

Oral health is essential for quality of life in older adults: A Swedish National Quality Register Study

Ulrika Lindmark^{1,2,3}  | Marie Ernsth Bravell^{3,4}  | Linda Johansson^{3,4}  | Deborah Finkel^{3,4,5} 

¹Department of Health Sciences, Karlstad University, Karlstad, Sweden

²Center of Oral Health, School of Health and Welfare, Jönköping University, Jönköping, Sweden

³Aging Research Network – Jönköping (ARN-J), School of Health and Welfare, Jönköping University, Jönköping, Sweden

⁴Institution of Gerontology, School of Health and Welfare, Jönköping University, Jönköping, Sweden

⁵Department of Psychology, Indiana University Southeast, New Albany, IN, USA

Correspondence

Ulrika Lindmark, Department of Health Sciences, Karlstad University, Karlstad, Sweden.

Email: ulrika.lindmark@kau.se

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Abstract

Objective: To examine the relationship between QoL and oral health from two Swedish national quality registries (NQRs). **Background:** Oral health plays an important part in general health, which might also affect QoL. No studies have examined the relationships between QoL and oral health in late adulthood based on aggregated data from Swedish NQRs.

Material and methods: Four NQRs incorporated the EQ-5D, which assesses 5 aspects of QoL: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Items from the Revised Oral Assessment Guide, obtained from the NQR Senior Alert, were used to identify older adults at risk for oral health issues.

Results: A total of 510 individuals had data on all relevant variables. Analyses indicated significantly higher QoL for individuals without risk of oral health problems ($M = -0.15$ ($SD = 1.01$)), compared to those with risk ($M = -0.75$ ($SD = 1.52$)). Logistic regression analysis showed that lower QoL ($OR = 0.69$ ($0.49, 0.97$)), mental status ($OR = 0.37$ ($0.19, 0.71$)), lower self-rated health ($OR = 0.59$ ($0.42, 0.85$)) and higher age ($OR = 1.07$ ($1.01, 1.13$)) were significantly related to risk of oral health problems. Higher BMI ($OR = 1.13$ ($0.99, 1.30$)), living alone ($OR = 2.37$ ($0.93, 6.06$)) and more years of education ($OR = 1.15$ ($1.01, 1.31$)) were associated with higher risk of oral health problems.

Conclusions: Oral health is a significant component of quality of life in late adulthood. NQRs are of value for healthy ageing research in populations that may be underrepresented in research studies.

KEYWORDS

healthy ageing, oral health-related quality of life, quality of life, quality register

1 | BACKGROUND

Increased life expectancy for people aged 65 or older is a fact worldwide.¹⁻³ Oral diseases such as dental caries, periodontitis and dry mouth are highly prevalent in older adults, and the risk of tooth loss

in old age is high.^{4,5} Oral disease measured by dental professionals is only one perspective of oral health and does not include a person's experiences of oral health in relation to their context or situation. Furthermore, oral health problems may have social, economic and psychological consequences and thus also have an impact on quality

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of life (QoL).⁶⁻⁸ QoL has been defined by WHO as “the proper and correct perception that a person has of itself in the cultural context and values on which it is embedded, in relation to its objectives, standards, hopes and concerns”.⁹ Thus, it is important to consider these perspectives, that is oral health and QoL, both from the professional and the individual's points of view, as important components in creating age-friendly healthy environments. Addition of the health aspect to QoL is expressed as health-related quality of life (HRQoL),¹⁰ which is often measured by EuroQol (EQ-5D).¹¹

Oral health plays an important part in general health caused by the interaction of lifestyle, behaviour and systemic disease, for example heart disease and diabetes.¹²⁻¹⁴ With the exception of some genetic contribution, acquired risk factors such as hyposalivation, rheumatoid arthritis, smoking/tobacco use, undiagnosed or sub-optimally controlled diabetes and obesity are common acquired risk factors for both caries and periodontal diseases.¹⁴ Moreover, oral health problems have shown a relationship with malnutrition, which strongly influences general health^{14,15} and health-related HRQoL.¹⁶

