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DEVELOPMENT OF RETROSPECTIVE LIFE-LONG PHYSICAL ACTIVITY QUESTIONNAIRE: FIRST STAGE

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Abstract. *With the increase in life expectancy and declining birth rates, the issue of improving the quality of life in people over 60 has become one of the priorities in health care (WHO, 2015). So far a limited number of studies have addressed the long-term relationship between aerobic exercise and cognitive processes (e.g. see systematic review by Young, Angevaren, Rusted, & Tabet, 2015). The aim of the study was to conduct the first stage in developing an instrument to retrospectively investigate life-time physical activity. Methods: a literature search in databases EBSCO, Pubmed, SCOPUS and Science Direct using keywords "retrospective physical activity", "long-term physical activity" was conducted. After literature review, individual interviews with participants aged from 65 to 76 were held to create a retrospective physical activity questionnaire. Interviews were conducted according to literature-based protocol, which was updated after each participant. Results: eight main categories of life-time activity: "work", "education", "sleep", "transportation", "self-care", "leisure time", "household activities" and "sports". Conclusions: means of measuring life-long physical activity retrospectively would be highly beneficial in physical activity research; however, further work in developing and validating retrospective physical activity questionnaire is needed.*

Keywords: *physical activity, retrospective research, life-time.*

Introduction

The World Health Organization (WHO) predicts that in 2050 the number of people aged 60 will double in comparison with current situation, therefore, one of the current WHO priorities is reducing age-related psychosocial and economic burdens (WHO, 2015). Physical activities with aerobic load elements are one of the preventive measures to mitigate the effects of aging (Prakash, Voss, Erickson, & Kramer, 2014). While a large amount of studies regarding the relationship between physical activity and different psychological concept (e.g.

cognitive functioning, personality traits) have been conducted, so far research on long-term or even life-long physical activity studies has been sparse. This is mainly due to lack of retrospective measures.

Characteristics of physical activity

In Latvia only 12.2% of the population (10.4% women and 14.1% men) follow the recommendations from WHO Guidelines for physical activity to devote 30 minutes of physical activity daily (Centre of Disease Prevention and Control, 2012).

Physical activity can be categorized in a variety of ways. However, the simplest categorization identifies the physical activity that occurs while sleeping, at work, and at leisure (Caspersen, Powell, & Christenson, 1985). It is important to register not only exercising, but also leisure activities (Paffenbarger et al., 1993), as well as to consider seasonal changes (Shephard, 2003). Domains of physical activity are defined in Table 1.

Table 1 Physical activity categories

The aim of physical activity	
Exercise physical activity	Domains referring to exercise or other activities that are more vigorous than usual everyday activities (Williams et al., 2012).
Household physical activity	Includes all domains referring to activities within the home and/or garden (Williams et al., 2012).
Leisure-time physical activity	Type of physical activity undertaken during an individual's discretionary time that results in substantial energy expenditure (i.e., a physically active lifestyle). Physical activity may be undertaken for a variety of reasons, but one of the main objectives involves improving morbidity or health outcomes (Motl et al., 2017).
Physical activity intensity - Intensity refers to the rate at which the activity is being performed or the magnitude of the effort required to perform an activity or exercise (WHO, 2010).	
Moderate-intensity physical activity	On an absolute scale, moderate intensity refers to activity that is performed at 3.0–5.9 times the intensity of rest. On a scale relative to an individual's personal capacity, moderate-intensity physical activity is usually a 5 or 6 on a scale of 0–10 (WHO, 2010).
Vigorous-intensity physical activity	On an absolute scale, vigorous intensity refers to activity that is performed at 6.0 or more times the intensity of rest for adults and typically 7.0 or more times for children and youth. On a scale relative to an individual's personal capacity, vigorous intensity physical activity is usually a 7 or 8 on a scale of 0–10 (WHO, 2010).
Physical activity frequency - The number of times an exercise or activity is performed. Frequency is generally expressed in sessions, episodes, or bouts per week (WHO, 2010) .	

Retrospective measures of life-time physical activity

A vast number of questionnaires have been developed for short- or long-term physical activity assessment. Such well-known questionnaires as International Physical Activity Questionnaire (IPAQ, Booth, 2000) or Physical Activity Scale for the Elderly (PASE, Washburn, Smith, Jette, & Janney, 1993) are focused on high or moderate levels of physical activity in past weeks or a year, not considering other aspects of activity, such as sedentary activities or household activities. There have been several attempts in creating life-time physical activity questionnaires. Probably one of the first attempts was conducted by Kriska and colleagues (1990), who developed a structural-interview-based questionnaire Historical leisure activity questionnaire (HLAQ), that included questions on physical activities (sports, occupational), occupational activity, moderate and vigorous leisure time activities and watching TV. Activities were divided into different periods of life since the age of 12 and considered number of years, months per year and hours per week. Administering the questionnaire could take from five to 60 minutes depending from the activity of the participant. Validity study of this questionnaire confirmed that it can be used in their target sample. More than a decade later, modified version of HLAQ was used in a validation study and it was found that the questionnaire can also be self-administrated. This study as well indicated reproducibility of HLAQ, using test-retest as validation method (Chasan-Taber et al., 2002).

