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Title:
German translation and content validation of the OSTRC Questionnaire on overuse injuries and health problems

Running head:
The OSTRC Questionnaire - German translation

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Abstract:
The importance of a standardised injury and illness surveillance system in elite sports has been emphasized several times in the recent literature. The Oslo Sports Trauma Research Centre Questionnaire on Health Problems has been proven to be a reliable and valid tool in monitoring acute and overuse injuries as well as other medical conditions including illnesses. The aim of this study was to translate, culturally adapt, and validate the OSTRC Questionnaire in a German context. A standardised translation method was used to translate the questionnaire, resulting in very high internal consistency and good test-retest reliability (Cronbach's Alpha 0.92, intraclass correlation coefficient (ICC) 0.91). Final validation was done in 24 high-level Paralympic athletes followed over 20 consecutive weeks showing a very good compliance (mean response rate 92%) and high acceptance by the athletes.

Keywords Injury surveillance; overuse injuries; epidemiology; injury prevention; cross-cultural adaptation; questionnaire

Introduction:

The importance of a standardised injury and illness surveillance system in elite sports has often been highlighted over the past decade (Clarsen, Ronsen, Myklebust, Florenes, & Bahr, 2014; Ekegren, Gabbe, & Finch, 2016). Although surveillance systems have successfully been implemented in major international sports events such as Olympic Games and sport specific championships (Alonso et al., 2012; Alonso et al., 2009; Alonso et al., 2010; Edouard, Depiesse, Hertert, Branco, & Alonso, 2013; Engebretsen et al., 2010; Junge et al., 2009; Mountjoy et al., 2010; Ruedl et al., 2012) and a reduction in injury incidence was demonstrated in elite Olympic and Paralympic sports following implementation of injury prevention strategies (Webborn, 2013; Willick et al., 2013), continuous health monitoring of athletes in individual sports during out-of-competition phases is rare (Clarsen, Myklebust, & Bahr, 2013; Clarsen et al., 2014; Mountjoy et al., 2015; Timpka et al., 2014).

Recent studies pointed out that injury in the month before important championships is very frequent and represent a risk factor for sustaining an injury during the championship (Alonso et al., 2015; Edouard, Depiesse, Branco, & Alonso, 2014; Mountjoy et al., 2015). Additionally, several high quality studies have shown that much higher injury rates are reported when athletes are continuously monitored than when they are monitored retrospectively (Bjorneboe, Florenes, Bahr, & Andersen, 2011; Ekegren et al., 2016; Junge & Dvorak, 2000). Junge and Dvorak showed that fewer than two out of three injuries and illnesses in soccer are reported retrospectively at the season's end (Junge & Dvorak, 2000). Thus, there are many sound reasons to implement a valid weekly reporting system for high-level athletes.

In 2013, Clarsen et al. developed and validated the OSTRC Overuse Injury Questionnaire (Clarsen et al., 2013), which enables the continuous monitoring of the consequences of overuse sports injuries in groups of athletes. The aim of this questionnaire was to capture all health problems perceived by the athlete regardless of its severity. Additionally, the injury severity should be determined based on changes in the athlete's sports performance, participation and symptoms, rather than on the duration of time loss, as is traditionally done. The questionnaire was then adapted to capture all types of health problems, including acute injuries and illnesses, and renamed the Oslo Sports Trauma Research Center Questionnaire on Health Problems (Clarsen et al., 2014). This method was prospectively evaluated in Norwegian athletes preparing for the London 2012 Olympic and Paralympic Games (Clarsen et al., 2013), and has since become part of the normal follow-up of Norwegian Olympic and Paralympic athletes.

The aim of the present study was therefore to translate and culturally adapt the OSTRC Questionnaire in the German context including validation in a professional Paralympic Athletes´ cohort so as to establish a similar monitoring system for the German Paralympic team.

Material and methods

Methods

The questionnaire

The OSTRC Questionnaire on Health Problems begins with four key questions recording the level of participation and performance impairment and the degree of symptoms caused by injury or illness. A single severity score is then calculated based on these four questions (Clarsen et al., 2013). Subsequent questions allow the athlete to report the anatomical location of injuries or list illness symptoms, and to provide additional information about the problem such as the number of days of time loss, and whether they have received medical attention. It is designed to be distributed weekly to all athletes being monitored, irrespective of their current health status.

Approval to translate the questionnaire into German, validate it, and use the questionnaire, was obtained from the head of the research group. In our cohort, the questionnaire was set up on an internet open-source platform for scientific questionnaires (*www.soscisurvey.de)*. The Web-link was distributed via e-mail.

Ethical approval

The study was approved by our University´s Ethics Committee (approval 522/15) and complied with the Declaration of Helsinki.

