Systematic Review

Polypharmacy and oral health-related quality of life in older adults: a systematic review

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ABSTRACT

Introduction: Patient-centered care requires medical personnel to address not only physical illnesses but also the psychosocial well-being of patients. older adultsOlder adults often have medically complex conditions, including one or more chronic diseases, requiring the use of multiple medications (polypharmacy). Polypharmacy is a common problem among older adults, with a reported prevalence of 30% to 80%. Many prescribed medications can lead to xerostomia and hyposalivation, which negatively impact the quality of life , including Oral Health-Related Quality of Life (OHRQoL). This systematic review aims to determine the impact of polypharmacy on OHRQoL in older adults and explore strategies to optimize OHRQoL in this population. **Method:** The dataset of articles concerning polypharmacy and OHRQoL in older adults was compiled from Google Scholar, PubMed, Semantic, and OpenAlex. The search encompassed publication from 2019 to 2024. Five articles were selected for in-depth analyses, and variations in methodologies used by the researchers in these selected studies were identified and considered. **Results:** Patients with polypharmacy hyposalivation exhibited significantly higher scores of the Summated Xerostomia Inventory questionnaire (SXI-PL) (8.60 ± 2.56) and the Oral Health Impact Profile-14 (OHIP-14sp) (16.0 ± 15.8). A statistically significant association was found between hyposalivation and both SXI-PL and OHIP-14sp scores ($p < 0.05$). Elderly individuals on continuous medication demonstrated increased odds of self-reported xerostomia (OR: 2.3; 95% CI: 1.19-4.67; P = 0.009). **Conclusion:** This study demonstrates an association between polypharmacy and decreased oral health-related quality of life (OHRQoL) in older adults.

KEYWORDS

hyposalivation, oral health-related quality of life, polymedication, polypharmacy, xerostomia

INTRODUCTION

With increasing life expectancy, the older adult population is growing globally. The World Health Organization (WHO) reported that in 2019, the number of people aged 60 years and over reached 1 billion. Projections indicate this number will rise to 1.4 billion by 2030 and 2.1 billion by 2050.[1] The Central Statistics Agency of Indonesia reported a life expectancy of 73.5 years in 2021. Consequently, the percentage of elderly individuals in Indonesia has doubled over five decades (1971 - 2020), reaching 9.92% (26 million people) and is estimated to increase to 15.77% (48.2 million people) by 2035.[2]

Aging is a normal, natural, and unavoidable biological process. In humans, these changes occur at different levels and are influenced by lifestyle, environment, and genetic.[3] Older adults generally experience changes in both physical and psychological aspects. Furthermore, aging is often associated with a decline in immunity, making individuals more prone to various diseases.[4] This process can directly or indirectly increase the risk of developing diseases.

necessitating the use of mediations.[5] Consequently, older patients frequently use multiple medications and have a higher incidence of comorbid conditions.[6]

Maintaining quality of life is essential throughout a person's life span, particularly in advanced age. In medical and health research, the concept of quality of life is defined as a multidimensional areas involving the physical, functional, psychological, and social health of patients. Health-related quality of life significantly impacts overall performance. While healthy behavior in older adults often reflect skills they acquired in the early stages of their lives. However, maintaining these habits becomes increasingly challenging with age. The use of drugs[4] and changes in oral health[8] elevate the risk of developing oral diseases and complex dental problems.[9]

Dry mouth is a common complain among older adults. Hyposalivation and low salivary pH are known to negatively impact quality of life.[10] Xerostomia, the subjective sensation of dry mouth, affects over 30% of individuals aged 65 and older.[11] This condition results in the oral cavity becoming more susceptible to infection, dental caries, periodontal disease, denture discomfort, and difficulty with mastication and swallowing.[9] Xerostomia can arise from various factors, including medication use, radiotherapy treatment for head and neck cancer, chronic rheumatic diseases such as Sjögren's syndrome, and systemic disorders such as diabetes mellitus.[12] Notably, the most common cause of salivary gland hypofunction and xerostomia is drug intake.[13]