Oral diseases, such as caries and periodontitis, can lead to tooth loss and presumably cause functional impairment, for example, with regard to chewing and aesthetics,¹⁴ which might ultimately affect HRQoL. Some studies have shown an increasing relationship between HRQoL and chewing ability¹⁷ and remaining teeth^{18,19} in older individuals. Oral health-related quality of life (OHRQoL) addresses a person-centred perspective and concerns HRQoL but is also related specifically to oral health and disease outcomes,²⁰ often measured using the Oral Health Impact Profile 14 (OHIP-14) and the Geriatric/General Oral Health Assessment Index (GOHAI).²¹ In this context, studies have shown relationships between OHRQoL and oral health status.²²⁻²⁶ Moreover, HRQoL is also related to OHRQoL in older populations.²⁷ Consequently, oral health services are important parts of primary geriatric health care. In general, older people have poor or infrequent oral hygiene habits. Compared with non-institutionalised older people, frail and institutionalised people have markedly lower standards of self-care practices, oral hygiene and utilisation of oral health services.⁴ Oral health promotion must be performed where people live.²⁸ Thus, studies in different populations and contexts are recommended, and elder people in different care settings are suggested as a target group.^{5,14,29}

As part of a general effort to improve health and social care for older adults, the Swedish government invested in the development and expansion of national quality registries (NQRs)³⁰ which aim to examine and improve delivery of health care based on individual clinical data.³¹

The data from NQRs are collected routinely by healthcare staff. The data enable researchers to collate extensive information from different registries on an individual level. Most of the NQR data are single conditions, medical treatment and outcomes, and the main purpose of the recorded data is to monitor and compare adherence to guidelines and equality of care of one disease but also for health quality improvement and research. It has been suggested that combining different data sources can be an effective way to measure and develop health care for older adults, and it has been suggested that data from different registries should be used together in research.³² Also, NQRs can be a significant source for collecting data about frail older adults that

otherwise might be underrepresented in research because of their age and poor health. The information available in NQRs provides a starting point for the possible use of registry data as a basis for research on interventions into the issues associated with ageing.³³

The aim of this study was to examine the relationship between HRQoL and oral health from a selected set of 4 Swedish national quality registries, in older adults in different care settings.

2 | METHODS

2.1 | Design and participants

As part of the “Health Development in Late Life” project, data were collected from various national quality registries (NQRs) in Sweden during 2014 and individually matched to the Screening Across Lifespan Twin Study (SALT).³⁴ The SALT population provided a means for selecting a large representative sample from the NQRs. The participants in SALT have been shown to be representative of the Swedish population.³⁴ SALT was a telephone survey that started in 1998 and ended in 2002. The telephone interview included a broad set of questions about health and diseases, symptoms, pharmacological treatment, cognition and lifestyle. Four of the NQRs included a measure of quality of life: BOA (Better Management of Patients with OsteoArthritis), Rikshöft (the Swedish National Registry of hip fracture patient care), Riksvikt (the Swedish Heart Failure Registry) and SwedeHeart (The Swedish Web-system for Enhancement and Development of Evidence-based care in Heart disease Evaluated According to Recommended Therapies). The NQR Senior Alert, which focuses on preventive care in older persons, included measures regarding oral health, pressure ulcers, falls and malnutrition. Other correlates were available from SALT. Combining data across sources resulted in a sample of 510 individuals with data on all variables included in the analyses. Age at the time of the SALT interview ranged from 60 to 98 years, with a mean of 78.13 (SD = 7.51). Most of the NQR data about QoL came from Riksvikt (49.6%) and SwedeHeart (40.6%); BOA and Rikshöft accounted for 6.3% and 3.5% of the sample, respectively.

2.2 | Measures

The variables included were chosen for their potential relevance to oral health based on the expertise within the research group and the relevant research literature.

