

Manuscript received May 10, 2026; revised July 3, 2026; accepted August, 2026; date of publication August 30, 2026

Digital Object Identifier (DOI): <https://doi.org/10.35882/ijahst.v6i4.633>

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How to cite: Tiara Muda Galuh Ayu Dewanti¹, Imam Sarwo Edi¹, Dwi Septiarini¹, Dr. Anshad Ansari² "Association Between Oral Health Maintenance Knowledge and Tooth Loss Among Older Adults at Hargo Dedali Nursing Home Surabaya", International Journal of Advanced Health Science and Technology, Vol. 6 No. 4, pp. 324-331, August 2026.

Association Between Oral Health Maintenance Knowledge and Tooth Loss Among Older Adults at Hargo Dedali Nursing Home Surabaya

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ABSTRACT Tooth loss is a prevalent oral health problem among older adults that adversely affects chewing ability, nutritional status, and overall quality of life. Despite its multifactorial etiology, oral health knowledge is a modifiable factor that may influence preventive behaviors and contribute to the preservation of functional dentition. However, evidence regarding this relationship among institutionalized older adults remains limited. Therefore, this study aimed to determine the association between oral health maintenance knowledge and tooth loss among older adults residing at the Hargo Dedali Nursing Home, Surabaya. A quantitative correlational study with a cross-sectional design was conducted involving all 29 eligible residents using a total sampling technique. Oral health maintenance knowledge was assessed using a validated 20-item structured questionnaire, while tooth loss was evaluated through direct clinical examination by counting the remaining functional teeth according to World Health Organization criteria. Descriptive statistics were used to summarize participant characteristics, and the chi-square test was applied to examine the association between oral health knowledge and tooth loss. The findings revealed that 69.0% of participants had poor oral health maintenance knowledge, while 72.4% had fewer than 20 functional teeth. Statistical analysis demonstrated a highly significant association between oral health maintenance knowledge and tooth loss ($p < 0.001$), with a strong relationship indicated by a Contingency Coefficient of 0.691. Older adults with poorer knowledge were substantially more likely to experience severe tooth loss than those with adequate or good knowledge. These findings indicate that oral health maintenance knowledge is strongly associated with tooth retention among institutionalized older adults. Strengthening oral health education, promoting regular dental examinations, and implementing preventive oral healthcare programs in long-term care facilities may improve oral health literacy, encourage healthier behaviors, and reduce the burden of tooth loss in the elderly population.

INDEX TERMS Oral health knowledge, Oral health maintenance, Tooth loss, Older adults, Functional dentition.

I. INTRODUCTION

Population aging has become one of the most significant global public health challenges, accompanied by an increasing prevalence of chronic oral diseases and tooth loss among older adults. Oral health is recognized as an integral component of healthy aging because it influences chewing efficiency, nutritional status, communication, social participation, and overall quality of life [1]–[5]. Tooth loss remains one of the most common oral health conditions affecting older adults worldwide and is frequently associated with dental caries, periodontal disease, inadequate oral hygiene practices, limited access to dental services, and insufficient oral health literacy [6]–[9]. The World Health Organization (WHO) recommends that older adults retain at least 20 functional teeth to maintain adequate masticatory function and nutritional status [2]. However, many institutionalized older adults fail to achieve

this standard due to accumulated oral diseases and inadequate preventive care [4], [10].

Recent studies have increasingly emphasized that oral health outcomes are influenced not only by biological factors but also by behavioral and educational determinants. Oral health maintenance knowledge is considered a modifiable determinant that shapes individual attitudes and preventive behaviors, including toothbrushing practices, dietary habits, utilization of fluoride products, and regular dental visits [11]–[15]. Several investigations have demonstrated that higher levels of oral health literacy are associated with better oral hygiene status, lower incidence of periodontal disease, and improved preservation of natural teeth [13], [16], [17]. Moreover, preventive educational interventions have been shown to significantly improve oral health knowledge and self-care behaviors among older adults residing in community settings and long-term care facilities [14], [18]. These findings

indicate that educational approaches may contribute substantially to reducing the burden of tooth loss in aging populations.

