Title: Development and validation of sunlight exposure measurement questionnaire (SEM-Q) in an adult population residing in Pakistan.

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Author’s response to reviews: see over
To
The Editor
BMC

Subject: Re submission of MS: 4487558236486080 – Development and validation of sunlight exposure measurement questionnaire (SEM-Q) in an adult population residing in Pakistan.

Dear Dr. George Rachiotis,

We are grateful to you for providing a critical review of our manuscript. We believe that we have now addressed all the queries and comments raised by the reviewers in the manuscript. A point wise explanation of all the comments is also provided in this letter. I have highlighted all the comments and then addressed those. I hope that you will find the changes satisfactory and accept our manuscript for publication in your esteemed journal.

Thank you

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Reviewer 1: Ingrid van der Mei

Between brackets after each point Major, Minor or Discr, referring to Major Compulsory Revisions, Minor Essential Revisions and Discretionary Revisions.

Overall, this is a useful paper. There are only few papers that validate sun exposure questionnaires.

Find below some recommendations for improvements. The lack of detail on the scoring system is of particular concern.

Materials and methods:
Development of sunlight exposure questionnaires

• Please indicate that period that both these questionnaires capture (Major)

Thank you for highlighting an important aspect. The long term questionnaire captures last 1 year sunlight exposure in summer and winter seasons, whereas, the short term questionnaire captures the current 1 day sunlight exposure. This is given in ‘table 1’, and as suggested, we have added it in ‘material and methods’ under ‘development of sunlight exposure questionnaires’ on page 5 in first paragraph.

Factors affecting individual UVR exposure

• You mention what you measured, not how it was measured. Indicate which items were measured or add part of the questions asked. Given that this whole paper is about how good your questionnaires are, we need as much detail as possible. If the journal allows you to add the questionnaires as a supplementary table on the web that would be great. (Major)

Thank you for your comment. Indeed, our paper is about how well our questionnaires assess sunlight exposure. The two questionnaires had 7 domains each, for sunlight exposure assessment e.g. weather outdoors, clothes worn/body covered, sun protection practices etc. We have added example of domains in the ‘materials and methods’ under ‘development of scoring system for SEM-Q’s’ on page 6. Table 1 also lists the different domains used in the two questionnaires.

We will be very happy to submit our questionnaires if the journal editors will allow us to do so.

• How did the participant know the UVR intensity? (Discr)

This is a very important question. The participants did not know about the UVR intensity. The questionnaire or methods did not require for the participants to know about the UVR intensity at the data collection time.

Development of the scoring system
• **How did you decide on the weights (Major)**

Thank you for pointing the gap in the manuscript. Each domain was given a percentage which was already established in various previous studies. E.g. if sunscreen was used, literature tells us that it blocks almost 92% of UVB and only 8% UVB penetrates the skin. Therefore, for a person wearing sunscreen, 0.08 is given. If the person has not used any sunscreen then a proportion of 1 is given which corresponds to 100% UVB penetration. OR If the face is not covered, it receives 100% UVB, hence a proportion of 1 is given, whereas, if the face was covered or partially covered it receives 0% and 50% UVB’s translating into a proportion of 0 and 0.5 respectively.

An example of how different weights and percentages were given is added in the ‘materials and methods’ under ‘development of scoring system for SEM-Q’s’ on page 6, first paragraph.

• **The development of this system is completely a black box for the reader with you spitting some results out at the end. Please justify the decisions made + provide information in the results, so readers are getting confidence in your scoring system. It is uninterpretable at the moment.** *(Major)*

Thank you for your comment. The scoring system was indeed one of the most important and complex aspects of the study and need further elaboration. We are adding a table (Table 2 mentioned under ‘materials and methods’ page 6) in the main manuscript showing how different weights were given for sunlight exposure scoring’. We hope the table will provide a clearer picture of how weights were given to arrive to the scoring system.

