidental activity related to housework. Planned physical activity scores were significantly lower in older participants, in people with worse health and a worse score on the timed up-and-go test. The two versions of the IPAQ were compared using non-parametric Spearman ρ correlations. Overall, the correlation was substantial to outstanding, ranging from 0.67 to 0.89 (table 1), with a similar concurrent validity.

DISCUSSION

The current study evaluated two different versions of the IPAQ, ie, a weekly version and an average weekly version over a period of 3 months. Both versions have excellent measurement properties and concurrent validity. The IPAQ-WA was more reliable,

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probably because it allows for understandable week-to-week variability; but the IPAQ-W showed a better concurrent validity. Both versions could be used for different purposes. When investigating short-term effects, the IPAQ-W would be more appropriate but for longer term longitudinal studies the IPAQ-WA would result in a more reliable measure. The two main strengths of the IPAQ are that it assesses low, moderate and high-level physical activities specifically designed for older people, and that it is a short, self-report questionnaire that makes it feasible for clinical trials.

Internal consistency was lower than for that reported for the Physical Activity Scale for the Elderly (PASE)[11] but was still acceptable, mainly indicating that each of the questions addresses a different aspect of physical activity. During the development of the questionnaire, the item content was closely evaluated by both experts and older people[6 8] over a series of longitudinal studies,[12–16] to ensure the items included different levels of activity. This development process is indicative of excellent face validity. We included both moderate to high-intensity physical activities as well as low-intensity activities,[4] without increasing the length and complexity of the scale.[1] Even though the feasibility of the scale was not specifically assessed, a total of less than 2% of missing data points indicated that the IPAQ is not too long or too complex to be included as part of a longer questionnaire. In addition, when examining the internal structure of the IPAQ (construct validity), it was confirmed that all items form a unidimensional scale.

Our findings confirm that both versions of the IPAQ have at least as good reliability and validity as any existing measure of physical activity. Furthermore, being a short and easy questionnaire with questions and response categories for both frail and active older people ensures the scale is appropriate for use in clinical intervention trials. The stability of the IPAQ-WA is better than any of the previous measures.[5–11 25] The relationships of the IPAQ with some related variables such as disability, age and balance indicates an excellent concurrent validity, similar to previous questionnaires.[6 11 26] A study investigating the direct validity of the IPAQ using an accelerometer is underway (K Hauer *et al*, study in progress). The next step in the validation of the IPAQ will be to demonstrate that it has an acceptable sensitivity to change. This study suggests that the IPAQ is a good candidate for this role, as its psychometric properties are excellent, and it is able to assess levels of physical activity over a wide range of activities and response categories.

The validation of a test is an ongoing process that should last for as long as the test is used. Considering the rigorous assessment of measurement properties, we feel that this tool may prove to be useful in future studies, especially clinical trials. However, in order to permit direct comparison between studies and populations in different countries and settings, the psychometric properties of the IPAQ need be assessed across a range of languages and cultural settings.[1 4] Finally, we believe the scale could also be trialled in people with cognitive impairment. Considering the wide range of activities and response categories, the IPAQ should be useful as long as there is a reliable informant.

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APPENDIX A INCIDENTAL AND PLANNED ACTIVITY QUESTIONNAIRE (VERSION WA)*

Q1–Q4. In the past 3 months, how much time did you spend in the following activities on average per week?

Never ( ) Please go to question 5

Activity type	No of times/week	No of minutes per session				
		<30	30–45	45+	1–2 h	2–4 h
Activity class	_____	( )	( )	( )	( )	( )
Home activity (eg, stationary bicycle, stretching)	_____	( )	( )	( )	( )	( )
Other activity 1 (please specify)	_____	( )	( )	( )	( )	( )
Other activity 2 (please specify)	_____	( )	( )	( )	( )	( )
Other activity 3 (please specify)	_____	( )	( )	( )	( )	( )

Examples of other activities: bowls, golf, tennis, swimming, dancing, jogging, bicycling, etc.

Q5. During the past 3 months, how often have you been on walks specifically for exercise on average per week? (ie, walking in the park, in the streets, cross-country walking, walking the dog etc).

