Title: Development of the European Health Interview Survey - Physical Activity Questionnaire (EHIS-PAQ) to monitor physical activity in the European Union

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Version: 2
Date: 5 November 2015

Author's response to reviews: see over
Revision of the manuscript: “Development of the European Health Interview Survey - Physical Activity Questionnaire (EHIS-PAQ) to monitor physical activity in the European Union”

Dear Editor and Reviewers,

We thank you for the detailed and useful comments on our manuscript. In the following we respond to your remarks point by point and describe the changes we have made.

Reviewer 1:
Herman Van Oyen
Reviewer's report:
Major compulsory revision:
1)  • a conceptual framework presented in a graph of what is expected of the instrument

We have now included a graph with a conceptual model which distinguishes three physical activity domains, work-related physical activity, transport-related physical activity and leisure-time physical activity and shows which aspects the EHIS-PAQ covers from such domains (see Figure 2). Furthermore, it presents the general concepts of the EHIS-PAQ questions and shows which indicators can be calculated from EHIS-PAQ data. We introduce this conceptual model on page 10 line 1-3. In addition, we specify the general concepts EHIS-PAQ uses for defining ‘work’ on page 10, lines 17-21 and ‘active travel’ on page 10, bottom line.

2)  • contrary to the IPAQ instrument, the proposed instrument is setting specific. As this a major difference, the reasons for taking his option should be clarified, including strength and limitations of the approach. Further, can the information obtained been translated to a metabolic equivalent (from table 1, this is only done for transport related PA)? If not, is this considered to be a limitation / strength?

The reasons why it was decided to choose a setting-specific instrument was that from a European public health monitoring perspective it is important to have this setting-specific information for three reasons: 1) the health benefits across PA domains are different (i.e. health-enhancing
aerobic PA complies more often with leisure-time PA than work-related PA), 2) health promotion interventions to enhance PA often use setting-specific approaches that’s why setting-specific PA information is needed for health monitoring purposes and 3) it is easier for respondents to recall activities in specific settings than calculating total physical activity level (it is more user-friendly approach). However, limitations of setting-specific approaches are that for some people it can be difficult to define the settings (i.e. leisure time for retired people or unemployed). In addition, the EHIS-PAQ is not designed to produce an overall PA index based on MET because this unit is difficult to understand and to be interpreted in particular for lay people (i.e. policy makers). Furthermore, validation studies have demonstrated that those overall MET indices have more or less low validity compared to objective measurements; this raises concerns of what is the added value of calculating total PA indices on a MET basis. However, a MET calculation is possible for the domains transport-related PA (for combining walking and bicycling into a composite index) and also for the leisure-time domain. However, for the work-related PA domain the information on duration is not assessed for the reason that in EHIS only a limited number of questions can be implemented. It is in principle possible to use the information in EHIS on employment status (whether respondents are employed in part-time or full-time) to calculate a composite index for total physical activity level for the working population. We added a section on ‘Qualifying the EHIS-PAQ in comparison to IPAQ-SF and GPAQ’ at the end of the discussion section on page 16 in which we elaborate more in detail on the advantages and disadvantages of the EHIS-PAQ and IPAQ-SF.

Minor Essential Revisions:

Methods section

3) 1. page 6: can information on the literature search been specified including information on the key words used and a prism chart (as supplementary file)

As mentioned in the text we did not conduct a systematic literature search for PA questionnaires for four reasons: a) the Estonian group had already conducted a literature search for PA instruments before the expert meeting took place, b) the main eligibility criterion set by the EHIS Core Group for selecting PA questions was that they should have been used in large-scale population health surveys before. Therefore we focused on the HIS/HES data base which only includes questions which comply with this criterion instead of focusing on the general literature, c) up-to-date systematic literature reviews on PA instruments already existed in 2010 (Sports Med 2010; 40 (7): 601-623, Sports Med 2010; 40 (7): 539-563, Sports Med 2010; 40 (7): 565-600), however, the questionnaires were not always accessible and the production of the booklet on PA instruments served mainly the purpose to collect those questionnaires and their validity studies, d) the screening of the PA instruments reported in the reviews quickly showed that the vast majority of those instruments were too long and not feasible for the use in EHIS. We now clarify this on page 6, Method section first sentence and replaced in Figure 1 Phase 2 the working step ‘literature review’ with ‘instrument collection’ to be more precise.

