

Translating and Validating the Dutch version of the Oral Health Assessment Tool for Older people.

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ABSTRACT

Background In the increasing population of older people there is a significant risk of developing complex oral health problems. Worldwide, 56% to 85% of dentate senior citizens suffer from periodontal diseases, particularly community-dwelling older people have poor oral health. Nurses are responsible for the daily oral hygiene of their patients by signaling and reporting oral health problems. The Oral Health Assessment Tool (OHAT) is a validated instrument that could help nurses with identifying oral health issues, but a validated Dutch version of the OHAT is not yet available.

Aim The aim of the study was to translate the original English version of the OHAT into a Dutch version (OHAT-NL), and to test structural validity, internal consistency and inter-rater reliability, for use among care-dependent community-dwelling older people in the Netherlands.

Methods A cross-cultural validation study was done, which consisted of two phases: translation and validation. The five steps of Beaton's translation process were followed. The resulting OHAT-NL was then validated on care-dependent community-dwelling older people. Inter-rater reliability was determined by using the intraclass correlation coefficient (ICC). Individual items were compared using the Kappa statistic. Structural validity was determined using an exploratory factor analysis. Eigenvalues greater than one were retained in the factor structure. Lastly, the internal consistency was assessed using the Cronbachs Alpha (CA).

Results Inter-rater reliability was good with an ICC of 0.79. Agreement on item level ranged from fair to very good, kappa ranged from 0.36-0.89, with the lowest agreement on the item 'oral cleanliness', and the highest agreement on 'dental pain'. The factor analysis showed that the OHAT-NL consists of four underlying concepts. The CA was 0.56.

Conclusion The findings suggested that the OHAT-NL is a reliable tool, but not valid in community-dwelling older people. The tool has to be adapted before it can be used in practice.

Keywords: Oral health; Older people; OHAT; Oral Health Assessment Tool.

ABSTRACT DUTCH

Achtergrond In een toenemende populatie van ouderen is er een aanzienlijk risico op het ontwikkelen van complexe mondgezondheidsproblemen. Wereldwijd lijden 56-85% van de ouderen aan parodontale aandoeningen. Met name thuiswonende ouderen hebben een slechte mondgezondheid. Verpleegkundigen zijn verantwoordelijk voor de dagelijkse mondhygiëne van cliënten en het signaleren en rapporteren van mondgezondheidsproblemen. Verpleegkundigen vinden het lastig om problemen in de mond te signaleren, een meetinstrument zou hen daarbij kunnen helpen. De “Oral Health Assessment Tool” (OHAT) is een gevalideerd instrument voor de gezondheidszorg. Tot op heden is er geen Nederlandse versie van de OHAT gevalideerd.

Doel Het doel van deze studie was om de originele OHAT te vertalen naar een Nederlandse versie (OHAT-NL) en om structurele validiteit, interne consistentie en interbeoordelaarsbetrouwbaarheid te testen, voor gebruik onder zorgafhankelijke thuiswonende ouderen.

Methode Een cross-culturele validatiestudie werd uitgevoerd, bestaande uit twee fasen: vertaling en validatie. De vijf stappen van het vertaalproces volgens Beaton werden gevolgd. Ten slotte is de OHAT-NL gevalideerd in de praktijk. The structurele validiteit werd bepaald door een explorerende factor analyse. Eigenwaarden groter dan één werden meegenomen in de factor structuur. Interbeoordelaarsbetrouwbaarheid werd bepaald door de intraclass correlatiecoëfficiënt. Individuele items werden met elkaar vergeleken door een Kappa te berekenen. The interne consistentie werd bepaald door de chronbachs alpha te berekenen.

Resultaten Uit de factoranalyse kwamen vier onderliggende concepten, waardoor de OHAT-NL een multifactorieel meetinstrument is. Interbeoordelaarsbetrouwbaarheid was goed met een ICC van 0.79. Overeenstemming op itemniveau varieerde tussen redelijk en erg goed, met kappa's tussen 0.36-0.89. De laagste overeenstemming werd gevonden op het item 'mondhygiëne' en de hoogste overeenstemming op het item 'tandpijn'. The chronbachs alpha was 0.56.

Conclusies De OHAT-NL is een betrouwbaar maar niet valide instrument voor thuiswonende zorgafhankelijke ouderen. Voordat het instrument in de praktijk kan worden gebruikt moet hij aangepast worden.

