Preventive Medicine Reports 10 (2018) 43–48

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr

Reliability and consistency of a validated sun exposure questionnaire in a population-based Danish sample

B. Køster[a,b,*], J. Søndergaard[b], J.B. Nielsen[b], A. Olsen[c], J. Bentzen[a]

[a] Department of Prevention and Information, Danish Cancer Society, Strandboulevarden 49, 2100 Copenhagen Ø, Denmark
[b] Research Unit of General Practice, University of Southern, Denmark
[c] Research Centre, Danish Cancer Society, Denmark

ARTICLE INFO

Keywords:
Questionnaire
Validation
Reliability
Skin cancer
Prevention
Ultraviolet radiation

ABSTRACT

An important feature of questionnaire validation is reliability. To be able to measure a given concept by questionnaire validly, the reliability needs to be high.

The objectives of this study were to examine reliability of attitude and knowledge and behavioral consistency of sunburn in a developed questionnaire for monitoring and evaluating population sun-related behavior.

Sun related behavior, attitude and knowledge was measured weekly by a questionnaire in the summer of 2013 among 664 Danes. Reliability was tested in a test-retest design. Consistency of behavioral information was tested similarly in a questionnaire adapted to measure behavior throughout the summer.

The response rates for questionnaire 1, 2 and 3 were high and the drop out was not dependent on demographic characteristic. There was at least 73% agreement between sunburns in the measurement week and the entire summer, and a possible sunburn underestimation in questionnaires summarizing the entire summer. The participants underestimated their outdoor exposure in the evaluation covering the entire summer as compared to the measurement week. The reliability of scales measuring attitude and knowledge was high for majority of scales, while consistency in protection behavior was low.

To our knowledge, this is the first study to report reliability for a completely validated questionnaire on sun-related behavior in a national random population based sample. Further, we show that attitude and knowledge questions confirmed their validity with good reliability, while consistency of protection behavior in general and in a week's measurement was low.

1. Introduction

Intermittent and chronic sun exposure from the natural sun and artificial tanning is level I carcinogenic according to the WHO (IARC, 2011). Campaigns aimed at changing UV behavior, by reducing exposure at solar noon and using sun protection like clothe, shade hat and sunscreen, in the general population have been launched in several countries (Koster et al., 2009; Koster et al., 2010; Diffey and Norridge, 2009; Forsea and del Marmol, 2013; Dobbinson SJW et al., 2008; Garvin and Eyles, 2001; Stanton et al., 2004). The effects of these initiatives are generally evaluated by distribution of questionnaires (Saraiya et al., 2004), which are suitable for monitoring representative population-based samples and thus suited, when information regarding knowledge, attitude and behavior is desired. Few studies also used other methods than questionnaire (Andersen et al., 2016; O'Riordan et al., 2008). However, bias (recall, selection, social desirable answers) can potentially limit the reliability of conclusions drawn based on questionnaire data and it is thus essential that questionnaires are evaluated for validity and reliability (Edwards et al., 2009).

Reliability is an important aspect of questionnaire validation. Questionnaires should be able to reproduce results to be valid. Knowledge and attitude are concepts people normally do not change over short periods of time, however behavior questions relate on a specific period and therefore items addressing behavior loses reproducibility by time (Koster et al., 2016a). When evaluating sun related behavior on a weekly basis it is however relevant to know if that week reflects peoples' behavior in general. It has been shown that people might behave differently when being monitored by e.g. a personal dosimeter (Koster et al., 2016a; McCarney et al., 2007; Best and Neuhauser, 2006; Haggerty and Ericson, 2000; Strub, 1989).

Recently the first studies describing criteria validity from objective measurements showed that questionnaires could be applied for evaluation of sun-related behavior. All of these studies used measurement periods in the range of 7–10 days and with short recall period i.e. the

* Corresponding author at: Strandboulevarden 49, DK-2100, Denmark.
E-mail addresses: koester_brian@yahoo.com, brk@cancer.dk (B. Køster).

https://doi.org/10.1016/j.pmedr.2018.02.002
Received 4 August 2017; Received in revised form 26 December 2017; Accepted 5 February 2018
Available online 10 February 2018

respondents answered the questionnaire shortly after participating in the study (Cargill et al., 2012; Sun et al., 2014; Koster et al., 2016b).

Some questionnaires used for evaluations of health interventions aimed at reducing skin cancer have been tested for validity and reliability (Branstrom et al., 2002) and a few studies attempted to validate self-reported measures of UV-exposure by testing behavioral questions against objective measurements or against other self-reported data sources. However, these studies showed that it is possible to measure various aspects of people's behavior in the sun validly (Thieden, 2008; Thieden et al., 2006; van der Mei et al., 2006; English et al., 1998; Dwyer et al., 1996; Lower and Sanson-Fisher, 1998). These studies used diaries to assess sun related behavior, but diaries are not feasible for campaign evaluation, as they are an intervention per se. Recently, we published comprehensive studies of sun exposure criteria validity and of sun related knowledge, attitude and behavior conceptualized scales, which demonstrated high validity and described relevant scales to use as milestones in campaign evaluation (Koster et al., 2016a; Koster et al., 2016b; Koster et al., 2017; Koster et al., 2015a). Important aspects of the validated sun exposure questionnaire were not described, however.