4) 2. instrument review: it is unclear what was done:
   a. was it structured with a predefined instrument
   b. was there a link with a conceptual frame work to be analysed

See also answer on comment no. 3. No, there was no pre-defined instrument or conceptual framework when we started with the HIS/HES Database search, the research question was rather broad: Which PA questions have been used so far in international HIS/HES surveys? The
The organization of the themes (domains of PAs) was a process that took place during and after the instrument collection process. While searching in the HIS/HES database we reviewed all questions in the area 'lifestyle factors' with topic codes '411 - daily activities', '412 - physical activity', '413 - leisure time activities' and in the area 'Living and working conditions' with the topic codes '502 - working conditions' and '504 - working exposures'. We categorized the identified questions according to the PA domains: (a) work-related PA, (b) household PA, (c) transport-related PA, (d) leisure-time PA and (e) sedentary behavior. The eligibility criteria we used were that we searched for (a) 'all surveys' including health interview surveys (HIS), health examination survey (HES) and HIS/HES combined, (b) in 'all regions', (c) in 'national and international surveys', and (d) for 'survey years 1992 until 2008' because the HIS/HES database at the time of study covered this period. We now specify our search strategy in detail in the bottom lines on page 7, first paragraph. Furthermore, we now present the booklets in the Supplemental File 1.

5) 3. Fig 2: a. unit in the instrument is different for transport (minutes per day) compared to leisure (minutes per week). Is this not confusing for the interviewee? 
b. Q8: no time spend is added: why? This typical activity may already be included in Q6/Q7 as stated in the intro to Q8. Is there a link to an ECHI indicator?

a) This decision was taken because of the evidence gained from the cognitive testing study round 1. Respondent reported that their leisure-time activities are usually planned on a weekly basis. Transport-related PAs in contrast were reported to be daily activities (i.e. commuting to and from work) and it would be easier to report them on a daily basis. After this decision was made we tested this strategy in the cognitive testing round 2 where the first draft version of the EHIS-PAQ was tested. The majority of the respondents confirmed that they preferred the daily basis reference period for transport-related PA and for LTPA the weekly basis. We added paragraph in the cognitive testing results section on “reference periods (Q3, Q4, Q7)” on page 13, lines 7-15 in which elaborate on this issue.

b) The current WHO PA recommendation has two components: (a) adults should engage in at least 150 min aerobic moderate intensity PA per week (covered by Q6/7) and (b) muscle-strengthening PA should be performed at least 2 times per week (covered by Q8). The reason why we ask only for the frequency but not for the duration of muscle-strengthening PAs (Q8) was that we attempt to estimate part (b) of the WHO PA recommendations for which no duration is specified in the recommendations. Muscle-strengthening PA may be included already in PE6/7, however, this is not a problem, all participants are requested to answer PE8 and there is no filter. The current WHO PA recommendation was adapted from the 2008 CDC PA recommendations in 2010 and distinguishes for the first time between aerobic and muscle-strengthening PA, however the ECHI shortlist indicator 52 on PA does not consider this change in the recommendations yet. Thus, there is a need to update the ECHI 52 indicator according to the new PA recommendations.

6) 4. Table 1: why a binary approach for work-related PA as you can at least a difference moderate and heavy. This is also in contrast to the transport related PA for which you proposes quintiles.
Many different indicators can be calculated based on EHIS-PAQ. The indicators presented in the analyzing guidelines are examples which we consider to be important public health-relevant indicators. The binary work-related PA indicator was chosen because it is reasonable to distinguish between individuals who do mostly tasks of 'at least moderate physical effort' from other respondents. This indicator is then used as one component to build the subsequent indicator ‘sufficiently physical active in total’. We have now added a sentence in the text explaining that the suggested indicators are only examples of many indicators that can be derived from the EHIS-PAQ (see page 15 lines 2-3).

7) 5. Table 1 Transport related PA. Quintiles boundaries are always population specific (in case of EU: member states, gender, age categories). How will this be tackled?