INTRODUCTION

In the increasing population of older people there is a significant risk of developing complex oral diseases and dental problems¹. Worldwide, 56% to 85% of older people suffer from periodontal diseases - diseases of the gums around the teeth²⁻⁴. Oral health and general health mutually influence each other. Care-dependency and frailty are predictors of poor oral health because of the interaction between oral health, systematic diseases, medication use, and failing oral hygiene⁵. Care-dependency in this study is operationalized as “the self-care abilities of a person in terms of their daily physical and psychosocial human needs that have decreased to such an extent that the person’s care demands are, to some degree, dependent on professional support”⁶. Among care-dependent community-dwelling older people in the Netherlands, 53% had poor oral hygiene, 54% had caries, and 75% of wearers of complete removable dental prostheses had fitting problems. Only 31% of the people went to routine dental check-ups⁷. Lastly, of the people entering a nursing home, 66% of them had poor oral health⁸. Oral health was assessed by a dental examination. Assumedly, a large proportion of the persons will have received some form of homecare before being admitted in a nursing home. Therefore, community nurses play an important role in maintaining oral health.

Poor oral health can lead to life-threatening conditions, including infections^{9,10}, malnutrition and dehydration¹¹⁻¹³, and cardiovascular diseases^{14,15}. Poor oral health does not only affect general health, but it also affects quality of life¹⁶. Moreover, the mouth plays an important role in speech, communication and appearance. Therefore, poor oral health may lead to low self-esteem, social isolation and depression¹. Oral health maintenance was considered to be important according to senior citizens. Their main concerns were losing autonomy, losing control of dental treatments or losing dignity and self-esteem¹⁷. Nurses have an important role in maintaining oral health and providing oral hygiene. Oral health and oral hygiene are part of the Fundamentals of Care (FoC) according to Kitson¹⁸. FoC aims to integrate the physical, psychological and relational nursing care. Oral health and oral hygiene are part of physical nursing care. In addition, the Dutch Oral health Guideline for Older people in Long-term care Institutions (OGOLI), which is used in community nursing, states that nurses are responsible for daily oral care, like brushing teeth and dentures, and signaling and reporting oral health problems¹⁹. Contrary to the guidelines, oral health is not felt as a ‘core business’ for nurses, and difficulty is experienced in noticing oral health problems. This is caused by a lack of knowledge and a lack of reflection²⁰. Oral health problems are often identified too late, making older people long-term dependent on care. In conclusion, to identify problems ahead of crisis, and to make nurses aware of oral health problems, an assessment instrument is indispensable.

There are several instruments for assessing oral health problems, such as the Revised Oral Assessment Guide (ROAG)^{21,22}, the Brief Oral Health Status Examination (BOHSE)²³ and

the Oral Health Assessment Tool (OHAT)²⁴. The ROAG has limited evidence for validity and reproducibility; validity was only high for trained community workers. The BOHSE is a validated tool for nurses in health care facilities. The BOHSE was simplified into the OHAT by Chalmers²⁴. The OHAT is an instrument measuring the oral health through structured observation; it is validated for professionals, including nurses. The OHAT consists of eight items: lips, tongue, gums and tissues, saliva, natural teeth, dentures, oral cleanliness and dental pain²⁴. Its reliability is high, with an Intraclass Correlation Coefficient (ICC) of 0,96²⁵. Criterion validity was assessed, with high agreement on six out of the eight questions²⁴. Therefore, the best validated tool for assessing oral health problems seems to be the OHAT.

No validated Dutch version of the OHAT is available. Everaars²⁶ and Baat & Klüter²⁷ translated the OHAT independently. However, these translations were not produced in accordance with the guidelines for translation²⁸, nor have they been validated. The COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) developed a taxonomy and guidelines to use in validation studies. COSMIN divided the measurement properties in three groups: validity, reliability and responsiveness²⁹ (see Figure 1 for the complete taxonomy). In this study, the structural validity, internal consistency and inter-rater reliability will be determined.

[insert figure 1]

In conclusion, oral health problems are common among senior citizens, and nurses lack the knowledge to identify these problems. The OHAT could help identify oral health problems, but no validated Dutch version of the OHAT is currently available. Therefore, this study will translate the OHAT into Dutch and cross-culturally validate the Dutch version of the OHAT according to the COSMIN.

AIM

The aim of this study was to translate the original English version of the OHAT into a Dutch version (OHAT-NL), and to test the structural validity and inter-rater reliability for use among care-dependent community-dwelling older people in the Netherlands.

METHODS

Design

A cross-cultural validation study was done, which consisted of two phases: the translation process and the validation process. The translation process had a qualitative approach, while the validation process had a cross sectional design.