In late 1990's "The lifetime total physical activity questionnaire" (LTPAQ) was developed by Friedenreich and colleagues (1998). This questionnaire was based on HLAQ; however, also included household activities and asked to evaluate the level of each of the activities (sedentary occupational/light/moderate/vigorous). Also, unlike HLAQ, specific memory aids were used to help the participants to improve their recall. Validation of the questionnaire was ensured using test-retest reliability, which was high; however, it should be taken into consideration that this questionnaire was validated in a small sample consisting of middle-aged women, thus the results cannot be generalised.

Another retrospective physical activity questionnaire was developed based on self-administered questionnaire from German National Health Survey. "Short retrospective questionnaire for physical activity" (SRQPA) was developed by Schmidt and colleagues in Germany in all female sample (Schmidt, Slinger, Chang-Claude, Wahrendorf, & Steindorf, 2006). While initial questionnaire considered only past 3 months, Schmidt's modifications allowed to investigate physical activities since the age 30 using cognitive interviewing methods. Unlike previously described questionnaires, SRQPA asked questions regarding sleep and sitting time and vigorous/moderate/light activities in 24h time-frame. All data were set in Excel template so that the 24 hours were never exceeded. In this study,

criterion validity was used to ensure the validity of the questionnaire, and the addition of 24-hour frame-work was found to be beneficial in increasing the validity of SRQPA.

Since 1990's and the development of HLAQ, questionnaires for assessing life-long physical activity has been slowly improving, changing focus from purposeful physical activities to wider array of daily routine activities that might include moderate or vigorous physical activity load. However, despite the development, there still are some areas missing and higher precision needed, thus in this study, we aimed to conduct the first stage of developing an instrument for retrospective measures of life-time physical activity, based on literature review.

Methods

Literature search and review was conducted to identify possibilities for measuring physical activity retrospectively ($N = 27$). Out of the 27 sources, only five described the process and validation of retrospective physical activity measures.

Data for literature analysis were obtained using key words “long-term physical activity” AND “physical activity” AND “physical activity questionnaires” AND “physical activity interview” AND “retrospective physical activity questionnaire” in data bases “EBSCO”, “Pubmed”, “SCOPUS” and “Science Direct”.

A thorough literature selection and analysis was conducted using databases EBSCO, Pubmed, Science Direct and Scopus. Three retrospective physical activity questionnaires were found and used as a basis for the first draft of questions.

The data were analysed with thematic analysis. 27 articles were analysed, and initial codes were generated, considering three main aspects: regularity of activity, type of activity and frequency of the activity. In the next steps codes were organised in broader themes thus creating main themes and subthemes.

Results

Main activity domains

Thematic analysis was conducted based on physical activity domains described above. Overall, eight areas of physical activity were identified and characterised (see Table 2 for full description).

Table 2 *Included Activities in Physical Activity Areas*

Main theme	Sub-themes
Work	Vigorous physical activity work
	Moderate physical activity work
	Sedentary work
Education	Formal education (school, higher education or university)
	Non-formal education (seminars, language learning, courses)
Sleep	Full night's sleep
	Napping
Transportation	Cycling
	Walking
	Using public transportation
	Driving
Self-care	Personal hygiene
	Food consumption
Leisure time	Sedentary leisure activities
	Outdoor activities
	Social activities
Household activities	Vigorous household activities
	Moderate household activities
	Light household activities
Sport	Aerobic
	Strength
	Group

Work

This section includes regular paid full and part time jobs. For example, full time work as a secretary, working from Monday to Friday, from 9:00 to 17:30 would be included as eight hours of sedentary working activity, including the 30 minutes into self-care section.

Education

Education section included two different subsections – formal education, such as high-school, college and university, and non-formal education, such as seminars, courses. The regularity of study days and mean time of study per day was recorded, as well as the type of studies (e.g. language studies versus studying to become fitness trainer would have different levels of activity during the studies).

Sleep

While night's sleep and naps were divided separately during the interview, the total mean hours of sleep were recorded. The need to separate nap time from night's sleep arose as it helped to define the hours spent asleep.

Transportation

This section included questions regarding use of daily transportation. Participants indicated four main types of transportation: cycling, walking, using public transportation and driving. This section presented difficulties, as the type of transportation and the regularity differed across seasons (e.g. cycling during the warm season, while using public transportation during cold season).

Self-care

In the self-care section, participants noted two main areas of self-care – personal hygiene compliance (e.g. showering, brushing teeth) and food consumption (e.g. mean meal times). Challenges were found in this section, as several participants indicated that in specific periods in life they have been eating while doing other activities i.e. multitasking.

Leisure time

Leisure time was divided into three categories: sedentary leisure activities (e.g. reading, watching TV, writing, knitting), outdoor activities (e.g. hiking, visiting a Zoo) as well as social activities (e.g. clubbing, meeting with friends).

Household activity

Three levels of household activity were identified – vigorous, moderate and light. Vigorous household activities included such activities as gardening, repairs. Moderate activities involve cleaning, ironing, laundry washing. Light household activities such as dusting and washing dishes.