2.2.1 | NQR variables

Oral health

To measure risk of oral health problems in Senior Alert, the Revised Oral Assessment Guide (ROAG)³⁵ was used. Briefly, the ROAG

evaluates oral health by assessing the condition of the voice, lips, oral mucosa, tongue, gums, teeth, saliva, swallowing and any dentures/implants. Each item is measured on the following scale: 0: not relevant to assess; 1: healthy or normal condition; 2: moderate changes or deviations that can and must be treated by the nursing staff; and 3: severe changes or deviations that require contact with dental or medical professionals. Persons who score a 2 or 3 on at least one item on the ROAG are considered to have oral problems. The instrument has been shown to have good validity and reliability in previous studies.^{15,35,36} The ROAG was used to divide the sample into individuals with risk of oral health problems (N = 31) and those without (N = 479). Age at the time of the assessment in Senior Alert was used as the age metric in these analyses.

Quality of Life

The four NQRs collected the EQ-5D as a measure of health-related quality of life.¹¹ The scale includes 5 items that measure mobility, self-care, usual activities, pain/discomfort and anxiety/depression. The items are rated on a 1-5 Likert scale and then combined and standardised so that the average score is 0 and higher scores indicate higher quality of life, the possible range was -3 to +3.

The Modified Norton Scale (MNS)

The instrument, which is used in Senior Alert, is designed to assess risk of pressure ulcers. MNS includes 7 items: mental condition, physical activity, mobility, food intake, fluid intake, incontinence and general physical condition. The older persons are rated on a 4-point scale on each item. Four of these items were included in the current analyses because of their potential relevance to oral health: physical activity, mental status, food and fluid intake (Table 1).

Body mass index (BMI)

Self-reported height and weight are found in the Senior Alert and were used to calculate body mass index as weight in kilograms

divided by the square of height in metres. BMI was used in analyses as a continuous variable.

2.2.2 | SALT variables

The SALT telephone interview collected self-report data on measures including education, self-rated health, living status and depression. Education was quantified as number of years of formal education. Respondents also indicated whether or not they lived alone, and they rated their general health on a scale from 1 (poor) to 5 (excellent). Eleven of the 20 items from the Center for Epidemiological Studies–Depression (CESD) inventory were administered, measuring frequency of depressive symptoms during the preceding week.³⁷ Each item was rated on a 4-point scale: poor appetite, depressed mood, felt everything was an effort, restless sleep, felt happy, felt lonely, people were unkind, enjoyed life, felt sad, people dislike me and couldn't get going. The items were reverse-scored as appropriate and summed to create a measure of depression which ranged from 0 to 29 in the current sample: higher scores indicated more depressive symptoms.

2.3 | Statistical analysis

Stepwise logistic regression was used to predict membership in either risk of oral health problems or no risk of oral health problems groups, including age, sex, education, quality of life, BMI, self-rated health, depression, living status and the four MNS variables, that is physical activity, mental status, food and fluid intake, as potential predictors. Stepwise regression adds predictors to the model at each step by selecting the variable with the strongest relationship to the outcome variable. In addition, at each step SAS checks to see whether any variables should now be removed because the relationship is no longer strong enough. Using SAS version 9.4³⁸ and

TABLE 1 Variables in Modified Norton Scale (MNS) included in this study⁵⁹

Variable	Scoring
Mental status	4. Fully oriented to time and space 3. Occasionally confused 2. Cannot answer correctly 1. No contact
Physical activity	4. Ambulant without assistance 3. Walks with help by others (possibly wheelchair for independent transportation). 2. Chair-bound (all day) 1. Bed-ridden
Food intake	4. Normal portion (or full parenteral) 3. $\frac{3}{4}$ of normal portion (or corresponding parenteral) 2. $\frac{1}{2}$ of normal portion (or corresponding parenteral) 1. Less than $\frac{1}{2}$ portion (or corresponding parenteral)
Fluid intake	4. More than 1000 mL/d 3. >700 mL per-<1000 mL/d 2. >500 mL-<700 mL/d 1. Less than 500 mL/d