It is a common Eurostat procedure to report quintile boundaries for continuous EHIS variables and therefore this approach also was adapted for the EHIS-PAQ transport-related PA indicator. MS still can be compared with each other when comparing the cut-off-points of specific quintile boundaries. In the future once the data for the EHIS wave 2 are available it could be also an option to produce reference values for the EU28 for this index. For the time being we think that the quintile approach is more appropriate than proposing an arbitrary chosen cut-off-point MS should be compared upon.

8) 6. Table 1 and related text: Is there a reference that will be used to define the met / define the intensity related to walking / cycling in order to standardize the calculation?

For walking, a MET value of 3.3 should be used and 6.0 for cycling; the reference for those MET values is the IPAQ data processing and analyses guideline. We have added this information and insert this reference in the text on page 15, lines 14-15 and in Table 1.

9) 7. Discussion: you may make add information on additional validation work going on, such as validation against objective measures in the 2014 nutrition survey in Belgium

Two validation studies have been conducted between 2014 and 2015 in Germany and in Belgium. In Germany the study was conducted by a study group at the University of Regensburg in which the EHIS-PAQ was tested against objective measures (accelerometer, sub-maximal bicycle ergometer test and hand grip test), more comprehensive subjective PA instruments (IPAQ-Long Form and PA dairy) and also the reliability was tested. In Belgium, in the 2014 nutrition survey a validation study was implemented with a comparable methodology used by the study group in Regensburg. Data for those studies will become available and be published soon. We added this information on page 17, bottom paragraph and page 18, top paragraph.

Discretionary Revisions:

10) 1. page 5, line 3: GPAQ is too long. In order to appreciate please give an indication on the length of the instrument (e.g. by stating the number of questions)

The GPAQ has 16 questions the EHIS-PAQ has only 8. In the EHIS wave 1 questionnaire the IPAQ-SF was used which has 7 questions and the instrument requirements set by the EHIS Core Group was that the new PA module for the EHIS wave 2 should be more or less about the same length than the previous one. We added information on the length of GPAQ on page 5, lines 6, 7.
11) 2. page 5, line 7: the first use of the IPAQ-SF was a modified version. The critique of PA experts was that deviation of the original version was the main cause of problems encountered. Can both versions be presented in a table as supplementary information.

We think that this would be beyond the scope of this article. However, we have now described the differences between the original and modified version of the IPAQ-SF in more detail in the text on page 5, lines 9-11: ‘The original IPAQ-SF provides activity examples for each intensity dimension (moderate/vigorous) the respondents are requested to classify their activities in. Those activity examples were removed when the IPAQ-SF was used in the EHIS wave 1’.

12) 3. page 5, paragraph 3: IPAQ-SF was cognitively tested in 3 countries. However the authors do not make reference to the (grey ?) literature as I expect that in the process of the development of the IPAQ-SF, cognitive testing have been done.

We have now added a sentence stating ‘the results are described in detail elsewhere’ (page 5, bottom lines) and refer to the Final Project Report of the EHISImp project (in which the country reports of the cognitive testing round 1 are included) as well as to a submitted article on the cognitive testing round 1.

13) 4. page 6, line 1. 3 standalone indicators
a. does this mean that there is not information on total PA?
b. is there an age range considered (younger bound, older bound)
c. is there an indicator of lack of PA see comment on conceptual model to specify this.

(a.) Yes, the instrument was not designed to produce a total PA index based on MET values for the following reasons: (a) To do this in an appropriate way using a domain-specific PA approach instruments need to be more comprehensive, for instance the GPAQ uses 16 questions or the IPAQ-long version uses 27 questions, (b) validation studies have shown that the validity of the total PA scores have a rather low validity compared to objective measures, (c) the measurement unit MET is difficult to understand for non-PA experts, (d) the EHIS produces data for the European Public Health Information systems which should consist of indicators which are easy to understand and public health relevant, (e) The EHIS is not an epidemiological or sports science study for which more detailed PA information is required for which other instruments such as IPAQ/GPAQ may be more appropriate, (f) the ‘new’ WHO PA recommendations now distinguish between aerobic and muscle-strengthening PA which is not considered in a total PA index were both types of activities are summed up and WHO recommendation compliance cannot appropriately estimated.