Translation

The 'Guidelines for the Process of Cross-Cultural Adaptation' were followed in the translation process²⁸ (see Figure 2).

[insert figure 2]

The original OHAT questionnaire was independently translated into Dutch by two bilingual translators whose native language was Dutch. The Everaars²⁶ and Baat & Klüter²⁷ versions were used as the independently translated versions. The aforementioned are experts in the oral health field. The two forward-translations were merged into one forward translation. The resulted forward-translation was independently back-translated into English by two bilingual translators whose native language was English.

Expert meeting

All translations were compared for conceptual equivalence by the expert panel. The expert panel consisted of a dental hygienist and researcher (BE), a professor in Geriatric Dentistry (CB), a dentist (WK), an elderly care physician (GP), two nurse scientists (GH and HN) and one community nurse (AH). Discrepancies between versions were discussed and the pre-final version of the OHAT-NL was refined. The expert meeting was recorded with two devices, and notes were taken to give insight into the process.

Pretest

The pretest took place in February and March 2019. The translated OHAT was tested in a group of thirty-one nurses from different fields of nursing. Each of these nurses applied the OHAT-NL to one patient and answered questions about the comprehensibility of the tool. Nurses were approached by e-mail and answered open questions in a digital questionnaire. The answers were then analyzed qualitatively by the research group, which discussed the feedback of the nurses and made final modifications.

Validation

Between March and May 2019, the OHAT-NL was tested among care dependent community-dwelling older people aged 65 years or more. We approached 75 older people who met the following inclusion criteria: the participants were community dwelling people, were 65 years and

older, understood the Dutch language and were mentally competent. Terminally ill people were excluded from the study to avoid burdening them with the mouth assessment.

Setting and Participants

Participants were recruited in a community nursing team in the Eastern part of the Netherlands through convenience sampling. All eligible patients of that team received an information letter from their nurses. In the letter, an informed consent form (ICF) was included. After the patients signed and returned the ICF to the nurse, they were contacted about participating. An appointment was then made for the mouth assessment at their home.

Data collection and procedures

During the mouth assessment the OHAT-NL was completed by two raters, they were community nurses with a bachelor's degree. The raters received a two-hour training from a nurse specialized in oral health, where they learned about oral health, the most common problems and how to perform a mouth assessment. The nurses performed the mouth assessment one after the other and independently, meaning that the raters were not in the same room during the mouth assessment.

For the inter-rater reliability, a sample size of at least ten participants was computed, based on a power of 80% and alpha of 0.05 and a minimal ICC of 0.75, which indicates at least good agreement³⁰. For the structural validity eighty persons were needed according to the rule of thumb - ten persons per item³¹. However, with less participants, a first impression of the underlying concepts could be given.

Data

Data was collected using the OHAT-NL. The OHAT-NL consists of eight items, and nurses could answer with three options: '0=healthy', '1=changes', and '2=unhealthy'. When an item is scored 1 or 2, the patient has to be referred to a dentist. Additionally, date of birth, gender, presence of chronic diseases, medication use, type of dentures/natural teeth, last dental appointment, last oral hygienist appointment and Activities of Daily Life (ADL) were gathered. ADL was assessed using the Katz-ADL. This is a valid and reliable instrument for measuring ADL in older people in several settings³². KATZ-ADL can range from 0 to 6, where 0 is fully independent and 6 is fully dependent on professional help.

Missing data

Participants with two or more missing items were excluded. In case only one item was missing, the item was replaced by mean imputation. Some items are not applicable for all participants. For example, the item 'Natural teeth' is not applicable for participants with full dentures. These

missing items were filled in with the score 0, as if the item was 'healthy'. A score of 0 means that patients do not have to be referred to the dentist, and thus a healthy score makes sense.

Data analysis

General psychometric proportions

Answer proportions of each OHAT-NL item and OHAT-NL total scores were calculated. Floor and ceiling effects were calculated. Floor and ceiling effects were considered present if more than 15% of the participants had the lowest or highest possible total score³³. Data was checked for normality by determining skewness and kurtosis.

Reliability

Inter-rater reliability was assessed by using the Intraclass Correlation Coefficient (ICC) for the OHAT-NL total scores. ICC estimates and their 95% confident intervals were calculated using SPSS version 23 (SPSS Inc, Chicago, IL) based on a single rating, absolute agreement, and the two-way random effects model. The two-way random effects model³⁴ was used because the raters were selected from a larger population. Single measures³⁴ was used because the single measurements of the raters was used and not the average. Lastly, consistency is being pursued and not absolute agreement. The raters do not have to give the exact same answer, but there has to be a correlation between the raters' answers³⁴. ICC value was interpreted as follows: values less than 0.5 are poor, between 0.5 and 0.75 are moderate, between 0.75 and 0.9 are good, and greater than 0.9 are excellent reliability³⁴. For every single item a weighted kappa was determined by using the VassarStats webtool³⁵.

