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Construct Validity of the Orientation to Life Questionnaire in a General Adult Population in Norway and Its Association with Self-Reported General and Oral Health

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ABSTRACT

Objective: Individuals' Sense of Coherence (SOC) is measured with the Orientation to Life Questionnaire (OLQ-13). SOC reflects a person's orientation to life and ability to manage stress, which can impact health. The aim of the study was to test the reliability and construct validity of the OLQ-13, with self-reported general and oral health as criterion measures, in a Norwegian general adult population.

Methods: Data were collected using the OLQ-13 in addition to items measuring sociodemographic information, self-reported general health and self-reported oral health. This study was based on data from a population-based cross-sectional oral health study in Troms County, conducted from October 2013 to November 2014 ($n = 1875$, mean age 47.4 years, 50.5% women). Internal consistency was examined with Cronbach's alpha (α). Confirmatory factor analysis (CFA) was used to test the construct validity (one- and three-factor structure of the OLQ-13). The associations between SOC and self-reported general and oral health were tested using one-way ANOVA.

Results: The internal consistency of the OLQ-13 was good ($\alpha = 0.84$). The CFA showed that while the OLQ-13 demonstrated an unacceptable fit, a shortened 11-item version with a three-factor structure revealed an acceptable fit and good internal consistency ($\alpha = 0.86$). The highest mean SOC scores were found among individuals reporting good or very good general and oral health.

Conclusion: A three-factor structure with an 11-item version of the OLQ to assess SOC showed better validity than OLQ-13 in a general population in Northern Norway. Self-reported general and oral health can be considered appropriate criterion measures when validating SOC. To achieve a valid measurement scale for assessing SOC, a revision of the OLQ-13 appears necessary, and further studies are needed.

1 | Introduction

Salutogenesis, which means the origins of health, is a framework in health promotion that focuses on identifying factors that can promote health and well-being [1, 2]. Instead of a dichotomous view of health as consisting of endpoints such as

being healthy or sick, an individual's perception of health can be expressed as a continuous movement along a health continuum (the ease/dis-ease continuum) [1]. The balance between stress and generalised resistance resources (GRRs) against stress can have an impact on the individual's localisation on the health continuum. GRRs can be any characteristics of the

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person or the environment that facilitates stress management [3]. Knowledge, self-esteem, financial resources and supportive relations are examples of GRRs that can help counteract or regulate health-damaging stress. An overload of unmanageable stress may result in a movement towards the pathogenic side of the continuum, while GRRs against stress and the ability to use them, can contribute to an experience of manageability and a movement to the healthy side of the continuum [1]. In this way, stress management could affect whether the outcome will be pathological, neutral or health-promotive. Within the salutogenic framework, sense of coherence (SOC) reflects a person's orientation to life and ability to manage stress. According to Antonovsky [1], individuals with a strong SOC can be more able to identify and mobilise the right GRRs against stress, thereby more likely to exhibit health-promotive behaviour in stressful situations.

Three subcomponents contribute to an individual's SOC: comprehensibility, manageability and meaningfulness [1]. Comprehensibility is the ability to perceive and understand events in life as structured and clear. Manageability is the feeling of managing a situation and being aware of available resources to solve stressful situations. Meaningfulness is a motivational factor comprising the belief that situations in life are worth pursuing and worthy of care or engagement.

To assess an individual's SOC, Antonovsky developed the Orientation to Life Questionnaire (OLQ) in two versions, one with 29 items (OLQ-29) and one with 13 items (OLQ-13) [1, 4]. Generally, the OLQ seems to be valid, psychometrically reliable and cross-culturally applicable [5, 6]. The OLQ-13 version has shown a good internal consistency with Cronbach's alpha (α) ranging from 0.70 to 0.92 [5]. Five questions assess comprehensibility, while both manageability and meaningfulness are assessed with four questions. Even though the OLQ consist of three subcomponents, it was originally developed to measure SOC as a unidimensional construct, that is, not calculating each subcomponent separately [4]. However, the validity of the unidimensional structure versus the multidimensional structure appears unclear since some studies report best fit on a unidimensional factor structure, while other reports a multidimensional factor structure [5]. Some studies have evaluated the construct validity on OLQ-13 in specific patient and population groups in Norway [7–11]. However, there are no studies on the construct validity of OLQ-13 in a general, adult Norwegian population.