Older adults are more susceptible to chronic diseases and require multiple medications. Polypharmacy is a common problem among this population, with a prevalence of 30% to 80%.[14] Polypharmacy, also known as polymedication, refers to the use of multiple medications simultaneously by an individual, typically defined as taking five or more medications.[15] This condition is becoming increasingly prevalent, especially among older adults and chronically ill patients, driven by an aging population with multimorbidity 14.[16] Polypharmacy is associated with various risks, including adverse drug reactions, drug-drug interactions, and decreased medication adherence, especially among older adults.[15]

Drug side effects can range from mild symptoms, such as nausea and dizziness, to severe symptoms, including kidney failure and stroke. Drug interactions occur when two or more drugs are combined, leading to unintended effects.[14] Polypharmacy has been associated with negative impacts on oral health-related quality of life (OHRQoL) and overall health-related quality of life (HRQoL) in older adults. Studies have shown that xerostomia, a common side effect of polypharmacy, significantly impairs OHRQoL in this population.[12,17] The purpose of this literature review is to determine the impact of polypharmacy on OHRQoL in the elderly people. This systematic review aims to determine the impact of polypharmacy on OHRQoL in older adults and explore strategies to optimize OHRQoL in this population

METHODS

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[18] To ensure a rigorous and transparent review process, it is essential to operationalize the guidelines, particularly in terms of inclusion and exclusion criteria and database selection.

A comprehensive literature search was performed across four international biomedical literature databases: Google Scholar, PubMed, Semantic, and OpenAlex. The search terms included "Polypharmacy," "Polymedication," "Oral Health-Related Quality of Life," "Hyposalivation," and "Xerostomia." Keywords were determined using a combination of Medical Subject Headings (MeSH) terms and free-text terms to maximize the retrieval of relevant studies. Boolean operators (AND, OR) were used to refine the search strategy. The search was limited to studies published between January 1, 2019, and July 13, 2024.

The inclusion and exclusion criteria for this review were established to ensure the selection of only relevant and high-quality studies. The inclusion criteria comprised studies examining the impact of polypharmacy on oral health-related quality of life (OHRQoL) in older adult population. Eligible studies encompassed original research articles, including randomized controlled trials (RCTs), cohort studies, cross-sectional studies, and case-control studies. Additionally, studies assessing the relationship between polypharmacy and OHRQoL, with a particular focus on the prevalence and severity of xerostomia, were also included.

Only articles published in English or Indonesian were considered, studies in other languages were excluded. On the other hand, exclusion criteria encompassed studies that lacked sufficient data relevant to the research question, articles published in other languages than English and Indonesian, as well as review articles, commentaries, letters to the editor, and conference abstracts.

The quality of the included studies was evaluated using the Critical Appraisal Skills Programme (CASP) checklist and the Newcastle-Ottawa Scale (NOS) for observational studies. Each study was independently assessed by two reviewers to determine methodological rigor, risk of bias, and overall quality. In cases of discrepancies, discussions or consultations with a third reviewer were undertaken to reach a consensus.

A structured data extraction process was implemented to ensure consistency and accuracy. The extracted data encompassed study characteristics (author, year, country, and study design), population characteristics (sample size, age, and gender), intervention details (definitions of polypharmacy and medication classes involved), outcomes (OHRQoL scores, prevalence of xerostomia, and salivary flow rate), and key findings relevant to the research question. The data extraction process adhered to the PICO (Population, Intervention, Comparison, Outcome) framework, with the following specifications: The Population comprised of older adults experiencing polypharmacy, the Intervention involved exposure to multiple medications, the Comparison included individuals with limited or no medication use, and the Outcome focused on changes in OHRQoL and salivary flow rate.