**Study setting and design**

• Can you provide some information on the UV index during the year. Alternatively, provide this setting information in the introduction, including latitude and maybe even clothing customs so people can create a picture of the possible sun behaviour of your population. *(Minor)*
Thank you for this suggestion. We have added the information in ‘introduction’ section on page 3.

- Can you clarify whether this is a volunteer sample where people responded to fliers, or where particular staff members were invited with a personal letter. In the latter scenario provide a response rate. This info is somewhere in the paper, but not at a logical spot. (Minor)

Thank you for your comment. Our study was not a volunteer sample study nor was staff invited in advance. Participants were selected according to three predefined groups (high, moderate and low sunlight exposure). Individuals falling under one of the groups (e.g. gardners, house keeping etc) were approached and they were briefed about the study and inquired if they wanted to participate. If the individual responded yes, then eligibility and informed consent was processed. We have clarified and further elaborated this information in the ‘materials and methods’ section, under ‘study setting and design’, page 4.

**Study protocol**

- There is no information on the vitamin D assay that was used + reliability of the assay. (Major)

Thank you for your comment. Indeed information on vitamin D assay is essential for readers. Vitamin D status was determined by measuring serum 25OHD₃ concentrations by Electrochemiluminescence immunoassay on Elecsys auto analyzer (Roche Diagnostics, USA). For quality control low, medium and high Elecsys Preci Controls were used. The within-run CVs were 5.7%, 5.7%, and 5.4% at concentrations of 25.2, 39.9, and 65.6 ng/ml. were take.

We have added the information on vitamin D assay used and how reliability was ensured in the methodology section under ‘study protocol’ on page 8, first paragraph.

- Regarding the education provided to those with VDD, was this done after the study was completed or did it interfere with the study? (Minor)
Thank you for your comment. The participants were educated after the study was completed. This was the case because vitamin D analysis was run in the laboratory towards the end of the study. The active part of the study that involved participants to fill the questionnaires and wear dosimeters was completed by that time. Hence it did not interfere with the study. We have included a few words to clarify this in ‘materials and methods’, under ‘study protocol’ on page 8, line 8 and 9.

Potential confounders and sources of bias

• Who recorded the outdoor weather? (Discr)

Thank you for this observation. This study was carried out in Karachi, where maximum temperature throughout the year ranging between 25C to 35C and minimum temperature is usually between 10C to 17C with few days (3 or 5) of exceptions. So, the outdoor temperature was not recorded. The participants self reported the weather during their time outdoors.

• How did you adjust for confounders while creating the scoring? (Major)

Thank you for this important question. The scoring system involved giving weights to individual items which can be considered as confounder, such as weather outdoors, use of sunscreen, sun protection practices, clothing etc. A percentage was given for each of this item and final score was made by adjusting the total time spent in the sun for all of these proportions. As explained in one of the responses above, the individual items were given a percentage which had been established through previous studies. E.g. if sunscreen was used, literature tells us that it blocks almost 92% of UVB and only 8% UVB penetrates the skin.

Results

• Please provide the actual % of participants who were deficient and insufficient. (Minor)

Thank you for this suggestion. We have now reported percentages for participants who were VDD or vitamin D insufficient in second paragraph of ‘results’ section on page 9.
• Please provide the correlations between the questionnaires in the text. (Major)

This is indeed a significant aspect of the paper that we had not mentioned previously. Correlation between LT and ST questionnaires was assessed. It was found that the correlation coefficient between average time (minutes) spent outdoors as captured by LT and ST was 0.85 ($P<0.01$). Similarly, the correlation coefficient between the scores for LT and ST SEM-Q was observed to be 0.82 ($P<0.01$). We have added the Correlations between the two questionnaires in ‘results’ section, on page 10, 2nd paragraph.

• Table 1: says ‘Reference period’ twice. Please use better wording to capture what you want to say. Add to the footnote re the short term questionnaire that 4 questionnaires were filled out on the days that the dosimeters were worn. (Minor)

Thank you for your comment. We have rephrased and added the footnote on Page 21.