(b.) Indeed this is an important comment. We now specify the PA recommendations compliance according to age groups.
Adolescents 15-17 years of age: At least 60 min of at least moderate-intensity aerobic PA per day and at least 3 times per week muscle-strengthening PA
Adults 18+: At least 150 min of at least moderate-intensity aerobic PA per week and at least 2 times per week muscle-strengthening PA.
We now specify those age bounds in the manuscript on page 15/16, section ‘Health-enhancing PA’ as well as in Table 1.

(c.) See also answer on commend no. 6. We already proposed an indicator “sufficiently physically active in total” (see Table 1). This indicator defines “insufficient physical activity” as doing “mostly sitting or standing activities” (WRPA == 1) when working or “no work-related PA” (WRPA == 4) and health-enhancing aerobic PA < 150 min.

There is the possibility to define a ‘total physical activity’ categorical variable’ with four categories also: (a) ‘insufficient work-related PA and insufficient health-enhancing aerobic PA’, (b) ‘sufficient health-enhancing aerobic PA and insufficient work-related PA’, (c) ‘sufficient work-related PA and insufficient health-enhancing aerobic PA’, (d) ‘sufficient health-enhancing and work-related PA’. We introduce this option now in the text on page 16, lines 14-18.

14) 5. page 6: please provide a reference to the results of phase 1.

We added references referring to the Final Report of the EHIS imp project and the Interim Report.

15) 6. page 7, 2nd paragraph line 6: the amount of questionnaires => the amount of instruments

The HIS/HES data base search resulted in 30 Transport-related PA questions, generic PA 122, household PA 28, occupational PA 56, sedentary behavior 24, leisure-time PA 106. The short list included the following numbers: work-related PA, n = 10; Transport-related PA, n = 6; and Leisure-time PA, n = 14. We added this information on page 7, lines 9-11 and lines 18-19.

Reviewer 2:
Marieke Verschuuren
Reviewer’s report:
Minor essential revisions:

16) Page 4: ‘EHIS data are used for calculating the European Core Health Indicators (ECHI) - shortlist.’ This is really just a minor issue but I think it would be more accurate to state that the data are used for calculating the indicators rather than the shortlist.

We have corrected it.

17) Page 4: '... external experts in PA assessment were invited...'. I would be interested to learn a bit more about how these experts were selected and about their backgrounds.

The experts had backgrounds in physical activity assessment: One Finish expert had a background in health promotion PA intervention studies, one Estonian expert in military PA studies, one German expert in population health monitoring and one Swedish expert was part of the IPAQ study group.
This is now specified in the text on page 4 bottom line and page 5 top lines.

18) Background section: the timeframe of the study can be deduced from figure 1 but I would recommend mentioning it in the text somewhere as well.
We have added the time frame of the project in text on page 4, lines 14, 15.

19) Page 6, methods: Booklets were created for total PA, occupational PA and leisure-time PA. I was wondering why not for transport-related PA? Is this an omission in the text or is there a particular reason for this? In case of the latter, some explanation could be added.

The reason was that we searched in the HIS/HES data base on the level of ‘questions’, where we looked on transport-related PA questions separately. When we collected PA instruments from the general literature we categorized them on the level of ‘instruments’ into the groups: total, occupational and leisure-time PA instruments. Transport-related PA is usually not assessed with stand-alone instruments; transport-related questions are included as sub-sections in domain-specific ‘total physical activity’ instruments however. This is now specified in the Text on page 6, lines 15-17 and page 7, lines 8, 9.

20) Page 6, methods: why was the search in the HIS/HES database broader than the 3 categories needed for the EHIS questionnaire?

See also answer on comment no 4. As it is shown in the Figure 1, the time frames of the Phases 1 and 2 of the Project were partly overlapping. The HIS/HES data base search had already started before the EHIS Core Group meeting in February 2011 took place on which it was decided that the EHIS-PAQ should cover only the three domains work, transport and leisure. The aim of the HIS/HES Database search was to identify all physical activity questions which were asked in HIS/HES surveys in the defined time period. After identification of the questions they were grouped according to the PA domains: work-related PA, household PA, leisure-time PA, and sedentary behaviour as well as generic and other PA questions. We now clarify the search strategy more in detail on page 7, top paragraph.

21) Page 7, instrument review: '...PA instrument proposal was reviewed by PA experts..'. Are these the same experts as the ones mentioned on page 4?