Since SOC reflects an individual's orientation to life and interactions within their life context [1], it can influence both general and oral health. SOC has been reported in several studies to be positively associated with self-reported good health, including mental health [12–15]. Associations between SOC and self-reported good oral health have been documented in middle-aged women in Sweden [16] and general adult populations in Finland [17, 18]. Studies from Brazil have shown that adults [19] and older adults (60 years or older) [20] with self-reported poor oral health had lower mean SOC scores. While some studies have not found an association between SOC and clinical oral status [19, 21, 22], others have reported that a strong SOC was associated with having more teeth, fewer decayed teeth [18], fewer periodontal pockets ≥ 4 mm and lower plaque scores [23],

as well as less severe periodontitis [24]. A positive association between SOC and oral health behaviour has also been highlighted [25, 26], and some studies suggest that health behaviour is the mediator between SOC and clinical oral status, which could explain the varying results regarding SOC and clinical oral status [18, 27]. The association between SOC and clinical oral status appears to be conflicting, while the association between SOC and self-reported oral health seems to be more consistent. Consequently, self-reported general and oral health seems appropriate to use as criterion measures when evaluating the validity of OLQ-13.

The aim of the study was to test the reliability and construct validity (one-factor vs. three-factor structure) of the OLQ-13, with self-reported general and oral health as criterion measurements, in a Norwegian general adult population.

2 | Method

2.1 | Design and Study Population

This study was based on data from Tromstannen—Oral Health in Northern Norway (TOHNN), a population-based cross-sectional study in Troms County conducted between October 2013 and November 2014. In brief, an invitation letter was mailed to a random sample of 2901 adults (20–79 years) registered in the county. Of those invited, 1986 (68%) individuals underwent a dental examination and completed questionnaires to assess sociodemographic characteristics, self-reported general health, self-reported oral health and the OLQ-13. In this secondary analysis, only data from the questionnaire were used and participants with missing data on OLQ-13 were excluded (see Section 2.3). A detailed description of the invitation procedure and all the questions in the questionnaire can be found in Holde et al. [28] The study was conducted in accordance with the Declaration of Helsinki with informed consent from the participants, and the Regional Committees for Medical and Health Research Ethics of the Arctic University of Norway, approved the study (2013/348/REC North).

2.2 | Measures

Information on sample characteristics, self-reported general and oral health, and SOC was obtained from a questionnaire. Age was reported as a continuous variable. Education level was categorised into three groups: less than high school, high school and university. Self-reported general health was assessed with the question, 'How do you consider your health?' Self-reported oral health was assessed with the question, 'How do you consider your oral health?' This question has been validated in a previous study [29]. Both questions had five response options from very poor to very good.

The Norwegian version of the OLQ-13 [1, 30] was used to assess SOC. Permission to use OLQ-13 in this study was given by Avishai Antonovsky in the Society for Theory and Research for Salutogenesis. Five questions measured the subcomponent comprehensibility (5–35 points), and four questions measured each of the subcomponents manageability (4–28 points) and

meaningfulness (4–28 points). Every item was scored on a Likert scale ranging from 1 to 7 points, giving a total SOC score ranging from 13 to 91 points. Higher scores indicate a stronger SOC.