• Table 3: add the units for variables (missing for vitamin D, UV). Indicate how you obtained the adjusted time. Did you estimate a new time or was the correlation adjusted for some variables. At the moment it reads as if you are calculating a corrected time measure. (Minor)

Thank you for the comments and suggestions. Since another table was added, therefore Table 3 is now table 4. The units for Vitamin D were ng/ml and for UV dosimeter, the units were MED (Minimal Erythemal Dose). The time in minutes was adjusted for weather outside (cloudy/sunny) and sun protection practices like seeking shade under tree or building as the time spent in sun was thought to be affected by these two components. This is the reason for showing both time and adjusted time in the table. We have made changes on the table on page 24.

• A figure with some graphs including data points and a linear predictor will probably complement the understanding. (Discr)
Thank you for the suggestion. A figure showing scatter plots would have been an appropriate approach for better understanding but our data did not fulfill the normality and linearity assumption which is why we used Spearman’s rank correlation.

When describing table 4, please add some understanding in relation to the periods that measures relate to. Just build it into the sentences. It is critical for the understanding of your findings. (Major) o Vitamin D levels were measured from December to April.

Thank you for this important suggestion. We have added the time periods in the text. The study period was from December 2009 to April 2010, as now mentioned in ‘materials and methods, under ‘study setting and design’, line 2 (page 4). Blood sample for serum vitamin D were also collected from December 2009 to April 2010 and we have added this in ‘materials and methods’ under ‘study protocol’ on page 8, line 2.

The short questionnaire and the dosimeters are done on exactly the same days, aim to measure exactly the same so you expect a very high correlation.

Thank you for this observation. The ST SEM-Q and dosimeters were indeed done on the same day and we obtained a ‘good ‘correlation between the two as shown in the table 5 on page 24, and in the ‘result’ section on page 10, first paragraph.

The short questionnaire and vitamin D levels are taken at the same time, so you expect a high correlation, but not as high as with the dosimeters, because vitamin D captures UV exposure from the last 4-6 weeks and is a surrogate marker of UV.

Thank you for your comment. The ST SEM-Q and dosimeters were indeed used at the same time and so was vitamin D which was taken during the active part of the study i.e. between December 2009 to April 2010.
The dosimeters measured the sunlight exposure, our questionnaire also captured the sunlight exposure and the correlation between the two was assessed.

A score was created for ST SEM-Q and correlation was assessed between the score and vitamin D levels. Score was created from a questionnaire, after adjusting various factors that can externally affect the synthesis of Vitamin D in the body and hence we did not expect a very high correlation between the two

Why do you compare ‘time in the sun’ with the dosimeters, but the ‘score’ with serum vitamin D? I cannot interpret that because I do not know how the average time in the sun relates to the score? How the score is expressed (units)?

Thank you for the comment. The ST SEM_Q had domains such as, the time (minutes) spent in sun, clothing worn, sun protection practices, weather outdoors etc. The dosimeter captured the total UVB received in the day and did not take into account factors such as clothing worn (how much the body was covered), and use of sunscreen that affect UVB absorption. Hence the time (minutes) reported in ST SEM-Q was assessed against dosimeters. This time was then adjusted for weather outdoors and sun protection practices such as seeking shade of tree or traveling in car and correlation was assessed again with dosimeters.

The score took into account all the factors that could affect the UVB absorption into the body (different weights given to different factors as described in one of the questions above). The domains included in our study are all the factors that externally affect the vitamin D synthesis in the body and hence the score was compared against vitamin D levels, whereas, time and adjusted time against dosimeters.

I am unclear what the Long questionnaire asked. Do the winter questions relate to that same period or a year ago. That is critical for the interpretation of your correlations.
Thank you for your observation. The LT SEM-Q inquired the sun exposure during the summer season and winter season of the previous year. We have clarified it further in table 1 on page 21 now.