Variables	Oral health risk N = 31	No oral health risk N = 479	Group comparison
% Female	25.81%	29.44%	$\chi^2(df = 1) = 0.19$, <i>n.s.</i>
% Live Alone	29.03%	21.50%	$\chi^2(df = 1) = 0.96$, <i>n.s.</i>
Mean Age (SD)	79.69 (8.04)	77.73 (7.44)	$t(508) = 1.41$, <i>n.s.</i>
Mean Education (SD)	9.94 (3.92)	8.84 (2.77)	$t(508) = 2.08$, $P < .05$
Mean BMI (SD)	26.51 (3.33)	25.82 (3.15)	$t(508) = 1.18$, <i>n.s.</i>
Mean Self-rated Health (SD)	3.10 (1.33)	3.79 (1.07)	$t(508) = 3.44$, $P < .01$
Mean Depression (SD)	4.68 (6.10)	3.06 (4.12)	$t(508) = 2.05$, $P < .05$
Mean Quality of Life (SD)	-0.75 (1.52)	-0.15 (1.01)	$t(508) = 3.12$, $P < .01$
Mean Norton Liquid (SD)	3.55 (0.57)	3.55 (0.67)	$t(508) = 0.06$, <i>n.s.</i>
Mean Norton Nutrition (SD)	3.48 (0.93)	3.52 (0.81)	$t(508) = 0.24$, <i>n.s.</i>
Mean Norton Physical Status (SD)	3.45 (0.72)	3.68 (0.72)	$t(508) = 1.75$, <i>n.s.</i>
Mean Norton Mental Status (SD)	3.35 (0.55)	3.73 (0.51)	$t(508) = 3.96$, $P < .01$

TABLE 2 Demographic characteristics of individuals with and without risk of oral health problems

Step	Variable	Estimate (SE)	Significance	Odds ratio	95% Confidence interval
1	Norton Mental Status	-1.00 (0.33)	0.00	0.37	0.19, 0.71
2	Self-rated Health	-0.52 (0.18)	0.00	0.59	0.42, 0.85
3	Age	0.07 (0.03)	0.02	1.07	1.01, 1.13
4	Quality of Life	-0.38 (0.18)	0.03	0.69	0.49, 0.97
5	BMI	0.12 (0.07)	0.08	1.13	0.99, 1.30
6	Education	0.14 (0.07)	0.04	1.15	1.01, 1.31
7	Live Alone (0 = No; 1 = Yes)	0.86 (0.48)	0.07	2.37	0.93, 6.06

TABLE 3 Stepwise logistic regression to predict risk of oral health problems

following standard procedure, significance level for entry into the model was set at .30 and significance level for staying in the model was set at .35.

2.4 | Ethical approval and participant consent

The project entitled "Health development in later life" was approved by the regional ethical board in Linköping, Sweden (2014/25). According to the Declaration of Helsinki (WMA, 1964), ethical guidelines for research related to register data were followed. Approval was also granted by the Swedish Data Inspection Board, a national agency that serves as an institutional review board for studies using database linkage. This study used anonymised data from Swedish

national registers, and thus, informed consent from the participants was not applicable.

3 | RESULTS

In the current sample, HRQoL scores ranged from -3.6 to + 2.0. As shown in Table 2, individuals with risk of oral health problems reported significantly lower quality of life, on average. Persons with risk of oral health problems had significantly more years of education and significantly lower self-rated health than persons without risk (Table 2). As shown in Table 2, individuals with risk of oral health problems reported significantly more depressive symptoms than those without risk.