Validity

Structural validity was determined by using an Exploratory Factor Analysis (EFA). EFA in such a small sample gives a first impression of the underlying factors of the tool. Maximum likelihood was used as technique. Maximum likelihood is the best choice for EFA unless there is a seriously lack of multivariate normality in the measures³⁶. An oblique rotation technique - Direct Oblimin - was used, because in practice, factors are often correlated with each other³⁷. Eigenvalues greater than one were retained in the factor mix, because eigenvalues less than one means that the factor accounts for less variability than a single variable³⁸.

Internal Consistency

To confirm the results of the factor analysis, the Chronbachs Alpha (CA) was assessed. The acceptable range of CA is between 0.7 and 0.95, but with a CA higher than 0.9 there might be some redundancies³⁹. A CA lower than 0.7 indicates that there is no interrelatedness between the items, or the scale is not unidimensional³⁹.

Ethical issues

Ethical approval was granted by the local medical ethics committee (CMO). The study does not fall within the remit of the Medical Research Involving Human Subjects Act (WMO). The study has been reviewed by the local ethics committee based on the Dutch Code of Conduct for Health Research, the Dutch Code of Conduct for Responsible Use, the Dutch Personal Data Protection Act and the Medical Treatment Agreement Act. Written informed consent was obtained, because this is the policy of the local ethics committee.

RESULTS

Translation

The translators had no irresolvable issues in the second step when synthesizing. A third person was consulted to reach consensus in the translation of some sentences, and the third person had the casting vote.

Expert meeting

In the expert meeting, all versions of the OHAT were compared with each other. There were no irresolvable issues concerning semantic, idiomatic, experiential or conceptual equivalence. The resulting OHAT-NL is presented in Table 1.

[Insert table 1]

Some semantic adaptations were made. For example, in Dutch there is a different word for teeth – teeth are “tanden”, and molars are “kiezen”. In English, the word teeth could be used for the whole set of teeth. Therefore, “tanden en kiezen” was used, Dutch for teeth, in the translation. Some experiential adaptations were made. For example, the original version states that dentures should be labeled with a name, but in the Netherlands, community-dwelling older people and people in the hospital do not have their name on dentures. That only applies to a nursing home setting. Because the sentence did not convey any information about oral health it was therefore removed from the tool.

Pre-test

Thirty-one participants participated in the pre-test. Half of the nurses found the tool very useful, while the other half found it very difficult to use. The most reported feedback was that nurses did not know if the comma's in the pre-final version stood for 'and' or for 'or'. Therefore, the conjunctions 'and' and 'or' were added in the items. Also, several nurses said they could not identify caries or plaque. We discussed in the research group about a different word for those symptoms, but there is no different word that could help nurses better understand those

symptoms. The problem was not in the translation, but rather in the lack of knowledge. Therefore, those words were not changed. The nurses also stated that they did not know what interventions to do with a high OHAT-NL score. After the final corrections of the above feedback points were made, the OHAT-NL was made final.

Validation

A total of 51 participants, 22 men and 29 women agreed to participate in the study. For 37 participants, two measurements from two raters were taken. The mean age was 80.9 years (SD = 7.3 years). Their demographic characteristics are shown in Table 2. There were no missing items.

[Insert Table 2]

Oral health

Table 3 shows the answer proportions of the OHAT-NL items. The mean OHAT-NL score of the participants was 3.2 (SD = 2,1 points). The worst scored item was “oral cleanliness”, with the highest mean score of 0.98. Floor and ceiling effects were not present in this sample. Floor effects - or score 0 - were present in 7% of the scores. In addition, the mean oral health score was 3.2, which is in the lower range of the tool. No participant had a score of 16, therefore no ceiling effects were present.

[Insert Table 3]

Reliability

The inter-rater reliability for the total score was good, with an ICC of 0.79. The Kappa scores for the individual items are shown in Table 4. For the item ‘oral cleanliness’, the agreement was fair. For the item ‘natural teeth’, the agreement was moderate. For the items ‘lips’, ‘tongue’, ‘gums and tissues’, ‘saliva’, and ‘dentures’, the agreement was good. Lastly, for the item ‘dental pain’, the agreement was very good.