**Discussion**

• Please state your actual findings in the first paragraph. (Major)

Thank you for this suggestion. We have added a paragraph stating the actual findings in the start of the discussion section on page 10

• You do not actually discuss your findings in relation to each others. E.g. short and long questionnaires findings in relation to the dosimeters. Same for vitamin D. When do you recommend to use the Short questionnaire and when to use the long questionnaire. (Major)

Thank you for your comment. Indeed it is of grave importance to narrow down our findings in relation to each other and recommend the use of the questionnaires to the readers. It is important for the readers to know that both the questionnaires can be used to assess the sunlight exposure as both have shown good correlations with dosimeters and fair correlations with serum vitamin D levels. However, LT SEM-Q might be preferred due to convenience of its use and reflection of a longer duration of sun light exposure inadequacy which may be more relevant for epidemiological work. We have added this information in the discussion section, page 12, last paragraph.

• You compare you sun-dosimeter results to other studies. What about the sun-vitamin D results. How do they relate to other studies?(Minor)

Thank you for your comment. To the best of our knowledge, our study is the first one reporting correlations between sun exposure (reported as scores adjusted for other confounders) and dosimeters. Consequently we cannot discuss our findings in relation to other work.
I do not buy your argument of inability to find variation in terms of vitamin D levels given you sampled based low, medium and high UV. Did you expect a really high correlation in the first place (maybe not, see discussion above about matching time periods, and surrogate marker). (Discr)

Thank you for your comment. We were expecting a greater degree of variation in our serum vitamin D levels give the fact that we had enrolled participants with varying levels of sun exposure. However, we did not observe this variation in serum vitamin D levels of our participants (mention mean VD values with SD here) it is this fact that we have eluded to in our discussion section.

• Please discuss the possible influence of interviewer bias for the illiterate people, who were only part of your high sun group. (Minor)

Thank you for this suggestion. We have added a few lines in ‘materials and methods’ under ‘study protocol’ on page 7. The dosimeters and ST SEM-Q were distributed one day and collected the following day from the participants and the ST SEM-Q was verified. For illiterate participants, the dosimeter was collected and ST SEM-Q was filled by asking questions regarding previous day when the dosimeter was worn. In the verification process, all the participants were asked questions from ST SEM-Q and the information already filled in by the participants was checked for consistency. This minimized the influence of interviewer bias as same method was deployed for both literate and illiterate participants.

Moreover, interviewer bias and reporting bias were minimized as much as possible by selecting the participants in accordance with the inclusion and exclusion criteria and proper training of the research assistant and following the study methodology properly.

• You did not measure ambient UV when the dosimeters were worn so can not calculate a ratio. (Discr)
Thank you for your comment. Yes we did not measure the ambient UV and we did not calculate a ratio.

• Please discuss the limitations of the use of dosimeters. Even though they are the gold standard, they e.g. can only measure UVR at a particular body site, and only measure short term UV where variable climatic conditions might not reflect a longer term period that you might be interested in. For example, vitamin D levels are mostly influenced by UVR in the last month or 6 weeks (half life around 6 weeks). (Major)

Thank you for your comments. As correctly pointed out, the UV dosimeters, although gold standard for measuring UVR, have a few limitations which makes the questionnaires preferred source for assessing sunlight exposure. UV dosimeters are expensive tools and are not readily available in developing countries and hence need to be imported for use. Secondly, the calibration and reading of dosimeters is a complex process and require sensitive equipment and expertise, which is not easily available especially in our settings. The dosimeters can be used to measure UVR at a particular site or UVR received in a day. It is more sensitive to measure UVR on a particular site of the body as different body parts receive different amount of UVR due to the anatomical positions.

We have added a separate paragraph on the limitation of use of dosimeters in ‘discussion’ section, page 13.
Reviewer 2: Monika Janda

Reviewer's report:
The authors aimed to develop and validate a questionnaire of sunlight exposure. Validation was performed against UV dosimeters. This is an interesting and challenging topic. However several aspects of the current manuscript are unclear and need further revisions to obtain a clear picture of exactly has been done.