2.3 | Statistical Analyses

The IBM SPSS Statistics (SPSS) software (IBM Corp. Released 2021. IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp) was used to analyse descriptive data, while AMOS (Version 28.0) [Computer Program] (Chicago: IBM SPSS) was used for confirmatory factor analyses (CFA). Missing data occurred at a very low frequency (0.3%–2.8%). Missing values for the OLQ-13 instrument varied between 1.5% and 2.8%, with item 11 having the highest number of missing values ($n = 55$). An analysis of missing data patterns computed by SPSS, showed that missing values were at random and at a low rate (1.6% of the total values used in the present analysis). All participants who did not have a complete OLQ-13 questionnaire were excluded from the analysis ($n = 111$). Sample characteristics are presented as numbers and percentages, means and standard deviation (SD). Pearson's R (r) was used to inspect the correlations between the items and subcomponents in the OLQ-13. Corrected item-total correlations were reported. Mean scores and SD were calculated for the OLQ-13. Reliability (internal consistency) was examined with Cronbach's alpha (α). The CFA was used to test the construct validity (one- and three-factor structure of the OLQ). Construct validity is the extent to which a set of measured variables represents the theoretical latent constructs they are intended to measure [31]. The factor loadings from the CFA can confirm whether the indicators are strongly related to their associated constructs. A strong association can be an indication of construct validity. Factor loadings above 0.32 are considered poor, 0.45 as fair, 0.55 as good, 0.63 as very good and 0.71 as excellent [32]. Several goodness-of-fit indices were used to evaluate how well the model fits the data. The ratio of the χ^2 to the model's degrees of freedom (χ^2/df), generally low values are preferred (there is no absolute standard, but a ratio between 2 and 3 is indicating a good or acceptable model fit), and a non-significant p value (>0.05) of the model [33]. However, since both these indices can be affected by the sensitivity of the χ^2 test to the sample size (larger samples often lead to significant p values even when the model fit is adequate), goodness-of-fit indices such as the root mean square error of approximation (RMSEA), the comparative fit index (CFI) and the Hoelter 0.05 was emphasised when evaluating the model fit. The RMSEA measures the model's approximate fit to the population covariance matrix and is therefore considered with the discrepancy due to the approximation. RMSEA values <0.05 indicate a good fit, values between 0.05 and 0.08 indicate an adequate fit, values between 0.08 and 0.10 indicate a mediocre fit, and values >0.10 indicate an unacceptable fit. The CFI compares the fit of the target model with the independence (or null) model, which assumes that all variables are uncorrelated [34]. Acceptable and good fit were set at <0.95 and 0.97 , respectively [33]. A Hoelter 0.05 index with values >200 indicate that the model adequately represents the sample data [34]. A scrutiny of the modification indices (MI) and the standardised residuals (SR) was done when the model presented an unacceptable fit. High MI and SR can be an indication of model misspecification [34]. Especially high MI can indicate that there can be potential problematic cross-loading in

TABLE 1 | Sample characteristics. $N = 1875$.

Variable	Mean (SD)
Age	47.4 (15.5)
	<i>n</i> (%)
Sex	
Men	928 (49.5)
Women	947 (50.5)
Education ^a	
Less than school	277 (14.8)
High school	803 (42.8)
University level	777 (41.4)

Abbreviation: SD, standard deviation.

^aMissing values on 18 (1%) of the participants.

the model (for instance, if a pair of items is redundant) [31]. The fit of the model can be improved by allowing the corresponding path to be freely estimated. However, modifying or removing an item from a model, requires a sound theoretical rationale [35]. A χ^2 difference test was conducted to determine which model provided the best fit (assessing whether the difference in the χ^2 and df values between the models are statistically significant) [33]. Self-reported general and oral health were used as criterion measures in the validation of OLQ. The association between SOC and self-reported general and oral health was tested with One-way ANOVA. p values <0.05 were considered statistically significant.

3 | Results

The final sample consisted of 1875 individuals, of which 50.5% were women. The mean age of the participants was 47.4 years (SD = 15.5). The sample characteristics are presented in Table 1.

Several items in the OLQ-13 were strongly and positively correlated (all $p < 0.001$): OLQ2-OLQ3 ($r = 0.64$), OLQ8-OLQ9 ($r = 0.71$), OLQ9-OLQ10 ($r = 0.61$) (Table S1). For the sub-components, the correlation between comprehensibility and manageability was strong: $r = 0.77$, while moderate between comprehensibility and meaningfulness: $r = 0.52$, and meaningfulness and manageability: $r = 0.52$.

The means with SD, corrected item-total correlations and α for the OLQ-13 and the subcomponents (comprehensibility, manageability and meaningfulness) are presented in Table 2. The α for the total scale was 0.84. For the subscales, the α values were: comprehensibility at 0.73, manageability at 0.68 and meaningfulness at 0.53.

3.1 | Confirmatory Factor Analysis

An overview of the Goodness-of-fit measures from the CFA of the one-factor and three-factor structure (with comprehensibility, manageability and meaningfulness) of the OLQ-13 is

TABLE 2 | OLQ-13 presented with mean scores and standard deviations.