Results of the stepwise logistic regression are reported in Table 3. The procedure went through seven steps before it stopped because no more variables met the criterion for entry into the model. At no step was a variable that had been entered into the model removed because of declining significance. Therefore, of the 12 variables entered into the stepwise regression, seven contributed significantly to the prediction of risk for oral health problems. The Hosmer–Lemeshow test of goodness of fit indicates poor fit if the significance value is less than .05; for this regression model, chi-square ($df = 8$) = 11.22, $P = .19$. Somer's D indicates strength (0 to 1) and direction (negative or positive) of the relationship between risk of oral health problems and the combination of predictors, for the current regression Somer's $D = 0.55$. Variables are listed in order of entry into the model in Table 3. All variables contributed significantly to the model at $P < .08$; the significance levels for Norton Mental Status and self-rated health were at $P < .01$. Lower quality of life, lower mental status, lower self-rated health, higher age, higher BMI and living alone were all associated with being at risk of oral health problems. However, more years of education were associated with higher risk of oral health problems.

4 | DISCUSSION

This study revealed a statistically significant relationship between HRQoL and oral health, that is a lower self-reported quality of life was related to being at risk for oral health problems, in an older Swedish population, even considered in the context of possible covariates. The result, based on aggregating data from NQRs, is in line with earlier studies focusing on HRQoL and oral health outcomes,^{17–19,39} suggesting that oral health status plays an important role for self-reported quality of life among older people, including populations that may be underrepresented in research studies. This relationship arises from the link between oral health problems and both general chronic and/or acute diseases and malnutrition/undernutrition leading to physical frailty affecting quality of life.⁴⁰ Our study supports the conclusion that oral health is related to quality of life for older adults in different care settings and is consequently a vital part of general health.

Furthermore, lower mental status and lower self-rated health were associated with being at risk for oral health, which has been found in a recent systematic review.⁴¹ Another literature review confirmed that mental health such as depression in older people (>60 years) is related to worse oral hygiene and oral health problems, for instance periodontitis, stomatitis, mucosal lesions and reduced salivary flow.⁴²

The results also indicated that higher BMI was a risk factor for oral health problems. As earlier studies have stated, oral health has a strong relationship with malnutrition in older people.^{12,13,32} BMI is one anthropometric measurement of several screening tools for nutritional assessment³² and has also been used in a study analysing oral health and malnutrition where no association between oral health outcomes and malnutrition was found.⁴³ However, the

sensitivity of using BMI as a screening component for malnutrition risk in older patients has been discussed.⁴⁴ The other nutrition variables used in the analysis of present study, that is the Norton nutrition and liquid, were not identified as predictors by the regression and thus might not be the best ones for measuring nutritional status. The Mini-Nutritional Assessment (MNA)⁴⁵ and the Subjective Global Assessment (SGA)⁴⁶ have been used in several studies, showing pathways of association between oral health problems, malnutrition and low QoL in older adult populations.⁴⁰ MNA was a possible variable in the current study, but was excluded as the sample size would have been severely reduced.

The current study showed that not only physical and mental status but also social-related factors such as living alone were related to risk of oral health. Oral health is vital for social interactions.^{47,48} For example, being edentate and having poor oral health functioning, that is difficulty eating and speaking, could result in loneliness affected by the unwillingness for social contacts. Although it is possible to reverse loneliness, it has been associated with a decreased probability of regular dental attendance⁴⁹ and oral health.⁵⁰ Loneliness has also been recognised to be related to QoL among older people.^{51,52} Thus, promoting good oral health in older age could be seen as a protective factor against loneliness. It is also possible that loneliness affects oral health, but little research has investigated that possibility.