Major compulsory revision

1) Please state if this is a completely new questionnaire or a translation of an existing questionnaire. There are several areas in the manuscript where this is unclear, e.g. the forward backward translation, which would indicate translation of an existing instrument, and mention in the discussion first paragraph that the questionnaire is adapted. On the other hand the last sentence in the introduction and first sentence in the discussion seems to indicate that it is a new questionnaire.

Thank you for this important comment. The questionnaires we developed were new questionnaires. The different domains or factors influenced by sunlight (e.g. use of sunscreen, clothing worn, sun protection practices etc) were extracted after thorough literature search and these factors have been previously used in other studies. However, no particular questionnaire or ‘sunlight diary’ has been used for creating our questionnaires. The forward and backward translation for English to Urdu then back to English was done to maintain consistency.

We selected different factors for use in our society and we have made the changes in discussion section, page 10.

2) Table 1, please provide a full copy of the questionnaire. From the current description it is impossible to obtain a clear picture of its properties. Why was a different administration mode chosen for the LT and ST forms of the questionnaire and what are the implications of this?
Thank you for your suggestion. We will be glad to provide a full copy of LT and ST questionnaires for clarity of differences among the two questionnaires. A different mode of administration was employed because both the questionnaires catered different time and method of sunlight exposure. LT SEM-Q was interviewer administered while the ST SEM-Q was self-administered by the participants and the two questionnaires were independently validated. We have made a few changes to table 1 (page 21) and the two supplementary questionnaires will hopefully give a clearer picture.

Table 3: please clarify if second line PS UV dosimeters is given in MED? Please explain in the footnote what adjusted time is?

Thank you for this suggestion. UV dosimeter reading was indeed in MED and we have added this information in the table. The time as reported in ST SEM-Q was adjusted for factors such as, weather outdoors, seeking shade of building/tree etc, or travel in a vehicle. We have also explained it as a footnote in table 4, page 24. Kindly note that as an additional table has been added, therefore, table 3 is now table 4.

There is the superscript letter c without corresponding footnote.

Thank you for the comment. We have removed the superscript letter.

Table 4: It is indicated in this table that adjusted time is a measure of time adjusted for sun protection and weather, it is unclear how that adjustment has been performed?

Thank you for your comment. The actual time was adjusted by putting in the equation the different weights if weather was cloudy or if the person travelled in a vehicle, or used shade of tree or building as a sun protection method. The different percentages and weights generated have been explained in table 2 which we have added in the revised version of manuscript. This
will, perhaps, help explain the adjustment of time as notified in table 5 (previously table 4) page 25.

3) Please provide more detail on the dosimeter distribution, collection, transport, data extraction, laboratory specifics and reliability of dosimeter measurements.

Thank you for this suggestion. We have elaborated and rephrased the ‘study methods and protocol’ in ‘material and methods’ page 7.

The participants were given 4 dosimeters packed in 4 individual envelops. The participants were instructed to place the used dosimeter back in envelops and these were collected the next day from the participants. All of the dosimeters were properly stored and later on, packaged and sent to ‘University of Southern Queensland (USQ), Australia’ for subsequent data analysis using spectrophotometer for post-exposure absorbance. The dosimeters were also calibrated before use and a calibration curve was obtained and applied to the final readings of all the dosimeters to obtain calibrated UVR values.

4) Rather than correlations should Bland Altman plots have been used to assess agreement between questionnaire scores and dosimeter readings?

Thank you for your comment. We used Spearman’s rank correlation and Pearson’s correlation instead of bland & altman test because different methods of measurement and different units were used. The dosimeters measures UVR (units MED) where as the questionnaires captures time (minutes) and various other factors. The score created for SEM-Q’s could not be translated into MED units.
Reviewer 3: mary saridi

Reviewer's report:
1. The question is posed by the authors is well defined

2. The methods of this paper are well described and enough appropriate. I think the questionnaires must be more analyzed.