Sports

This section included purposeful physical activity that were divided in three categories – aerobic, strength and group activities. Aerobic activities included such exercises as running, swimming or Nordic Walking, while as strength activities weight lifting were included. Group activities involved basketball, volleyball etc.

Structure of the questionnaire

After conducting the thematic analysis, an open-ended three-part questionnaire was developed.

In the first part, task will be given, where participant is asked to divide their life-span in separate periods of time starting from the age of 15, based on a specific area of life (see example in Figure 1).

72-year-old man from the age of 15 to 18 years studied in high school. From 19 to 32 years worked as a bus driver. From 33 years to 36 years he studied at a university and worked as a bus driver. For 37 years to 50 years, he worked as an accountant in the company which was located near the home but from the age of 51 to 65 years worked as an accountant in the company which was an hour away by train from the home. From 66 years and had to retire to 70 years spent time at home but in the last year from the age of 71, every third day works as a guard. In general, he divides his life into seven stages (15 to 18 years; 19 to 32 years; 33 to 36 years; 37 to 50 years; 51 to 65 years; 66 to 70 years; 71 until now).

Figure 1 Example of completing the first stage of the questionnaire

In the second part of the questionnaire, participant will be asked to reply to questions focusing on a specific period of life, marking the hours/minutes spent per day/week/month in the aforementioned activity areas. Questionnaire will be filled in written form and no time limit is given to complete it.

The third part of the questionnaire will be conducted as a structured interview, with interviewer using the filled-in questionnaire as basis for the interview. During the interview, the interviewer must specify the time, frequency and intensity of the physical activity by registering the information in protocol page. Time spent doing activities should not exceed 24 hours.

To evaluate the intensity of the activity, all data were referenced to the Compendium of Physical Activity (Ainsworth et al., 2011), that includes MET measures to daily activities.

Discussion

The aim of the present study was to conduct the first stage in developing an instrument to retrospectively investigate life-time physical activity. Thematic analysis was conducted on literature research on physical activity and retrospective measures of activity. As a result, a framework for retrospective life-long physical activity assessment was developed.

Our analysis indicated eight main sections in daily physical activity – work, education, sleep, transportation, self-care, household activities and sport as purposeful exercise. Such division in part complies with the sections of questionnaires considered above; however, while Historical Leisure Activity Questionnaire (HLAQ) included only occupational activity and leisure activities apart from sports, a systematic progress towards adding other daily areas as well

as sedentary and light physical activities can be noticed in other questionnaires. To our knowledge, so far, we are the first to attempt to investigate the daily routine in such detail.

Final structure of the questionnaire includes three separate parts: specifying periods of life, written self-reported questionnaire that is later used as a cue for both – interviewed and interviewer, and structured interview. This structure is similar to the structure of questionnaires discussed above, with the procedure probably being closest to Schmidt's Short retrospective questionnaire for physical activity; however, while previous studies have offered already prepared divisions of life-time, our questionnaire allows participants to select the periods themselves, based on the most consistent activity at that time (usually – job activities, education or child care). Major part of questionnaires regarding physical activity are designed as surveys, including close-ended questions or questions with answer options (e.g. 5-point Likert scale) and are conducted independently (Sarkin, Nichols, Sallis, & Calfas, 2000). Few researchers have opted to use free reports and diaries to obtain data (Williams et al., 2012a); however, such methods are not an option regarding retrospective data and are usually used to document present activities.

Essential here is the question of validity and reliability. In all questionnaires mentioned above, test-retest reliability measures were used, and it should be taken into consideration as a significant limitation, as it indicates that the questionnaire gives similar results after each administration; however, does not mean that the answers comply with real-life experience of physical activity. To eliminate such limitations, often concurrent validity is measured with comparable tests and analysed using Pearson's or Spearman's correlation coefficients (Schmidt & Steindorf, 2006). Still, as mentioned above, there are no reliable and objective questionnaires that could confirm that the questionnaire is indeed valid and reliable. However, with the increase in accessibility and decrease in price, more and more studies are using electronic fitness bracelets to objectively measure physical activity. Fitness tracking devices measure health indicators (heart rate, number of steps, distance, energy consumption and sleep duration) under various activity states (resting, walking, running, sleeping) (Xie et al., 2018) and could be used in our case. Pros and cons of fitness devices have been investigated in different studies (e.g. see systematic review by Henriksen et al., 2018).

Verbal probes can easily lead to false memories of previous activities, thus a strict protocol for interviewing should be prepared and available to interviewer. Also, an electronic protocol that is currently in development, should be used during the third part of the questionnaire to ensure compliance with the time-frame of the specific period.

The next step in this study is to conduct validity and reliability measures, using fitness bracelets as objective measures of daily activity.

Conclusions

An eight-section framework for a questionnaire that allows to retrospectively investigate physical activity throughout life has been developed. While the framework for the proposed questionnaire partially complies with previously developed measures, this framework differs in detail and flexibility. In the future, thorough validation of the questionnaire should be conducted.

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