The study selection process commenced with the identification of 501 articles through the initial search. After eliminating 56 duplicates, 445 studies remained for screening. The screening process was conducted based on journal name, year of publication, author, and title. Following a full-text assessment for relevance and methodological quality, six studies met the inclusion criteria. At the final stage, one study was excluded due to its lack of focus on the older adult population. A detailed overview of the study selection process is presented in Figure 1. Structuring the methodology into these specific sections enhanced the transparency and systematic nature of the review process, effectively addressing the concerns raised by the reviewers.

RESULTS

The identification process, conducted using Harzing's Publish or Perish software, identified five articles for further review from the Semantic Scholar, OpenAlex, PubMed, and Google Scholar databases. Data extracted from these articles, including authors, year of publication, article title, number of participants, research design, and main findings are summarized Table 1. Among the selected articles, three were published in 2023, and two were published in 2021.

Patients with polypharmacy and hyposalivation exhibited higher Xerostomia Inventory (XI) scores (8.60 ± 2.56) and Oral Health Impact Profile-14 (OHIP-14) scores (16.0 ± 15.8). OHIP-14 scores showed significant correlation with hyposalivation ($p = 0.0425$). Among the OHIP-14 dimensions, "Physical Pain" had the highest impact (3.35 ± 2.81).[19]

The prevalence of hyposalivation was 69.4% based on unstimulated saliva and 56.5% based on stimulated saliva. The overall XI score ranged from 2 to 8, with a mean of 7.95±3.87. Patients with hyposalivation had a significantly higher

mean XI score (9.50±3.25; p=0.0126). The overall OHIP-14 score ranged from 25 to 40, with a mean of (10.20±7.35). The mean OHIP-14 score was also higher in patients with hyposalivation (15.0±6.8; p=0.061). Among the OHIP-14 dimensions, "Physical Disability" had the highest impact, characterized by unsatisfactory eating patterns due to chewing disorders resulted from problems with teeth, mouth or dentures.[20]

Among the 100 subjects included in this study, nearly 70 patients (70%) were diagnosed with xerostomia. Pearson correlation analysis was conducted to examine the relationship between the severity of xerostomia and patients' quality of life. A significance level of 5% $p < 0.05$) was adopted for all statistical tests.[20]

Older adults with diabetes exhibited a significantly increased likelihood of reporting xerostomia (OR: 3.59; 95% CI: 1.48-8.68; P<0.001). Similarly, those with chronic diseases and using continuous medication also showed a higher odds ratio for xerostomia (OR:2.3; 95% CI: 1.19-4.67; P=0.009). Furthermore, elderly individuals using continuous medication for the digestive tract conditions were also more likely to experience xerostomia (OR: 2.14; 95% CI: 1.03-1.44; P =0.030).[21]

Patients taking gastrointestinal and metabolic medications had higher XI and OHIP-14 scores compared to those not taking these medications, with averages of 21.3±9.3 and 4.6±8.5. Factors influencing the severity of xerostomia and OHIP-14 scores included patient-reported dry mouth, salivary flow rate, age, and gender. However, only the XI score was significantly associated with the OHIP-14 score.[17]