Item	Description	Mean (SD)	CITC	α
OLQ1	Do you have the feeling that you don't really care about what goes on around you?	5.29 (1.87)	0.19	
OLQ2	Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?	4.51 (1.34)	0.41	
OLQ3	Has it happened that people whom you counted on disappointed you?	4.53 (1.44)	0.45	
OLQ4	Until now your life has had: no clear goals or purpose at all...vs. ...very clear goals and purpose	5.48 (1.19)	0.45	
OLQ5	Do you have the feeling that you're being treated unfairly?	5.47 (1.39)	0.54	
OLQ6	Do you have the feeling that you are in an unfamiliar situation and don't know what to do?	5.43 (1.28)	0.54	
OLQ7	Doing the things you do every day is...a source of deep pleasure and satisfaction vs. ...a source for pain and boredom	5.66 (1.15)	0.47	
OLQ8	Do you have very mixed-up feelings and ideas?	5.52 (1.42)	0.68	
OLQ9	Does it happen that you have feelings inside you would rather not feel?	5.29 (1.61)	0.65	
OLQ10	Many people, even those with a strong character, sometimes feel like sad sacks (losers) in certain situations. How often have you felt this way in the past?	5.02 (1.33)	0.63	
OLQ11	When something happened, have you generally found that...you overestimated or underestimated its importance... vs. you saw things in the right proportion?	4.75 (1.23)	0.43	
OLQ12	How often do you have the feeling that there's little meaning in the things you do in your daily life?	5.71 (1.26)	0.58	
OLQ13	How often do you have feelings that you are not sure you can keep under control?	5.88 (1.20)	0.59	
Comprehensibility (2, 6, 8, 9, 11)		25.51 (4.78)		0.73
Manageability (3, 5, 10, 13)		20.89 (3.84)		0.68
Meaningfulness (1, 4, 7, 12)		22.13 (3.61)		0.53
Total scale		68.54 (10.55)		0.84

Abbreviations: CITC, corrected item-total correlation; SD, standard deviation; α , Cronbach's alpha.

presented in Table 3. The one-factor (Model 1, Figure S1) and the three-factor structure (Model 2, Figure S2) of the OLQ-13 showed an unacceptable fit, characterised by too high RMSEA values and low CFI and Hoelter values. In Model 1, the factor loadings for the items ranged from 0.16 to 0.80. The loadings on OLQ1 (0.16), OLQ2 (0.34) and OLQ3 (0.42) were poor. To improve the model fit, a scrutiny of the MI and SR were performed, which revealed a high MI and SR between OLQ1-OLQ2 (MI=85.66, SR=8.49) and OLQ2-OLQ3 (MI=668.08, SR=21.42). The very poor factor loading on OLQ1 'Do you have the feeling that you don't really care about what goes on around you?' indicates that the question doesn't measure meaningfulness. The OLQ2

(comprehensibility): 'Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?' and OLQ3 (manageability): 'Has it happened that people whom you counted on disappointed you?' may appear semantically and theoretically linked, since people you know well (OLQ2) also often are the people you count on (OLQ3). Considering this, it seems theoretically sound to correlate these items. As a result, a nested model with a correlated error term between OLQ1-OLQ2 and OLQ2-OLQ3 was tested. The three-factor structure (Model 2a) showed a better fit to the data ($\chi^2/df = 433.14/60 = 7.22$, p value < 0.001, RMSEA = 0.06, CFI = 0.95, Hoelter 0.05 = 343) than the one-factor structure (Model 1a).

TABLE 3 | Goodness-of-fit measures for one-factor and three-factor structure of OLQ-13.

Fit measure	Model 1a, one-factor, 13 items	Model 1b, one-factor, 11 items	Model 2, three-factor, 13 items	Model 2a, three-factor, 13 items	Model 2b, three-factor, 11 items
χ^2/df	1554.94/65 = 23.92	592.25/44 = 13.46	1306.25/62 = 21.07	433.14/60 = 7.22	344.72/41 = 8.41
p	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
RMSEA	0.11	0.08	0.10	0.06	0.06
CFI	0.82	0.92	0.85	0.95	0.96
Hoelter 0.05	103	192	117	343	310

Note: Model 1a and 2a include a correlated error term between the items OLQ1-OLQ2 and OLQ2-OLQ3. Model 1b and 2b represent the shortened OLQ-11. Abbreviations: CFI, comparative fit index; RMSEA, root mean square error of approximation; χ^2/df , the ratio of the Chi-square of the models' degrees of freedom.