Thank you for your comment. We have added the two questionnaires as supplementary data for better understanding

3. The data are enough sound.

4. The manuscript adheres to the relevant standards for reporting and data deposition also.

5. The results must be structured with more data
Thank you for your comment. Additional data on questionnaire analysis has been added in the ‘results’ section. Page 9.

6. The discussion has to re-defined. You may add some more resent references about sun exposure habits in children adolescences(KNOWLEDGE AND ATTITUDES RELATED TO SUN EXPOSURE AMONG ADOLESCENTS IN GREECE. Saridi M., Pappa V.,Kyriazis I.,Toska A.,Giolis A.,Liachopoulou A., Skliros E.,Birbas K. RURAL AND REMOTE HEALTH)

Thank you for providing this valuable reference, we have now included it in our discussion section on page 12.
7. The limitations must be written after discussion in a separate part and not scattered into the discussion
Thank you for your suggestion. The limitations have now been described in a separate paragraph under ‘discussion’ page 12.

8. As I said in the discussion the literature has to be more recent and representative

Thank you for your comment. We have updated our literature search and have added 2 studies in the discussion section on page 12.

9. The title presents the meaning of the study

10. Abstract: I think the part of methodology must be shorter instead of the results that must be bigger. In Key Words you must add sun protection or sun light exposure

Thank you for the comment. We have shortened the method section and have also added the key word. Changes can be seen on page 2.

11. The writing is acceptable but it has to be checked again, especially the background and the discussion.
Thank you for the comment, we have done so.

Discretionary revisions:

I. You may add in your references more resent articles and you may add the following (KNOWLEDGE AND ATTITUDES RELATED TO SUN EXPOSURE AMONG ADOLESCENTS IN GREECE. Saridi M., Pappa V., Kyriazis I., Toska A., Giolis A., Liachopoulou A., Skiros E., Birbas K. RURAL AND REMOTE HEALTH) in your discussion (15, 156, et.c)
Thank you for providing this valuable reference, we have now included this reference in our discussion section on page 12.

**Minor Essential Revisions**

1. Page 3, Line 5: The word vitamin it has to be written in capital as previous

Thank you for the comment. We have made the change on Page 3, line 5.

2. Page 3, Line 12: There is no need to write again all the words (VDD)

Thank you for your suggestion. We have replaced Vitamin D deficiency with the abbreviation on page 3, line 12

3. Page 4, Line 14: Pakistan's geographically position is similar with many countries all over the World. You can use more literature here and in discussion about this item. Also you could use data from NASA satellite - NASA's Earth-observing Aura satellite- about the ozone hole.

Thank you for the valuable comment. We have added a few lines about location of Pakistan and its UV index on Page 3 under ‘introduction’ section.

4. Page 4, Line 1-2: You may be right about the questionnaire in Pakistan Population but you could find many others questionnaires studying sun exposure in similar populations like yours.

Thank you for your comment. regarding the availability of questionnaire that we developed and used. Unfortunately, we were unable to come across a study on sunlight exposure in South Asian countries. Through our literature search, we were not able to find sunlight exposure measurement questionnaires or sunlight diaries in studies done in Asian countries.

5. Page 4: Before starting the part of results you have to add Material and methods
Thank you for your observation and comment. We had initially formatted the manuscript according to ‘BMC public health guidelines’. We agree that methods should come before results and we have now formatted the paper in light with submission guidelines for BMC central.

6. Page 5, Line 1: Better start “As it seems from the recent literature”

Thank you for your kind suggestion. We have reworded the line in ‘Discussion section’ sections ‘Trough the recent literature, this study seems to be the first of its kind’. It can be traced in ‘Discussion’ section, on page 10, first line of last paragraph.

7. Page 5, Line 4: SEQ and not the whole words

Thank you for your comment. We have replaced the whole word with abbreviation.

8. Page 5, Line 11-18: You can add some more references

Thank you for your suggestion. We have updated our literature search and have added references in discussion section, page 11-12.