- ► Every day ( )
- ► 3–6 times/week ( )
- ► Twice/week ( )
- ► Once/week ( )
- ► Less than once/week ( )
- ► Never ( ) Please go to question 7

Q6. In these walks for activity, how long did you walk for?

- ► Less than 15 minutes/day ( )
- ► 15 minutes to less than 30 minutes/day ( )
- ► 30 mins to less than 1 h/day ( )
- ► 1 h to less than 2 h/day ( )
- ► 2 h to less than 4 h/day ( )
- ► 4 or more hours/day ( )

Q7. During the past 3 months, how often have you been on other walks (ie, walk to general practitioner, pharmacy or store) on average per week?

- ► Every day ( )
- ► 3–6 times/week ( )
- ► Twice/week ( )
- ► Once/week ( )
- ► Less than once/week ( )
- ► Never ( ) Please go to question 9

Q8. In these other walks, how long did you walk for?

- ► Less than 15 minutes/day ( )
- ► 15 minutes to less than 30 minutes/day ( )
- ► 30 minutes to less than 1 h/day ( )
- ► 1 h to less than 2 h/day ( )
- ► 2 h to less than 4 h/day ( )
- ► 4 or more hours/day ( )

Q9. In the past 3 months, in addition to the walking you mentioned above, how much time did you spend each day out of your house doing other physical activity such as house maintenance and gardening? (excluding housework and activities inside the house).

- ► Never (ie, no garden) ( )
- ► Less than 15 minutes/day ( )
- ► 15 minutes to less than 30 minutes/day ( )
- ► 30 minutes to less than 60 minutes/day ( )
- ► 1 h to less than 2 h/day ( )
- ► 2 h to less than 4 h/day ( )
- ► 4 or more hours/day ( )

Q10. In the past 3 months, how many hours did you spend on your feet each day indoors at home doing tasks like housework, self-care or care for another person?

- ► Never (ie, living in hostel, assisted living) ( )
- ► Less than 15 minutes/day ( )
- ► 15 minutes to less than 30 minutes/day ( )
- ► 30 minutes to less than 60 minutes/day ( )
- ► 1 h to less than 2 h/day ( )
- ► 2 h to less than 4 h/day ( )
- ► 4 or more hours/day ( )

APPENDIX B SUMMARY CALCULATIONS

Question	Response	Code
Q1, Q3	Never	0
	Once/week	1
	Twice/week	2
	Three times/week	3
	Four times/week	4
	Five times/week	5
	Six times/week	6
	Seven times/week	7
Q2, Q4	Never	0
	Less than 30 minutes	0.250
	30–45 minutes	0.625
	More than 45 minutes	1.000
	1–2 h	1.500
	2–4 h	3.000
Q5, Q7	Eery day	7.000
	3–6 times/week	4.500
	Twice/week	2.000
	Once/week	1.000
	Less than once/week	0.000
	Never	0
Q6, Q8, Q9, Q10	Never	0
	Less than 15 minutes	0.125
	15–30 minutes	0.375
	30 minutes to 1 h	0.750
	1–2 h	1.500
	2–4 h	3.000
	4 h+	5.000

Total time spent is summed across all components and expressed as hours per week. The score is derived from multiplying the frequency score and duration score to create a total duration for the week score.

Total activity = (Q1*Q2) + (Q3*Q4) + (Q5*Q6) + (Q7*Q8) + (Q9*7) + (Q10*7)

Several activity subscores can be derived by summing only those questions that are relevant to your research question.

Examples:

Incidental activity = (Q7*Q8) + (Q9*7) + (Q10*7)

Walking activity = (Q5*Q6) + (Q7*Q8)

Planned activity = (Q1*Q2) + (Q3*Q4) + (Q5*Q6)

Planned walking activities = (Q5*Q6)

Planned sport activities = (Q1*Q2) + (Q3*Q4)

* Version W is available at www.powmri.edu.au/fbrg

Delbaere K, Hauer K, Lord SR. *Br J Sports Med* (2010). doi:10.1136/bjsm.2009.060350

Downloaded from http://bjsm.bmj.com/ on May 11, 2016 - Published by group.bmj.com

Evaluation of the incidental and planned activity questionnaire for older people

K Delbaere, K Hauer and S R Lord

Br J Sports Med published online May 26, 2009

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