[Insert Table 4]

Validity

Table 5 and 6 show the main results of the factor analysis. Four factors emerged from the data, and these factors explained 93.2% of the variability.

[Insert Table 5]

In the structure matrix it is shown that the first factor consists of the items ‘natural teeth’ and ‘lips’. The second factor consists of the items ‘dentures’, ‘tongue’ and ‘gums and tissues’. The third

factor consists of the items 'saliva' and 'dental pain'. Lastly, the fourth factor consists of the item 'oral hygiene'.

[Insert Table 6]

Internal consistency

CA was 0.56 for the items and does not fall within the acceptable range. This confirms the multidimensionality of the scale.

DISCUSSION

This study aimed to translate the OHAT, and to test the validity and reliability of the OHAT-NL. In the translation process no irresolvable problems appeared, but still half of the nurses found the items to be very difficult. The OHAT-NL was considered a reliable instrument with a good inter-rater reliability, where ICC is 0.79. The 95% confidence interval falls within the range of 0.63-0.89. This means that the inter-rater reliability is at least moderate, ICC between 0.5-0.7 means moderate reliability³⁴. Item-level agreement ranged from fair to very good, kappa ranged from 0.36-0.89. The agreement between raters was good in most items. The item 'oral cleanliness' had fair agreement between raters. From the factor analysis, four underlying concepts emerged. The CA confirms the multidimensionality of the scale, and this means there is an interrelatedness among the items.

The factor structure of the OHAT was examined for the first time. The factor structure consisted of four factors, while the expectation was that one factor would emerge because oral health is one concept. An individual factor should consist of at least three items³⁶, that is not found in the factor structure. In addition, it is important that the factor could be explained as a concept^{36,37}. In this study, there is no logical explanation for the emerged factors, because there seemed to be no underlying theoretical concept for the factors. Therefore, conclusions can be drawn that there is no consistency between items. In the original development study, validity was assessed by comparing OHAT-scores to a mouth assessment performed by a dentist - in other words, construct validity was assessed²⁴. Thus, the factor structure and internal consistency were not assessed beforehand, which was a flaw in the development process, and which could explain the lack of consistency.

The item 'lips' does not load on the other factors. It could be argued that lip healthiness is a very different concept than oral health. The same can be said about 'dental pain', the item is determined by asking the participants if they experience pain. The OHAT was originally developed for residential care facilities²⁴. The difference between that population and that of the

community-dwelling older people is that the community nurses do not see their patients all day. The community-nurses could not see signs of dental pain during the day; therefore, dental pain was determined by asking the participants about their discomforts instead of looking for pain expressions.

The ICC found in this study was comparable with the ICC in the original development study of the English OHAT. The inter-rater ICC was 0.74 in the original study²⁴. The Kappa statistics of the OHAT-NL are higher than the Kappa statistics in the original English version of the OHAT. In the English version, Kappa ranged from 0.47 to 0.66²⁴. This means that the OHAT-NL is more reliable than the original English version. An explanation for the difference could be that the measurement was done by two raters, instead of a sample of raters in the original OHAT study.

The OHAT-NL scores in this study were low. In a study comparing the mouth assessments performed by nurses and dental professionals, it was found that caregivers and oral health care professionals interpreted the oral health-related problems significantly different⁴⁰. This means that the knowledge deficit, despite the short training for the nurses, could have influenced the OHAT-NL scores, which influenced the factors and validity. In general, the knowledge of nurses about oral health is poor^{41,42}, and this means these OHAT-NL numbers are probably generalizable to the overall nursing population.

There are several limitations that could be mentioned. The sample size of this study is too small to do a solid factor analysis. For a factor analysis, at least 100 participants should be included^{31,43}. Maximum likelihood tests are heavily influenced by sample size, with accuracy declining as the sample size increases⁴⁴. This indicates that the factors might change in a larger sample size. On the other hand, these findings emerged in a representative sample, and the confidence intervals of the mean scores show that in a larger sample the same answers would emerge. Another limitation is the reliability testing with two raters. It is best to test reliability with at least three raters³¹. Reliability is probably lower than emerged from this study.