Subsequently, given the improved model fit with correlated error terms between OLQ1-OLQ2 and OLQ2-OLQ3, a shortened version, OLQ-11 (without OLQ1 and OLQ2, which had the lowest factor loadings) was tested. The three-factor structure of the OLQ-11 (Model 2b, see Figure 1) was superior to the one-factor structure (Model 1b), and revealed an adequate fit on the emphasised indices RMSEA (=0.06), CFI (=0.96) and Hoelter (=310), while the χ^2/df (=344.72/41 = 8.41) and the p value (<0.001) indices were not fulfilled. In the OLQ-11, factor loadings ranged from 0.39 to 0.83, whereas three items showed good factor loadings, one item showed very good loading, and four items demonstrated excellent loadings.

To determine the best model fit, a comparison of the models' χ^2 was done (see Table 4). Model 2b, which represents the three-factor structure of the OLQ-11, exhibited the best fit. The α for the total OLQ-11 scale was 0.86. For the subscales, the α values were: comprehensibility at 0.76, manageability at 0.68 and meaningfulness at 0.69.

3.2 | Associations with General and Oral Health

The association between SOC (OLQ13 and OLQ-11) and self-reported general and oral health is specified in Table 5. For the OLQ-13, there was a significant difference in mean SOC score between the groups of self-reported general health ($F=27.33$, $df=4$, $p<0.001$) and oral health ($F=20.00$, $df=4$, $p<0.001$). Also, when using the OLQ-11 to measure SOC, similar differences were found between categories of both self-reported general health ($F=24.63$, $df=4$, $p<0.001$) and oral health ($F=17.20$, $df=4$, $p<0.001$). Individuals who reported good or very good general and oral health had significantly higher mean SOC scores than those who reported neither/nor or poor.

4 | Discussion

The construct validity of the OLQ-13 in this population of adults from a randomly selected sample in Northern Norway, showed an unacceptable performance due to model fit and poor factor loadings for some of the items in the measurement scale. The model demonstrated an adequate fit when testing a shortened scale with 11 items (without OLQ1 and OLQ2) and a three-factor structure. Individuals reporting good health had higher mean SOC scores than those reporting poorer health.

The OLQ-11 with the three-factor structure achieved an acceptable model fit since the three emphasised a priori goodness-of-fit criteria were met (RMSEA, CFI and the Hoelter 0.05). As expected, the model failed to satisfy the χ^2 model fit criteria. However, since the statistical significance value (p value) calculated by the χ^2 test is sensitive to the size of the sample (i.e., a larger sample is more likely to get higher χ^2 value and a lower p value) [36], it can increase the chances to reject a good model [37]. Therefore, the significance of the χ^2 should not be emphasised [33]. Considering this, the OLQ-11 with a three-factor structure seems to be best suited to use in population-based studies at least in Northern Norway. According to Antonovsky [4], the structure of the SOC concept is unidimensional, comprising the three correlated