The instrument proposal was reviewed by one Estonian expert from the previous expert group and one additional German expert. This is now specified in the Text on page 8, lines 5, 6.

22) Page 8: in the sentence with the age-group strata there appears to be a '15' too many (after 60+ years).

We have corrected it.

23) Page 11, leisure time PA: in this paragraph I was confused by the numbers. Eg:'All 11 German respondents and 6 out of 12 Estonian respondents (74% of all respondents, who...'). In the first sentence however it is stated that there are 7 Estonian respondents and not 12 (or 15, but I think the ones engaged in leisure PA are meant here). 74%: 17 out of 23, but I wonder whether this is correct (as this is based on 12 Estonian respondents). Also, later on 7 out of 8 German respondents are mentioned, but is not clear to me where the number 8 comes from. Also in this sentence again 12 Estonian respondents are mentioned.
We have checked the numbers and revised this paragraph to make it easier to understand. There was an error in the first sentence of this section: the number of respondents who reported that they were engaged in sports, fitness or recreational activities in Estonia was 12 and not 7 out of 15 totals. We have corrected this mistake. The reason why the denominators differ is that some respondents did not provide answers on some questions mostly because they were not doing the activities the question focused on. We have checked all numbers in the whole cognitive testing results section again and have revised the section to be clearer about the subgroups (denominators) the probes refer to. We have also moved all results on ‘reference periods’ into a separate section to better structure this section (see also answer on comment no. 5). The revised section can be found on page 12/13.

24) Page 14: ‘... a recent study indicates that self-reported PA is more strongly related to objective information when ...’. I would appreciate a bit more explanation of/elaboration on the term objective information (to me now it is a bit vague).

In the cited study, objective PA information was assessed with a strategy combining accelerometer and heart rate monitor data. We have clarified this in the text on page 16, line 7.

25) Page 15: the statement that validation studies will be implemented in 2013 is outdated. I would recommend rephrasing (maybe even refer to some outcomes if already available?). Also, as a reader you wonder why these validation studies were not done prior to implementation of the instrument in EHIS. I can imagine time and budgetary constraints are the main reasons here, but maybe it would be worthwhile to explain this.

See also answer on comment 9, we have now updated the information on ongoing validation studies. It is important to highlight that the EHIS-PAQ is adapted from questions which were validated before and which had been used in large-scale health surveys. Nevertheless, there was a need to validate the EHIS-PAQ as some questions were revised and also the way the question are combined in the EHIS-PAQ needs to be tested. Indeed, time and budgetary constraints were the reasons why it was not possible to conduct the validation studies in the framework of EHISImp project. The results of the validation studies will be soon published. We explain this now in the text on page 17, bottom paragraph and on page 18, top paragraph.

26) Page 15: is there any idea about when the EHIS data will become available?

The data collection will be completed in all countries in 2016. The EHIS wave 2 data are expected to become available for the scientific community the end of 2017 or beginning of 2018. We added this information on page 18 lines 10-12.

27) Discussion: the PAQ was tested in a limited number of countries. What are the authors' views on the applicability of the tool in other parts of the EU, e.g. in mediterranean or Balkan countries?

The EHIS-PAQ was tested and developed from experts from different regions and cultural settings in Europe. It follows partly the concept of the GPAQ which was developed mainly for the use in a low- and middle-income country setting. For this reason we think that the EHIS-PAQ can be used in all regions of Europe. However, some MS representatives stated for instance that...
in some regions in Europe geo factors such as mountains, water, weather condition etc. will have an impact on the transport-related PA domain, in terms of low prevalence in those countries is expected for this domain. In other MS transport-related PA is one of the most important fields in which PA promotion interventions are implemented. Also the distribution of work-related activity is expected to be very different across countries within different states of economic development across Europe. Low WRPA again has an influence on LTPA participation and vice versa. In sum we think that the EHIS-PAQ is a well-balanced instrument which covers WRPA, TRPA and LTPA and has the potential to show the differing patterns of PA in the EU, EFTA and Candidate countries.

We added a brief conclusion on this issue on page 18, lines 18-21.

Once again, we would like to thank the reviewers for their comments, which have helped us to improve the manuscript considerably. We hope the revised manuscript can now be accepted for publication.

Sincerely yours,

The corresponding author on behalf of all authors