Another social factor in the present study revealed that risk of oral health problems was associated with more years of education. This result was quite unexpected, as educational level has been found to be positively related to better oral health in earlier studies.²⁵

Most of the older people in current study were healthy, that is no risk of oral health problems. In studies using the same assessment tool as used in the current study, that is the ROAG, individuals with oral health problems varied between 11% and 30%.^{15,53,54} The difference between the current study and previous studies could be explained by the difficulty in using the ROAG as a screening tool within nursing care or in different contexts of the study populations.⁵⁵ However, oral problems are very common in older people, especially frail older adults^{4,5} and those with cognitive disorders.⁴² Current analyses also agreed with earlier results showing that age is related to oral health problems.⁴¹

Thus, education to caregivers, independent older people, their families and important others, is one of the targets to support healthy ageing.^{4,6} To increase quality of life for dependent older people, it is suggested that effort is needed to increase oral health education for non-dental healthcare professionals. Moreover, it would be beneficial to find health-promoting strategies to encourage care providers to include oral care in daily general health care.¹⁴

This study is based on data from several national registries, which may introduce some sources of error. Individual health registries are not representative of the entire population because they are targeted at collecting data about specific health conditions. Moreover, in the current study, registries were selected on the basis of inclusion of the EQ-5D assessment of quality of life, which may further limit representativeness. These data were

found in four registries, and approximately 90 percentage of the sample were obtained from NQRs recording care in relation to a heart disease. Cardiovascular diseases are common and also the leading cause of death,⁵⁶ but this sample might not fully reflect the older population that often also have other types of diseases, which could bias the results in terms of representativeness and interpretation. However, in terms of survivor bias, a strength of using the NQRs is the ability to collect data about a population that may be underrepresented in most research on ageing because of their age and poor health. Thus, in current study the results mirror the most ill older adults, which is an increasing population in Sweden as in many other countries. Moreover, quality of life is a broad concept.⁹ We used the EQ-5D focusing on quality of life from a general health perspective, which must be considered when interpreting the results in relation to studies using other quality-of-life instruments including oral health perspective, that is OHQoL.

Also, in order to be included in the analyses a person had to be registered in different registers. This criteria of course affected the sample size as many were excluded, which can be seen as a limitation of the study. There might also be a bias because of the coverage in the different NQRs. However, using NQRs makes it possible to use data from those adults who typically are not included in studies of ageing: frail older adults. The sample ranged in age from 60 to 98, with a mean of 78, age ranges that can be challenging to recruit in a study conducted de novo. Another aspect is that the follow-up age is not given, which would presumably reflect a much older age distribution than the currently reported age. However, as this study is based on aggregating data from different NQRs, the follow-up age will vary depending on the studied variable.

The mean education level of 8 to 9 years is representative for individuals born in the first half of the 20th century in Sweden.⁵⁷ Combining registry data, collected in a healthcare context, with the SALT telephone survey, may have reduced confounding that can arise when quality of life and oral health are collected in the same survey or setting.

Our results confirm the associations among quality of life, general health (physical, mental and social) and oral health among older adults. Thus, it is important to include oral health as a part of general health for older people⁶ as it is reflective of overall QoL. Kandelman and colleagues⁶ also highlight the importance of the awareness about the relationship between oral health and QoL in older people to promote healthy ageing. It is also in line with the World Health Report 2015, which completed a global survey of oral health needs among older people.⁵⁸

5 | CONCLUSIONS

Oral health is a significant component of quality of life in late adulthood. The present study supports the importance of a holistic perspective, preparing for age-friendly healthy environments. Moreover, national health quality registries should include measures

of QoL to support investigation of efforts to meet government goals of supporting healthy ageing.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

AUTHOR CONTRIBUTIONS

MEB and LJ planned for, and collected, the data. All authors contributed to the study design and methodology. DF conducted the statistical analysis of the data. UL and DF wrote the paper. All authors contributed to the interpretation of the findings and reviewing drafts of the paper, read and approved the final version.

ORCID

Ulrika Lindmark  <https://orcid.org/0000-0003-2786-707X>

Marie Ernst Bravell  <https://orcid.org/0000-0003-4149-9787>

Linda Johansson  <https://orcid.org/0000-0001-7101-3165>

Deborah Finkel  <https://orcid.org/0000-0003-2346-2470>

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