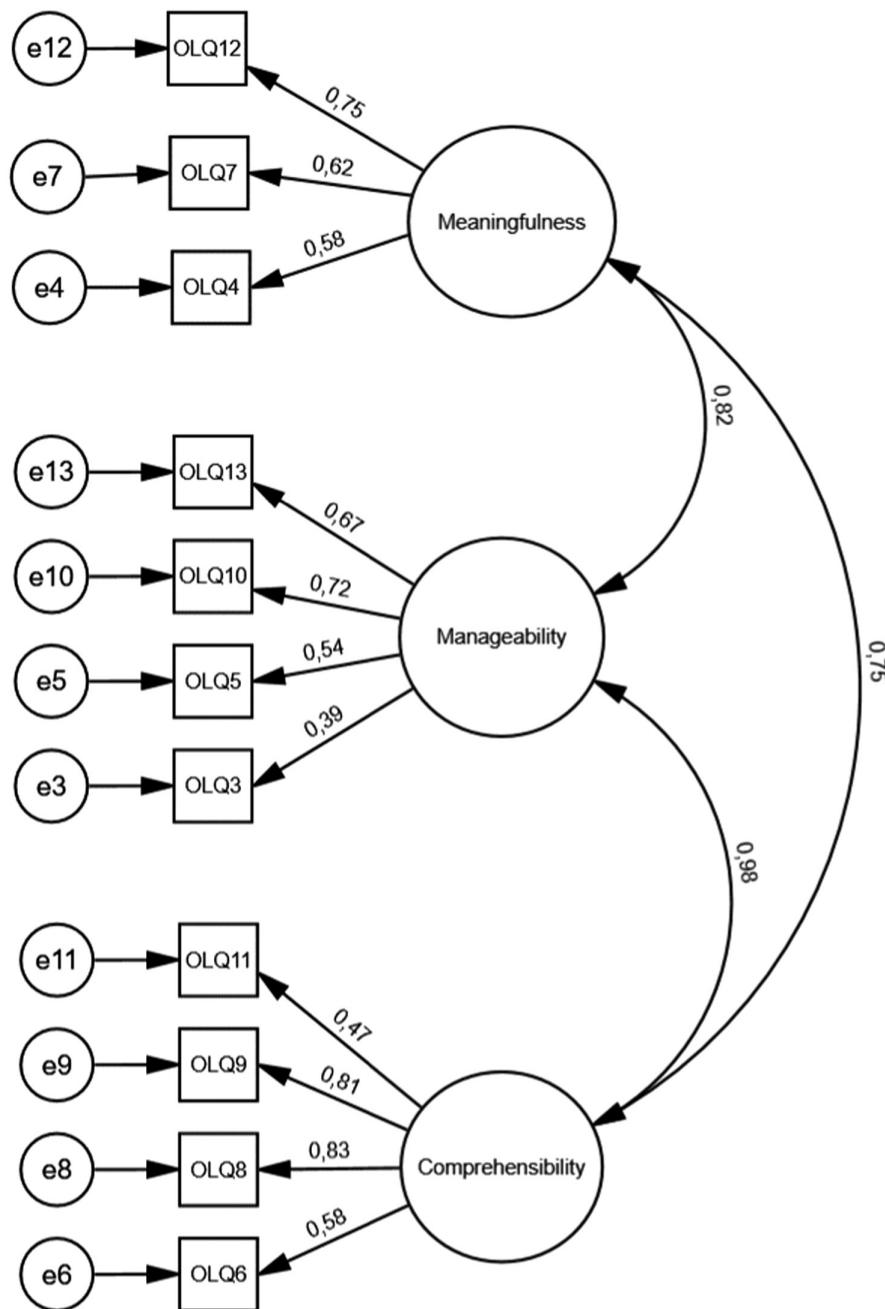


FIGURE 1 | Model 2b. CFA of the three-factor structure of the OLQ-11. Without OLQ1 and OLQ2.

subcomponents comprehensibility, manageability and meaningfulness. However, our findings and several previous studies on Norwegian populations [7, 9] and international studies [6, 38–40], support a three-factor structure. In contrast, a survey of Norwegian women in postnatal care found that a one-factor structure had the best fit [8]. In the current study, the correlations between the subcomponents were considered moderate to strong, with comprehensibility and manageability showing the strongest correlation. This strong correlation can be linked to Antonovsky's theoretical notion that high manageability depends on high comprehensibility [1, 6]. A strong correlation between these components is in line with findings from other studies [6, 9, 38], and may indicate that they measure similar aspects, potentially limiting their use as distinct SOC indicators [38]. A systematic validation review

on OLQ in different populations stated that the dimensional factor structure seems to be unclear but lends support to a multidimensional factor structure rather than a unidimensional factor structure [5].

In the current study, several items in the OLQ-13 represented poor factor loadings, indicating that these items are not strongly related to their associated constructs, which can affect the construct validity [31]. OLQ1 'Do you have the feeling that you don't really care about what goes on around you?' had the lowest factor loading (0.16). The low factor loading on OLQ1 is in accordance with findings in other studies [7, 39], indicating that OLQ1 may not contribute sufficiently to SOC or the subcomponent meaningfulness. In line with our findings, other studies conducted in Norway [10, 11] also excluded OLQ1 since the item did not

TABLE 4 | Statistical comparison of the χ^2 test from the models.

Model	χ^2	df	Diff χ^2 , Model 1	Diff χ^2 , Model 1a	Diff χ^2 , Model 1b	Diff χ^2 , Model 2	Diff χ^2 , Model 2a	Diff χ^2 , Model 2b
1	1554.94	65	—					
1a	686.19	63	868.75***	—				
1b	592.25	44	962.69***	93.94***	—			
2	1306.25	62	248.69***	-620.06***	-714.00***	—		
2a	433.14	60	1121.80***	253.05***	159.11***	873.11***	—	
2b	344.72	41	1210.22***	341.47***	247.53***	961.53***	88.42***	—

Note: All Model 1 versions are one-factor structures, while all Model 2 versions are three-factor structures. Model 1a and Model 2a include a correlated error term between OLQ1-OLQ2 and OLQ2-OLQ3. Model 1b and 2b represent the shortened OLQ-11.