9. Page 5, Line 15-20: This has to put it in Limitations part

Thank you for your suggestion. We have made the suggested change in ‘Discussion’ section, page 12

10. Page 5, Line 22: PS, I think you have to write polysulphone if it’s the first time

Thank you for pointing our error. The word polysulphone has been used in the materials and method section, which we have now placed after ‘background & introduction’. Hence we can now use abbreviation on your correctly pointed out place.
11. Page 6, Second paragraph: This has to put it in Limitations part

Thank you for your comment. The paragraph pointed out is indeed describing the limitations of the study. We have now added an opening sentence to it that communicates to the readers that the paragraph explains the limitations. Changes have been made in the ‘Discussion’ section, page 12.

12. Page 7- Material and methods: More information about the questionnaires that were used and the validity(pilot-face…) you used too.

Thank you for your comment. We have added more information about the questionnaires in ‘Material and methods’ under the heading of ‘Study protocol’ on page 7 & 8. We developed the LT and ST SEM-Q after detailed literature search and several different types of data were collected in this study. Questionnaires were administered through a face to face interview. The LT-SEMQ had 3 elaborate components, the socio-demographic, sun exposure measurement, and skin tone assessment component. Biochemical assessment was carried out and UV Dosimeter data was collected from each participant. Details of each of these three types of data collection processes are described below. Prior to the actual data collection, pre-testing of the questionnaires was carried out on 15% of the sample (n=8) to ensure standardization and reliability of the questionnaire. The questionnaires were then revised and finalized on the basis of the pretest results.

13. Page 7- Factors affecting individual UVR exposure: Many of these must be put in Introduction part

Thank you for your keen observation. We have now mentioned the factors in the introduction section as well on page 3, last paragraph. These factors were put in method section instead of Introduction because one important aspect of the study was to ‘develop’ the questionnaires as well and questionnaire development process was hence explained in the method section.
14. Page 8- Development of the scoring system for LT SEM-Q and ST SEM-Q: Only the first three-four lines are needed and must be a part of the “Development of sunlight exposure questionnaires”

Thank you for your kind suggestion. We have rephrased the lines under the heading ‘development of scoring for questionnaires’, page 5. We, however, are not able to remove the specified heading as other reviewers have suggested more detail for scoring system development.

15. Page 8- Gold standard for validation of the questionnaires: You refer only about the validation of the UV dosimeters and not about the questionnaires

Thank you for your comment. The heading is perhaps confusing. The UV dosimeters are the gold standard for measuring sunlight exposure and the dosimeters, the gold standard, were used to validate the questionnaires. We have reworded the heading as ‘Gold standard for sunlight exposure measurement’ (page 6)

16. Page 8-9- Study setting and design: A short part of these must be added in material and methods

Thank you for your comment. We have moved the study setting and design into the first part of ‘materials and methods’ on page 4.

17. Page 9- Eligibility criteria: Put it in the end of material and methods too

Thank you for your suggestion. We have moved the eligibility criteria as suggested. (page 4, under ‘materials and methods’)
18. Page 9-10- Study protocol: It’s too big. There is no need to explain again all the protocol of your research.

Thank you for your comment. We have re-worded (page 7) the study protocol to make it as concise as possible.

19. Page 10- Potential confounders and sources of bias: Do you think those are limitations? And why you didn’t use a scale for phototype from other studies?

Thank you for your comments. The confounders and sources of bias were indeed not limitations. These confounders were adjusted during creating scores for the questionnaires. For the skin tone scale, we did come across two widely used scales, the Von luschan and the Firtzpatrick scale but these scales were mainly developed for Caucasian population. These two scales had 6 categories, ranging from very light or pale skin to very dark brown or black pigments, the two extremes not generally present in Asian population. We were unable to find a standardized scale for Asian population through literature search and therefore had to develop a skin tone scale.

20. Page 11- List of abbreviations: there is no need to submit this.

Thank you for your suggestion. BMC public health format required list of abbreviations but we have removed the abbreviation list from the text.