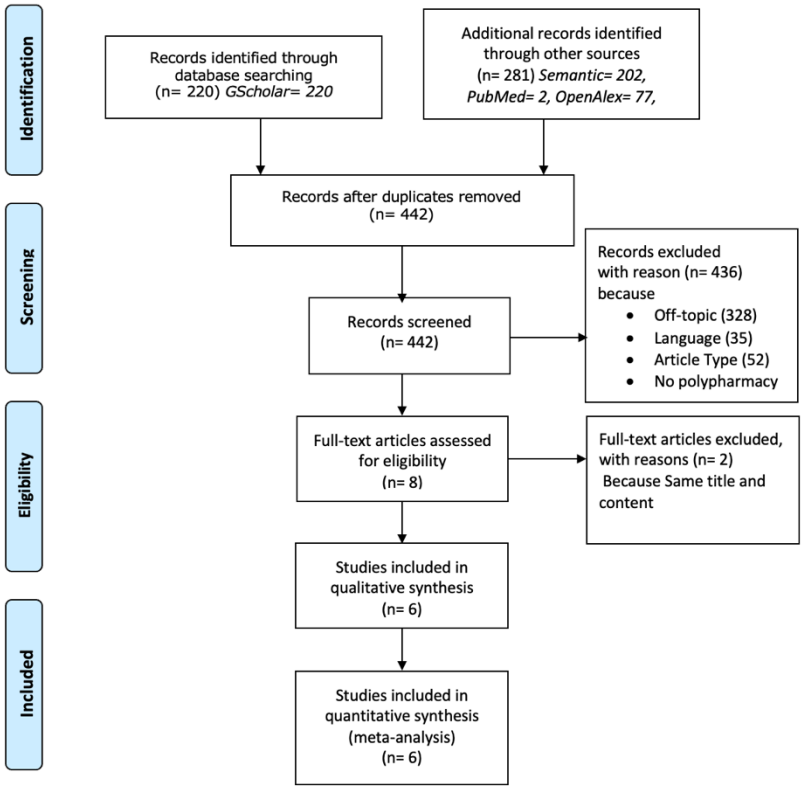

Figure 1. PRISMA flowchart diagram

Table 1. The impact of polypharmacy on OHRQoL

	References	Number of participants	Design of Study	Key Findings	Correlation result
1	*Factors influencing xerostomia and oral health-related quality of life in polypharmacy patients* (L Ramírez et al, 2023)	218 hypertension patients	Cross-sectional	Of the 83 patients with hyposalivation, 55 (66.3%) had xerostomia.	The mean XI score was higher in women than in men (22.4 [SD = 9.0] vs. 18.9 [SD = 7.9]; *P* = 0.002). The mean OHIP score was also higher in women, but the difference was not statistically significant (3.9 [SD = 7.3] vs. 3.2 [SD = 7.4]; *P* = 0.85).
2	*Assessment of hyposalivation, xerostomia, and oral health-related quality of life in polypharmacy patients* (JG Marques et al, 2021)	40 polypharmacy patients from Clínica Dentária Egas Moniz	Cross-sectional	OHIP-14sp scores ranged from 0 to 51, with a mean of 11.50 (± 12.98).	The mean score of OHIP-14sp was higher in patients with hyposalivation (16.0 ± 15.8). The results demonstrate a statistically significant correlation between OHIP-14sp scores and hyposalivation (*p* = 0.0425). Significant relationship between hyposalivation and XI and OHIP-14 scores ($p < 0.05$)
3.	*Evaluation of the Effect of Xerostomia and Hyposalivation on Oral Health Related Quality of Life among Polypharmacy Patients* (S Koduri et al, 2023)	62 polypharmacy patients who regularly used the following drugs: anticonvulsants, antidepressants, oral hypoglycemics, antihypertensives, antihistamines for more than 1 year	Cross-sectional	The presence of hyposalivation and xerostomia was observed in majority of the study population.	Patients with hyposalivation had a mean score of 9.50±3.25 and 15.0±6.8 with the OHIP and SXI questionnaires respectively, with a P value of .10, considered statistically significant.
4.	*Assessment of Xerostomia and Oral Health Related*	100 elderly patients with signs and	Cross-sectional	64 subjects had a saliva pH of 5.5 and a	Statistically significant correlation

	Quality of Life in Geriatric Subjects on Polymedications- A Prospective Study in Regional Dharwad (P Purohit, et al, 2023)	symptoms of xerostomia and history of underlying systemic conditions and details of medications taken (duration, dose, frequency of treatment)		moderate dryness category.	between degree of dryness and various drugs used ($p < 0.05$). Majority of patients were on antihypertensive or antidiabetic medication ($P = 0.000 < 0.05$).
5.	*Prevalence of xerostomia and its association with systemic diseases and medications in the elderly: a cross-sectional study* (CB Fornari et al.,2021)	293 elderly in Brazil	Cross-sectional study	The prevalence of self-reported xerostomia was 19.1%.	lderly with diabetes had higher odds of self-reported xerostomia (OR: 3.59; 95% CI: 1.48-8.68; $P < 0.001$). Those with chronic diseases and continuous medication use had increased risk (OR: 2.3; 95% CI: 1.19-4.67; $P = 0.009$). Continuous medication for the gastrointestinal tract increased likelihood of xerostomia (OR: 2.14; 95% CI: 1.03-1.44; $P = 0.030$).