In future research, it is important to take a step back and return to the development phase of a tool. After searching in the literature, the OHAT was the only valid - measured as construct validity - and reliable tool, but there is no consistency between the items in the Dutch version of the tool. To develop a valid and reliable Dutch tool, the first step in the development process should be carried out again in an expert meeting or Delphi study, with a panel of experts, methodologists, nurses and older people³¹. Future research should be carried out in a larger sample of at least 100 participants. In the qualitative part of the study, nurses said they found it very difficult to identify caries and plaque. This seems to be a knowledge deficit in nurses. Research shows that the lack of knowledge in oral health is a barrier^{42,45}, and that proper education helps improving this knowledge^{46,47}. For future research it might be important to first

take into consideration educating nurses before letting them complete an assessment tool. For validity it is important to assess the construct validity of the developed tool, because nurses do not assess the mouth in the same way as dental professionals⁴⁰. It might be important to compare the OHAT-NL with dental check-up data, to ensure the validity of the tool.

Application of the OHAT-NL in practice is not recommended yet, mainly because it is probably not valid. Some adaptations need to be done first in order to make the tool more valid in practice. It is important for nurses to identify oral health problems, but at the moment not with the OHAT-NL. In the future we hope to help Dutch nurses with a proper tool.

CONCLUSION

Although tested in a small sample size, the findings suggest that the OHAT-NL is a reliable tool, but the tool is not yet valid, and therefore needs to be adapted. Future research should take a step back in the development process and discuss with expert what items an instrument should consist of.

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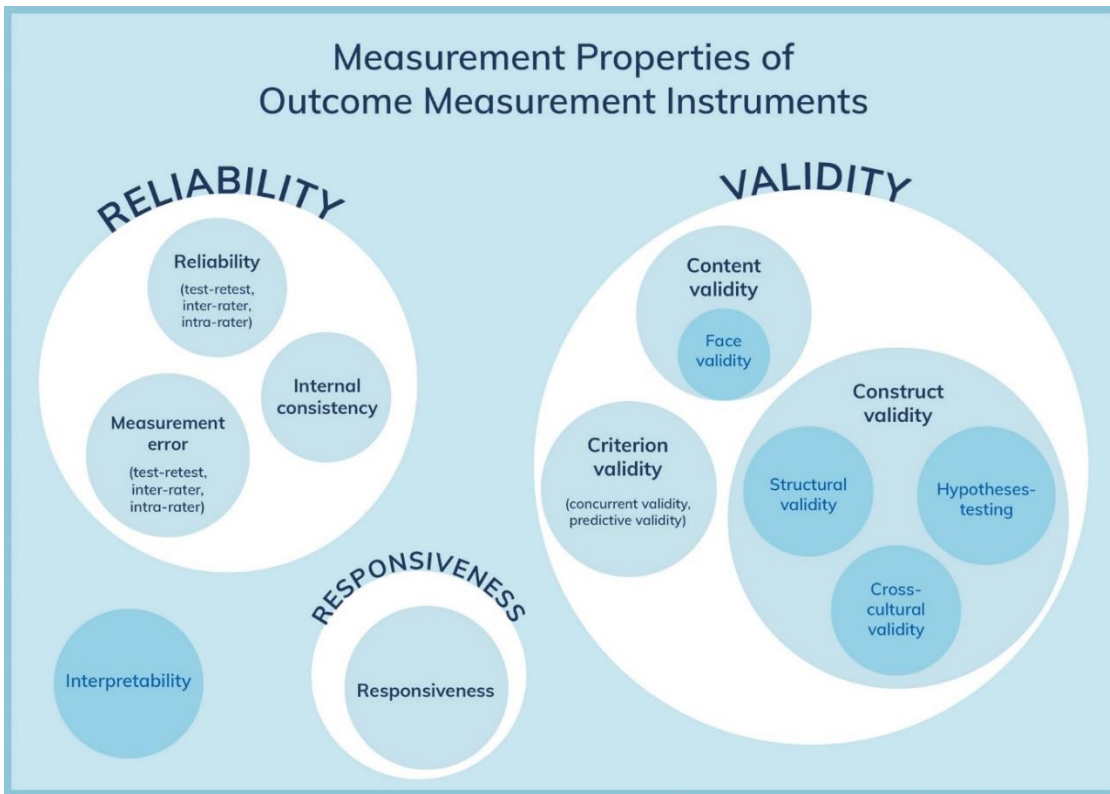