Translation and Evaluation Process

The English version of the OSTRC Questionnaire on Health Problems was used for the German translation. The translation of the questionnaire was conducted according to the guidelines published by Beaton et al. (Beaton, Bombardier, Guillemin, & Ferraz, 2000) as well as a slightly modified back-translation method described by Werner and Campbell (Werner, 1970).

The translation process included the following five steps: (a) forward translation by 3 independent English-German bilingual individuals; (b) primary evaluation of the comprehensibility of the translated questionnaire; (c) back translation into English by 2 English native speakers blinded to the original and the intended use of the questionnaire; (d) discussion in an expert committee and agreement on a final version; and (e) evaluation of the test-retest reliability and content validation in 24 high-level Paralympic athletes.

1. Forward translation. Three independent bilingual German residents (T1, T2 and T3), with German as their mother tongue, translated the entire English questionnaire into German. T1 and T2 were aware of the concepts being examined, whereas T3 was not (Beaton et al., 2000). The project manager was one of the translators and participated in all steps in the adaptation process (Wild et al., 2005).
2. Agreement. An initial consensus meeting was held with the 3 translators (T1, T2, and T3) to address discrepancies in the forward translations. A written report documented issues in relation to the translation process (Beaton et al., 2000). Unresolved queries were cleared with the original developer (Clarsen et al., 2013).
3. Evaluation of comprehensibility. 24 high-level German Paralympic athletes were asked to complete the translated questionnaire and make suggestions for improving it.
4. The consensus questionnaire was than back translated by two German-speaking residents whose mother tongue is English (BT1 and BT2). BT1 and BT2 have no medical background but are postgraduate schoolteachers (mathematics, German and music) as well as professional medical English translators. BT1 and BT2 were both blinded to the purpose of the questionnaires and had no insight into the original English version (Beaton et al., 2000).
5. The German and English translated versions were then compared with the original versions to ensure conceptual equivalence; the remaining discrepancies and ambiguities were resolved in a consensus meeting among the project manager, the forward and backward translators. The original developer of the questionnaire was involved via e-mail and telephone contact (Wild et al., 2005).
6. Validation: 24 Paralympic athletes completed the questionnaire during 20 consecutive weeks. In week 10, they were additionally asked how satisfied they were with the questionnaire and the project. At the end of the 20 weeks, a test-retest analysis was performed, the athletes being asked to complete the questionnaire twice within 48 to 72 hours. They were also asked about the comprehensibility of each question and additional comments.
7. A final version of the questionnaire considering all the aforementioned aspects was generated, proofread, and checked for errors of spelling and grammar; the layout was finalized by an expert committee consisting of the project manager, T2 and T3, as well as an independent research sports scientist (Beaton et al., 2000).

Athletes and recruitment

The initial cohort was defined as all members of the national paracycling team Germany (26 high-level athletes). 24 athletes agreed to participate and signed written informed consents.

The participants' demographics are summarized in Table 1. After signing the consent form, athletes were contacted each week via e-mail and reminded two days later if the questionnaire had not been turned in.

Statistics

Instruments used for individual assessment in clinical practice should reveal high test–retest reliability, i.e., an intraclass correlation coefficient (ICC) of at least 0.90 (de Vet, 2011; Jorgensen, Rathleff, Rathleff, & Andreasen, 2015).

We included 24 participants in the OSTRC Questionnaire study and 19 participants in the test-retest analysis. Internal consistency was determined by calculating Cronbach's alpha with 0 indicating no internal consistency and 1 corresponding to perfect internal consistency. ICC was calculated from the test-retest measurement to analyse reliability. Statistical analysis was processed using SPSS 23.0.

Results

Translation and adaptation

There were no major problems with the questionnaire's forward translation process. Minor discrepancies included the synonymic use of nouns explaining symptoms or localisation of injury, the use of singular vs. plural, use of past tense or perfect, sentence structure and the use of prepositions. Typical examples are "vergangene Woche = past week" instead of "letzte Woche – last week", "gesundheitliche Probleme = health problems" instead of „gesundheitliche Beschwerden = health complaints", "In großem Umfang = to a major extent" instead of „in beträchtlichem Umfang = to a considerable extent".

A few times, intentional changes to the literal interpretation and syntax of the original questionnaire were made. In the original questionnaire, the authors used headings in some of the answers to questions 1-3 ("no reduction", "to a minor extent" "to a moderate extent") whereas the last answer always includes a verb ("cannot participate at all"). We discussed keeping this structure instead of changing it to consistently use headings only ("no participation" instead of "cannot participate at all". We decided for a compromise "no participation possible". Additionally, a question about training volume was added to the questionnaire following the suggestion by several athletes.