Abbreviations: df, degrees of freedom; χ^2 , Chi-square.

*** $p < 0.001$.

TABLE 5 | Mean SOC score (OLQ-13 and OLQ-11) and confidence intervals for different self-reported general and oral health categories. $N = 1875$.

Variable	n (%)	Mean OLQ-13	95% CI	Mean OLQ-11	95% CI
Self-reported health					
Very poor	9 (0.5)	62.7	52.1, 73.2	52.8	42.6, 63.0
Poor	63 (3.4)	65.0	62.2, 67.8	55.3	52.7, 57.8
Neither/nor	432 (23.0)	64.9	63.8, 65.9	55.7	54.7, 56.6
Good	816 (43.5)	68.9	68.2, 69.6	59.1	58.5, 59.7
Very good	552 (29.4)	71.4	70.6, 72.2	61.1	60.4, 61.8
Total	1872 (99.8)	68.5	68.1, 69.0	58.7	58.3, 59.2
Self-reported oral health					
Very poor	71 (3.8)	65.3	62.6, 68.0	56.8	54.3, 59.2
Poor	178 (9.5)	64.7	63.0, 66.5	55.1	53.5, 56.6
Neither/nor	725 (38.7)	67.2	66.4, 67.9	57.7	57.0, 58.4
Good	713 (38.0)	70.5	69.8, 71.2	60.3	59.7, 61.0
Very good	178 (9.5)	71.0	69.4, 72.5	60.6	59.2, 62.1
Total	1865 (99.5)	68.5	68.1, 69.0	58.7	58.3, 59.1

Note: ANOVA test for differences in mean SOC scores. OLQ-11 is a reduced scale without OLQ1 and OLQ2.

Abbreviations: CI, confidence interval; OLQ, Orientation to Life Questionnaire; SOC, sense of coherence.

meet the criteria for item fit. The low factor loadings and the high MI and SR between OLQ1-OLQ2 and OLQ2-OLQ3 made it relevant to test a shortened scale. Although MIs can be useful in identifying items that can contribute to model misfit, items in a model should only be modified or removed if there is a theoretical justification [35]. The particular items OLQ2, (comprehensibility: 'Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?') and OLQ3, (manageability: 'Has it happened that people whom you counted on disappointed you?'), appear semantically and theoretically linked, as people you know well (OLQ2) are often the people you count on (OLQ3). Thus, feelings of disappointment or surprise in these two relationship contexts appear equivalent in that encountering disappointment may also be unexpected, and therefore, surprising. This can indicate that these items share a

common variance not explained by their respective factors [38]. Hence, it seems theoretically sound to reconsider or revise these items, especially since they are in different subcomponents. The relationship between OLQ2 and OLQ3 has been described as a potential weakness of the scale in a study from Finland [38] and considered problematic in other studies from Norway [7-9]. Drageset and Haugan [9] reported a good model fit when OLQ-2 was removed. In the current study, the OLQ3 demonstrated poor factor loading, and it could have been relevant to reconsider this item. However, since the model fit was adequate, the item could be retained in the scale. Careful consideration is essential when reducing items to ensure the integrity of the underlying conceptual model [41]. Additionally, the reduction must be based on a sound methodology to maintain the validity of a shortened instrument.

The internal consistency of both the OLQ-13 and OLQ-11 was good; the α for the OLQ-11 was slightly higher ($\alpha = 0.86$) compared to the OLQ-13 ($\alpha = 0.84$). In OLQ-13, the subcomponent meaningfulness did not demonstrate good internal consistency ($\alpha = 0.53$) in this population. However, the internal consistency for meaningfulness is somewhat better in other Norwegian populations, such as adolescents (sample 1, $\alpha = 0.66$, sample 2, $\alpha = 0.63$) [7], women in postnatal care ($\alpha = 0.63$) [8], and older residents in nursing homes ($\alpha = 0.67$) [9]. Furthermore, in this current study, the internal consistency of the subscales was improved when reducing the number of items. The α for meaningfulness increased from 0.53 to 0.69 when OLQ1 was deleted, and for comprehensibility, the α increased from 0.73 to 0.76 when OLQ2 was deleted. Usually, more items in a measurement scale gives a higher α value (i.e., influences the internal consistency), but our results indicate that the shortened 11-item scale has good reliability [42].