The aims of this study were to examine reliability of attitude and knowledge items and behavioral consistency of a developed questionnaire for monitoring and evaluating population sun-related behavior. To our knowledge, this is the first study to report reliability and behavioral consistency for a completely objectively validated questionnaire on sun-related behavior in a national random population based sample.

2. Methods

2.1. Study design and population

In March 2013, a random sample of Danes in the age 15–65 years was drawn from the Danish civil registration system. An invitation to participate in the study was sent by mail in the end of April. To be eligible to the study potential participants should be able to wear a personal dosimeter wristband for one week of their summer vacation in Denmark in the weeks 19–35 (May–August) and complete an electronic questionnaire afterwards. The invitees signed up on the project page www.mituv.dk and indicated available weeks. Potential participants where then allocated to a participation week and contacted by phone at least one week in advance to receive instructions. Potential participants with more than one summer vacation week were allocated to a low season week, if available, to increase sample utilization. Participants who confirmed their participation by phone were sent a dosimeter including instructions and a prepaid envelope by ordinary mail. After participation they returned the dosimeter for data retrieval and were sent a questionnaire (Q1) the following week to assess their sun-related behavior in the measurement week as well as attitudinal and knowledge deficit scales. After additional four weeks the participants were sent a reliability questionnaire (Q2) including only attitudinal and knowledge deficit scales. Finally, from September 2013 or at least 2 weeks after Q2 participants were sent a questionnaire (Q3) to assess their sun-related behavior during the entire summer. Fig. 1 shows the flow of the project.

The study population was aimed to be representative of the Danish population within gender, age groups (15–24, 25–34, 35–44, 45–54, 55–65) and region. The recruitment of the 15–17-year-olds required parental consent in which case the invitation letter was initially directed to one of the parents. Persons who have inquired not to be drawn for research projects were excluded from the sample.

2.2. Ultraviolet dosimeter

The items described in this paper are relatable to objective measurements of UV-exposure. The use of personal dosimetry methods was previously described (Koster et al., 2016b; Koster et al., 2017) as well as their association to items.

2.3. Sample size, bias and confounding

The initial sample size was given by the restricted availability of qualified dosimeters in combination with the summer study period as well as a measurement period of 1 week and was previously described (Koster et al., 2016a; Koster et al., 2015a). Potential confounding was accounted for by including personal factors (gender, age region, skin-type, education, family history, sun protection behavior) and external factors (Ambient UV, week of participation) in the analysis of questionnaire reported and registered dosimeter data.

2.4. Questionnaire and scales

In addition to the questionnaire, Q1 previously described (Koster et al., 2016b), a questionnaire Q2 which was identical, but included only questions on knowledge and attitude was distributed. This questionnaire was used to examine the reliability in a classical test-retest setup (Branstrom et al., 2002; McMullen et al., 2007; Westerdahl et al., 1996). The third questionnaire Q3 included questions on the behavior only. However, the Q3 questionnaire was similar in design to the original evaluations of the Danish SunSmart campaign, addressing the behavior of the past summer (Behrens, 2014). We examined reliability by testing Q2 vs Q1, which compared identical questions and we examined consistency by testing Q3 vs Q1, however Q3 and Q1 compared similar questions only with different time ranges e.g. ‘In the past week did you experience sunburn?’ vs ‘In the past summer did you experience sunburn?’ and ‘In the week of your vacation how much of the time did you use the following protection?’ vs ‘In the past summer when you were of work and the sun was shining – how much of the time did you use the following protection?’ etc. Skin type was assigned according to Fitzpatrick (Fitzpatrick, 1988) by self-evaluated skin tan/burn reaction upon season's first exposure to the sun. The questionnaire was applied in Danish. English translated version of the questionnaires is available as supplement as well (Koster et al., 2016b).

2.5. Statistics

For all tests, p values < 0.05 were considered statistically significant. We used SAS version 9.3 (SAS Institute, Cary, North Carolina, USA) for the analyses. We compared on item level and on scale level whenever relevant. We calculated Kappa for items and intra class correlation for scales.

The project was sent to The National Committee on Health Research Ethics who decided that their approval was not necessary. Danish Data Protection Agency gave approval number 2012-41-0100.

3. Results

3.1. Participants

In Fig. 1, we show the flow of the study. Six thousand persons were invited and of those 25% signed up for participation. We collected data from 749 successful dosimeter measurements and we received 736 completed questionnaires and for 664 persons we have complete data for both dosimetry and questionnaire Q1 with a response rate of 89%. For these 664 participants 89% and 82% respectively completed Q2 and Q3.

3.2. Descriptive data

In Table 1, we show the distribution of demographic characteristics among participants who completed Q1, Q1 and Q2, and Q1 and Q3. The loss of participants was evenly distributed for all characteristics. More women than men were enrolled in the final sample compared to the