Two unresolvable problems were identified and clarified by contacting the original researcher. Firstly, the meaning of "fainting" was cleared to mean a genuine syncope involving a loss of consciousness rather than "dizziness/feeling faint/presyncope". Second, "to a major extent" is considered equivalent to "to a severe extent" and can thus be used synonymously.

Validation/Follow-up

All 24 athletes were followed over 20 consecutive weeks. There were 17 male and 7 female athletes. The athletes' characteristics are presented in table 1.

Out of the 24 athletes, 17 showed high compliance with weekly returns and with a maximum of one missing questionnaire within the 20 weeks. In total, 439/480 questionnaires were returned, corresponding to a response rate of 91.5%. In one hundred of the questionnaires, illnesses or injuries were documented, corresponding to five athletes per week (20.8%) reporting health problems. While 10 athletes weekly returned all 20 questionnaires, most of this cohort had a varying response rate, ranging from 5% to 35% missing surveys. A blind athlete, who needed help to complete the survey, had the highest missing rate (70%).

Overall, 114 lost training-days because of illness or injury were reported; split into 90 days attributed to illnesses and 24 to injuries. An average 3.0 ± 3.9 training-days were lost per illness, a mean of 1.0 ± 1.4 training-days were lost per injury. In our cohort of 24 athletes there were a total of 5.0 ± 5.2 lost trainings-days per week because of illness, and 1.2 ± 1.3 days per week because of injuries.

Test-retest

A test-retest analysis was possible in 19 participants. No major intra-individual disagreements were observed in the test-retest-answers on the first and the second completed questionnaires. The OSTRC-G demonstrated good reliability: the ICC was 0.91 for the injury severity index.

Mean values for Cronbach's alpha within the 20 weeks ranged from 0.67 to 0.98 with a mean value of 0.92, showing high internal consistency. Lower Cronbach´s alpha was associated with low variance at this measurement point (the range restriction in the items being the primary reason for the low alpha value). All the participating athletes rated the both questionnaire and all items on it as being

"understandable". Suggestions for linguistic improvement were minor. Several athletes suggested independently that a question be added about the weekly training volume. Acceptance of the injury and illness surveillance project was also queried, and was rated very high.
Injury Severity Scores ranged from 0 to 100, with the mean scores ranging from 1.7 to 21.1, respectively. These scores revealed considerable floor effects, as most of the participants marked very low values primarily. We identified two main patterns after having analysed individual ISS scores over the 20-week observation period. Several athletes had one or 2 peaks, with almost all their other values (including those the week before and after the peaks) being zero. This would be typical of a respiratory tract infection. In contrast, other athletes had a persistent, slightly elevated score fluctuating over a longer time span, which would be typical of a low-grade overuse injury or a chronic illness.

Discussion
The importance of a valid monitoring tool for injury and illness surveillance in high-level athletes has been emphasized numerous times in recent years. The OSTRC Questionnaire on Health Problems was developed and validated at the Oslo Sports Trauma Research Centre in Norway. The questionnaire is of very good test-quality and enjoys a high level of acceptance by athletes (Clarsen et al., 2013).

Translation and adaption
Until now, there had been no comparable questionnaire available in the German language. Therefore, an internationally recognised methodology was applied to translate the OSTRC Questionnaire into German and adapt it to the German context (Beaton et al., 2000; Ekman et al., 2015; Jorgensen et al., 2015). After independent forward and backward translations, a consensus meeting with all translators and a neutral, uninvolved sports scientist was held for harmonisation. The translated questionnaire was also context-validated by a cohort of 24 high-level Paralympic athletes over 20 consecutive weeks, and subjected to test-retest evaluation.
Our results clearly show that the German version of the OSTRC Questionnaire is valid, reliable, and acceptable for use in a German elite athlete population. No major disagreements were observed between the OSTRC and the back-translated version of the OSTRC Questionnaire in a German context. This observation is in line with two published translations of OSTRC Questionnaire into Swedish (Ekman et al., 2015) and Danish (Jorgensen et al., 2015). However, two main conflicts were raised and discussed by the harmonisation committee. Both conflicts were clarified with the research team of the original questionnaire (Clarsen et al., 2013) and matched accordingly. According to the repeated suggestion made by different athletes of having recorded the training volume, we added a question about weekly training volume to the questionnaire. Such an addition was also reported during the adaptation process of the Swedish translation published by Ekman et al. (Ekman et al., 2015). The Swedish group finally used two open background questions on the time of exposure during training as well as on exposure during competition. In the German version, we only added one question about the sum training volume per week (hours/miles per week). The original questionnaire was designed to be flexible, allowing project- and context-specific questions such as sporting exposure to be added to the end.