Figure 1: COSMIN Taxonomy²⁹

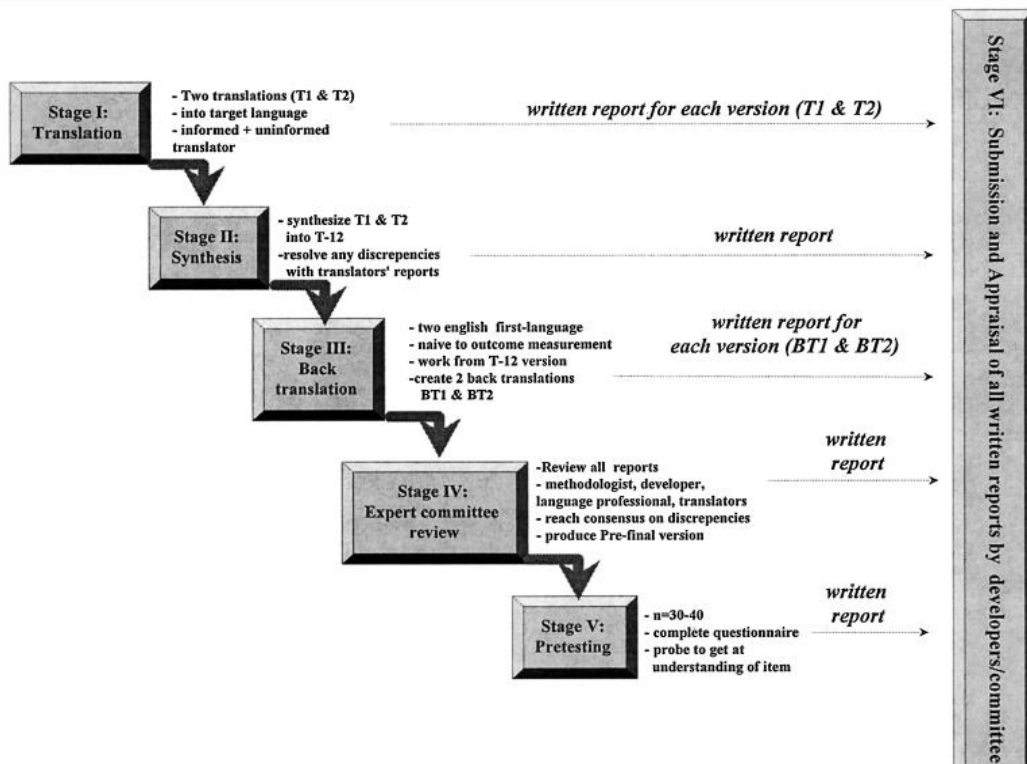


Figure 2: Cross-cultural validation guideline²⁸

Table 1: Dutch Oral Health Assessment Tool (OHAT-NL)

Categorie	0= gezond	1=afwijkingen	2=on gezond	Score
Lippen	Glad, roze en vochtig	Droge, gebarsten of rode mondhoeken.	Zwelling of knobbel; wit/rood/zwerende plek; bloedende/zwerende mondhoeken	_____
Tong	Normaal, vochtig en roze	Vlekkerig, diepe groeven, rood of met beslag	Plek die rood, wit, zwerend of gezwollen is.	_____
Tandvlees en slijmvliezen	Roze, vochtig, glad en geen bloeding	Droog, glimmend, ruw, rood, gezwollen rond 1-6 tanden of een zwerende/pijnlijke plek onder de prothese	Gezwollen, bloeding rond 7 of meer elementen, losse tanden/kiezen, zweren en/of witte vlekken, gegeneraliseerde roodheid/gevoeligheid	_____
Speeksel	Vochtige slijmvliezen, waterig, en speeksel aanwezig	Droge, kleverige slijmvliezen, weinig speeksel aanwezig; cliënt ervaart een droge mond	Uitgedroogde en rode slijmvliezen; erg weinig/geen speeksel; dik speeksel, cliënt ervaart een droge mond	_____
Natuurlijk gebit <input type="checkbox"/> Ja <input type="checkbox"/> Nee	Geen carieuze of afgebroken tanden/kiezen/wortels	1-3 carieuze of afgebroken tanden/kiezen/wortels	Vier of meer carieuze of afgebroken tanden/kiezen/wortels of erg afgesleten tanden, of minder dan 4 tanden/kiezen.	_____
Kunstgebit(ten) <input type="checkbox"/> Ja <input type="checkbox"/> Nee	Geen afgebroken delen of tanden/kiezen, kunstgebit(ten) wordt/worden regelmatig gedragen	1 afgebroken gedeelte/tand, kunstgebit(ten) wordt/worden hooguit 1-2 uur per dag gedragen	Meer dan 1 afgebroken gedeelte/tand, kunstgebit(ten) afwezig of wordt niet gedragen of alleen gedragen met kleefmiddel	_____
Mondhygiëne	Mond of (kunst)gebit is schoon, zonder voedselresten of tandsteen	Voedselresten, tandsteen of tandplaque op 1-2 plaatsen in de mond of op het kunstgebit; een slechte adem	Voedselresten, tandsteen of tandplaque op de meeste gebieden in de mond of het kunstgebit; of zeer slechte adem	_____
Tandpijn	Geen gedrags-, verbale of fysieke tekenen van pijn.	Verbale- of gedragstekenen van pijn, zoals vertrokken gezicht, op lippen bijten, niet eten, agressie.	Verbale-/ gedragsuitingen of fysieke tekenen zoals zwelling van wang of tandvlees, gebroken tanden, zweren en fistel.	_____