DISCUSSION

The studies included in this review indicate that hyposalivation and xerostomia are the most common symptoms associated with polypharmacy, significantly impairing patients' quality of life. A consistent association was observed between hyposalivation and both Xerostomia Inventory (XI) and Oral Health Impact Profile-14 (OHIP-14) scores in patients with polypharmacy.[17,19–22]

The diagnosis of xerostomia involves a combination of subjective symptoms and objective assessments, such as salivary flow rate assessment. Normal salivary flow rates vary widely, with a typical threshold of 0.25 mL/min. A salivary flow rate of less than 0.12 - 0.16 mL/min is considered abnormal.[9] Xerostomia can significantly affect the quality of life of older individuals by causing symptoms such as secondary dental caries, dysgeusia, dysphagia, oral candidiasis, bacterial infections, and ill-fitting prosthesis.[11]

This condition can interfere with a person's ability to eat, drink, speak, and swallow comfortably, thereby affecting aspects of a person's communication, comfort, and self-confidence. Consequently, xerostomia has a profound impact on the quality of life of older adults through its effects on oral health and daily functioning.

Xerostomia has many etiologies, but it primarily occurs as a side effect of medications, secondary to head and neck radiation therapy, or in association with

Sjögren's syndrome. Regardless of underlying cause, the primary complaint reported by patients is dry mouth. Treatment focuses on symptomatic relief, although complete resolution is not always achievable. Initial management strategies include patient education, such as encouraging regular water intake and avoiding tobacco use, as well as local measures like artificial saliva.[23] Pharmacological therapy, especially with pilocarpine [24], is introduced when non-pharmacological interventions are insufficient.

A correlation was observed between the number of medications ingested and the severity of xerostomia in a study conducted by Purohit et al. Increased medication intake was significantly associated with a higher severity of xerostomia in older adults.[22]

The most common medications associated with xerostomia are those with anticholinergic, sympathomimetic, and benzodiazepine activity. Drugs that can cause xerostomia include: (a) agents that directly damage the salivary glands, such as cytotoxic drugs; (b) anticholinergic agents (e.g. atropine, atropinic, hyoscine) and antireflux agents (e.g. proton pump inhibitors such as omeprazole); (c) centrally acting psychoactive agents, such as antidepressants (e.g. tricyclic compounds), phenothiazines, benzodiazepines, antihistamines, bupropion, and opioids; (d) agents acting on the sympathetic system, including sympathomimetics (e.g. ephedrine) and antihypertensives, such as α-1 antagonists (e.g. terazosin and prazosin), α-2 agonists (e.g. clonidine), which can reduce salivary flow, and β-blockers (e.g. atenolol and propranolol), which alter salivary protein levels; and (e) agents that deplete fluid, such as diuretics. The risk of xerostomia increases due to the synergistic effects of xerostomic medications, polypharmacy, higher drug doses, and prolonged treatment duration.[25]

Chronic diseases are the most prevalent conditions affecting older adults and often necessitate long-term medication use.[26] Among individuals with diabetes, there is an increased risk of xerostomia and decreased OHRQoL[27], consistent with findings from Fornari et al., who reported a higher risk of xerostomia in patients with diabetes.[21] In addition to medications for diabetes, depression and anxiety, other commonly prescribed drugs include those for cardiovascular disease, nervous system disorders, gastrointestinal diseases and metabolic disorders. Patients using medications for digestive disorders are at an increased risk of developing xerostomia.[21]