Response rate
Overall, we observed very high acceptance and compliance from our cohort of athletes, whose response rate was >90%. More than 70% of the athletes (17 /24) had not more than a maximum of one missing questionnaire over the 20-week period. Only two athletes missed more than 20% of the questionnaires, one of whom was a blind athlete who needed personal assistance to complete the questionnaire. These findings on high response rates confirm the results published by the Norwegian, Swedish and Danish group (Clarsen et al., 2014; Ekman et al., 2015; Jorgensen et al., 2015).

Test-retest
We conducted a test-retest analysis also, distributing the questionnaire twice within 48 to 72 hours. 19 participants successfully returned both questionnaires. No major intra-individual disagreements were observed in the test-retest-answers; the ISS scores' ICC amounted to 0.91. This reinforces the

results of Jorgensen et al., who reported considerably lower ICC values after a test-retest period lasting two weeks (ICC=0.62) than lasting one week (ICC=0.72) (Jorgensen et al., 2015). A longer period of time may allow to much time for natural changes in the severity of injuries and illnesses to occur, which may make the questionnaire seem less reliable than it actually is. Of course, memory effects or a recall-bias must be assumed when using a brief period of 2-3 days for retest (Streiner, 2014). However, the very high variability of the attributes and the sum score must be considered in this context. Considerable change is possible even during a single training session. The questionnaire is distributed regularly on a weekly basis in order to capture even minor problems in athletes' training habits, performance and well-being as early as possible. We thus did not think a longer time frame would have facilitated the assessment of test-retest reliability as the findings of Jorgensen et al. could show (Jorgensen et al., 2015). This preliminary assumption was supported by our analysis of the individual ISS scores over the 20 weeks. We noted strong fluctuations in intra-individual ISS scores/values from one week to the next. In our opinion, the ICC would, therefore, lose validity in conjunction with a longer test retest interval.
The mean Cronbach's alpha value over the 20 weeks was 0.92, showing high internal consistency. This concurs with the results of Clarsen et al. (Clarsen et al., 2015)reporting a Cronbach's alpha of 0.91 as well as Jorgensen 2015 (Jorgensen et al., 2015).

Injury severity score
Weekly absolute ISS scores ranged from zero to 100; mean ISS scores from 1.7 to 21.1, respectively. The considerable fluctuations from one week to the next can be interpreted as success for this monitoring tool, assuming that a prompt reaction by the medical team has a high impact on the history of the injury/illness resulting in rapid recovery. On average, over a fifth of the athletes on average reported health problems per week, leading up to a total of 114 lost training-days. These results highlight the need for and importance of an injury and illness surveillance system, not just during major sport events, but also in periods between events, to identify any early health-related risks of injury and other physical complaints. One could also argue that athletes are more susceptible to symptoms even when they are perceived as quite minor and that they tend to rate their consequences rather high. Some athletes revealed a slightly elevated score fluctuating persistently over a rather long time span. This finding can either be interpreted as reflecting a tendency to complain, or as an athlete suffering from a subacute illness/disease that they tolerate although it seems to impair their training or performance. In the authors´ opinion often working with disabled athletes it is more likely to be the latter; tolerating chronic problems, rather than complaining. But there is still high individual variability. With an increasing sample size in the future, cluster analysis will enable us to match types.

Perspectives
This study demonstrates that the translated German version of the OSTRC Questionnaire is a reliable and valid tool with high internal consistency for the medical monitoring of German athletes. The German Questionnaire, thereby confirmed the results of the Swedish (Ekman et al., 2015) and the Danish translations (Jorgensen et al., 2015).
The translated OSTRC Questionnaire therefore offers the opportunity for a continued surveillance of high-level German athletes in order to monitor and promptly treat medical conditions. Our experience in conducting this study support those of Clarsen et al., who contended that a fast reaction to potential medical problems can considerably expedite rapid recovery (Clarsen et al., 2014). Long-term observations of a larger cohort of Olympic and Paralympic athletes from different disciplines and with different handicaps should be conducted to deepen our knowledge of injury and illness prevalence in various sports, different athletic groups, and in different levels of athletic intensity.

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Table 1 Participants´ characteristics

Participants	24
Sex	17 male, 7 female
Age	37.8 ± 10.4 years (25-55 years)
Sport	21 paracyclists (9x handbike, 8x bicycle, 2x tricyle, 2x tandem); 3 able-bodied tandem pilots
Weekly training volume	14.4 ± 1.4 hours
Athlete-days	20x7x24=3360
Lost training-days	114 (3.4% of athlete-days)
because of illness	90 (mean 3 ± 3.9 per illness)
because of injury	24 (mean 1 ± 1.4 per injury)
Time to complete OSTRC-G	90.5 ± 20.7 seconds
Response rate	91.5 ± 5.4%
Handicap	para-/tetraplegia n=10, limb pathologies n=7, cerebral impairments n=2, visual impairments n=2

Fig 1: 3 typical courses of the ISS Score over the 20 consecutive weeks