Table 2: Demographic details

	n	%	Mean OHAT-NL score	SD
Gender				
Male	22	43.1	3.5	2.0
Female	29	56.9	2.0	2.3
Age group				
Up to 69 years	4	7.9	3.8	1.5
70-79 years	17	33.3	3.3	1.7
More than 80 years	30	58.8	3.2	2.4
Systemic diseases				
Yes	48	94.1	3,4	2.1
No	3	5.9	0.7	0.6
Type disease				
Hypertension	19	37.3	3.5	1.9
Diabetes Mellitus II	7	13.7	3.6	1.1
Respiratory	7	13.7	3.6	2.2
Joint Pain	21	41.2	3.5	2.4
Neurological	9	17.6	3.4	2.4
Dementia	11	21.6	3.7	2.1
Heart disease	19	37.3	3.5	2.2
Dentures or natural teeth				
Dentures	23	45.1	2.8	1.7
Natural teeth	9	17.6	3.8	2.6
Dentures and Natural teeth	19	37.3	3.5	2.4
Visit to dentist				
Yes	23	45.1	3.0	2.0
No	28	54.9	3.4	2.2
Visit to oral hygienist				
Yes	18	35.3	3.1	2.2
No	33	64.7	3.3	2.1
Dependence in ADL				
0	39	76.4	3.1	2.0
1	3	5.8	1.7	0.6

2	1	1.9	0.0	-
3	7	14.0	5.0	2.1
4	1	1.9	6.0	-

n=number of participants; %=percentage; SD=standard deviation; ADL = Activities of Daily Life

Table 3: score distributions

Item	Mean	95% Confidence interval	Score 0 (%)	Score 1 (%)	Score 2 (%)
Lips	0.08	0.00-0.15	90.2	9.8	0
Tongue	0.49	0.35-0.63	51.0	49.0	0
Gums and tissues	0.53	0.35-0.71	54.9	37.3	7.8
Saliva	0.39	0.24-0.54	62.7	35.3	2.0
Natural teeth (n=29)	0.47	0.27-0.67	41.4	37.9	20.7
Dentures (n=40)	0.16	0.04-0.27	82.5	15.0	2.5
Oral cleanliness	1.00	0.81-1.19	25.5	51.0	23.5
Dental pain	0.14	0.04-0.24	86.3	13.7	0

Table 4: Reliability (n=37). Percentage agreement, Cohen’s Kappa and Interclass correlation coefficient

Items	Percentage Agreement	Cohen’s Kappa		
		Weighted Kappa	.95 Confidence Interval	
Lips	97.3	0.6542	0	1
Tongue	81.1	0.6551	0.1741	1
Gums and Tissues	83.8	0.7735	0.4520	1
Saliva	75.7	0.6002	0.1233	1
Natural Teeth (n=21)	42.9	0.4425	0.1296	0.7554
Dentures (n=31)	83.9	0.6501	0.1531	1
Oral cleanliness	40.5	0.3651	0.0909	0.6393
Dental pain	97.3	0.8934	0.3393	1

Total OHAT score

ICC*= 0.79

.95 Confidence interval: 0.63-0.89

*ICC=Interclass correlation coefficient.

Table 5: Eigenvalues

Factor	Initial Eigenvalues		
	Total	% of variance	Cumulative%
1	3.170	39.62	39.62
2	1,871	23.38	63.01
3	1,280	15.99	79.00
4	1,154	14.43	93.43

Table 6: Rotated Factor pattern, factor analysis

	Factor			
	1	2	3	4
Item 'Natural teeth'	<u>93</u>	25	-4	35
Item 'Gums and tissues'	<u>-100</u>	13	-33	16
Item 'Dentures'	-18	<u>82</u>	-2	8
Item 'Tongue'	13	<u>73</u>	23	15
Item 'Saliva'	49	<u>73</u>	-2	-1
Item 'Oral cleanliness'	2	7	<u>95</u>	30
Item 'Dental pain'	47	17	<u>81</u>	-51
Item 'Lips'	11	18	12	<u>96</u>