One article outlines strategies to overcome the impact of polypharmacy on oral health-related quality of life (OHRQoL). Continuous oral health education and preventive measures, such as regular water intake and fluoride treatment, are recommended to prevent hyposalivation in older adults with polypharmacy.[17] Primary care providers, specialists, nurses, and pharmacists should deliver interprofessional education to patients with xerostomia, emphasizing hydration and the avoidance of triggers such as tobacco, coffee, alcohol, and dry or hard-to-chew foods. When medications are part of the treatment plan, pharmacists should verify all doses, perform medication reconciliation, and report any issues to the nursing staff, who will then notify the treating physician. Nursing staff can monitor treatment progress, assess adherence to therapy and lifestyle recommendations, and communicate findings to the healthcare team.

The effect of polypharmacy on OHRQoL in older adults is a critical concern, particularly due to the predominance of xerostomia as a common side impact of medications. As demonstrated by various studies, hyposalivation and xerostomia are directly linked to reduced OHRQoL, affecting oral health, comfort, and overall well-being. The mechanisms underlying this affiliation are complex and multifaceted. Xerostomia can lead to a cascade of oral health issues, including dental caries, periodontal illness, verbal mucosal contaminations, and difficulties with chewing and swallowing. Additionally, the subjective experience of dry mouth can significantly affect mental health and quality of life.

To mitigate the negative effect of polypharmacy on oral health-related quality of life (OHRQoL), a comprehensive approach is essential. Healthcare providers, including doctors/physicians, dental practitioners, and pharmacists, ought to work collaboratively to optimize medication regimens, minimize polypharmacy, and educate patients about the potential oral health side effects of their prescriptions. Regular oral health assessments, including salivary flow rate measurements, can offer assistance to recognize patients at risk for xerostomia and facilitate the implementation of appropriate preventive measures.

Whereas critical advance has been made in understanding the relationship between polypharmacy and OHRQoL, several limitations persist. The majority of studies have utilized cross-sectional designs, limiting the ability to draw causal interferences. Additionally, the reliance on self-reported measures of OHRQoL may present bias. Future research should utilize longitudinal studies to investigate the long-term effects of polypharmacy on oral health outcomes. Furthermore, objective measures of salivary flow and oral health status should be incorporated to improve the accuracy of assessments. By addressing the oral health needs of older adults with polypharmacy, healthcare providers can improve their overall quality of life and well-being.

With only five studies, all of which used a cross-sectional design, this systematic review has significant limitations in addressing the research questions. Cross-sectional designs do not permit causal inferences, making it difficult to determine whether an independent variable directly influences a dependent variable. Furthermore, the limited sample size in each study may increase the risk of bias and reduce the statistical strength of the analysis. Therefore, the findings of this review should be interpreted with caution and cannot be regarded as conclusive evidence.

Regular oral health assessments and preventive measures can help mitigate the negative impacts of polypharmacy on oral health-related quality of life (OHRQoL). While this study offers valuable insights, its limitations must be acknowledged. The cross-sectional design limits the ability to establish causal relationships, and the reliance on self-reported data may introduce potential biases. Future longitudinal studies with larger sample sizes are needed to further investigate the long-term effects of polypharmacy on OHRQoL and to identify effective interventions. By addressing the oral health needs of older adults with polypharmacy, healthcare providers can improve their overall quality of life and well-being.

CONCLUSION

This study has demonstrated a clear relationship between polypharmacy and a decline in Oral Health-Related Quality of Life (OHRQoL) in the older adult population. Xerostomia, a common side effect of many medications, is a major contributor to this decline. To optimize OHRQoL in older adults undergoing polypharmacy, a multidisciplinary approach is essential. Healthcare providers, including physicians, dentists, and pharmacists, should collaborate to educate patients about the potential oral health-related side effects of their medications. The implication of this research is that recognizing and addressing the impact of polypharmacy on oral health is crucial for improving the overall well-being of older adult patients.

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