The findings from the current study regarding SOC scores and self-reported good general and oral health are in line with other studies where positive associations between SOC and self-reported good health [13–15, 43] and good oral health [16–20] have been reported. A positive association between SOC and self-reported good general and oral health may be a result of the health-promotive stress management, but also because individuals with a strong SOC can have an optimistic orientation to life, focusing on opportunities rather than limitations, have fewer perceived problems and a greater degree of adaptability [1]. For instance, oral health-related behaviour such as toothbrushing can be affected by stress. If individuals with a strong SOC have a greater adaptability and stress management, it can be easier to maintain daily routines such as toothbrushing. The association between higher mean SOC scores and more frequent toothbrushing have been reported in several studies [21, 25, 26].

Disease prevention and its associated risk behaviours are a well-established approach in dental care [44]. A health-promotive direction with a salutogenic framework and the concept of SOC would be a useful complement in dental care as it focuses on people's resources and capacity to promote oral health [45]. Health professionals using a health-promotive approach should empower patients to make sound choices, raise awareness about determinants of health, facilitate the development of coping skills and the use of GRRs [46]. Encouraging individuals to reflect on stressful situations may enhance their understanding of the stress they are facing and thereby help them identify appropriate GRRs to deal with it [47]. Supporting reflection aimed at enhancing the patients' comprehensibility, manageability and meaningfulness is essential in a SOC-supportive approach.

4.1 | Strengths and Limitations

This is the first study validating OLQ-13 in a general population in Norway. The study had a large, random sample of a general population with a high response rate, which increased the representativeness of the current target population. A limitation of this study is that it was conducted in only one county in Northern Norway during 2013–2014. More participants had a high university-level education compared to nationwide (41% vs. 35%); still, the university-level education in suburban and

rural municipalities was equivalent to the national average [48]. Educational level was highest in the largest municipality, where UiT the Arctic University of Norway and the University Hospital of North Norway are located, which contributes to the high proportion of persons with university-level education. However, this pattern is probably similar to that of other Norwegian counties. Even though the demography of the population could be considered as representative of different parts of Norway and Scandinavia, the instrument would benefit from validation in other populations. To determine the validity of the OLQ-11 instrument, replicating the study with a different sample (cross-validation) is necessary [49].

5 | Conclusion

A three-factor structure with an 11-item version of the OLQ to assess SOC showed better validity than the original OLQ-13 in a general population in Northern Norway. Self-reported general and oral health can be considered appropriate criterion measures when validating SOC. A revision of the OLQ-13 appears necessary to achieve a reliable and valid measurement scale for assessing SOC in a general population in Norway. Further studies are needed to fulfil this aim.

6 | Clinical Relevance

6.1 | Scientific Rationale for Study

Sense of coherence (SOC) may contribute to health-promotive stress management. A strong SOC has been associated with self-reported good general and oral health. If SOC affects how individuals perceive their health, a self-reported health evaluation is an important indicator when validating SOC and the OLQ measurement scale.

6.2 | Principal Findings

A three-factor structure with a shortened OLQ-11 demonstrated a better fit than the original OLQ-13. Self-reported good general and oral health was associated with higher mean SOC scores.

6.3 | Practical Implications

A shortened OLQ-11 version can be appropriate for measuring SOC. A shorter, more concise scales could be beneficial as it reduces the time and effort required to participate, the willingness to contribute, and the completion of the scale.

Author Contributions

All authors made substantial contributions to the conception and design of the study. B.J. and G.E.H. planned the study and performed the data collection; K.M.M. drafted the manuscript and performed the statistical analysis and interpretation of the results in collaboration with J.-A.K.J. and B.J. All authors contributed to the analytical interpretation of data, provided critical comments and reviewed the prepared manuscript. All authors reviewed and approved the final manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data supporting this study's findings are available from Troms County. Restrictions apply to the availability of these data, which were used under licence for this study. Data are available from the authors with the permission of Troms County.

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Supporting Information

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