Despite these advances, the existing literature presents several limitations. First, most previous studies have focused on community-dwelling older adults or patients attending primary healthcare centers, whereas evidence involving institutionalized older adults remains relatively limited [15], [19]. Second, previous investigations have frequently examined oral hygiene behavior or clinical oral conditions independently without comprehensively evaluating the association between oral health maintenance knowledge and functional tooth retention [16], [20]. Third, institutionalized older adults generally experience unique environmental conditions, including dependence on caregivers, restricted access to oral healthcare services, and limited exposure to oral health education, all of which may influence oral health outcomes differently from community populations [5], [10], [18]. Consequently, evidence specifically addressing nursing home residents remains insufficient, particularly in Indonesia.

Hargo Dedali Nursing Home in Surabaya represents an appropriate setting for investigating this issue because preliminary observations indicated that many residents experienced substantial tooth loss while routine oral health promotion activities were not systematically implemented. Considering the high prevalence of tooth loss among institutionalized older adults and the potentially modifiable nature of oral health knowledge, further investigation is warranted to better understand their relationship. Such evidence is essential for developing effective preventive strategies and evidence-based oral health promotion programs specifically designed for long-term care institutions.

Therefore, this study aimed to determine the association between oral health maintenance knowledge and tooth loss among older adults residing at the Hargo Dedali Nursing Home, Surabaya. Understanding this relationship is expected to provide scientific evidence regarding the importance of oral health literacy in preserving functional dentition among institutionalized older adults.

This study offers several important contributions. First, it provides empirical evidence regarding the association between oral health maintenance knowledge and tooth loss among institutionalized older adults, a population that remains underrepresented in previous studies. Second, it expands the existing literature by emphasizing oral health knowledge as a potentially modifiable determinant of functional tooth retention within nursing home settings. Third, the findings provide practical recommendations for healthcare professionals, caregivers, and policymakers to develop targeted oral health education and preventive programs that support healthy aging and improve oral health outcomes among older adults living in long-term care facilities.

The remainder of this article is organized as follows. Section II describes the research methodology, including the study design, participants, data collection procedures, measurement instruments, and statistical analysis. Section III presents the research findings. Section IV discusses the results by comparing them with previous studies and highlighting

their practical implications. Finally, Section V concludes the study, summarizes the principal findings, outlines study limitations, and proposes recommendations for future research.

II. METHOD

A. STUDY DESIGN AND RATIONALE

This study employed a quantitative analytical approach using a cross-sectional correlational design to investigate the association between oral health maintenance knowledge and tooth loss among institutionalized older adults. A cross-sectional design was considered appropriate because it enables the simultaneous measurement of the independent and dependent variables within a defined population at a single point in time, thereby facilitating the identification of statistical associations without requiring longitudinal follow-up [21]. This design has been widely adopted in oral health epidemiological studies because of its efficiency in assessing behavioral and clinical variables and its suitability for generating baseline evidence for preventive healthcare interventions [22]. Since the objective of this study was to determine the relationship rather than establish causality, an observational analytical design was deemed the most appropriate methodological approach.

B. STUDY SETTING

The research was conducted at Hargo Dedali Nursing Home, Surabaya, East Java, Indonesia, a long-term residential care institution providing daily healthcare and social support services for older adults. The institution was selected because preliminary observations revealed a relatively high prevalence of tooth loss among residents and the absence of structured oral health promotion programs. Data collection was undertaken from January to March 2026, including participant recruitment, questionnaire administration, clinical oral examinations, data verification, and statistical analysis. Conducting the study within a single institution ensured consistency in environmental conditions and minimized variability related to differences in healthcare services and institutional policies.

C. STUDY POPULATION AND SAMPLING

The study population consisted of all older adults residing at Hargo Dedali Nursing Home during the study period. Eligibility criteria included individuals aged 60 years or older, permanent residents of the institution, capable of communicating effectively, willing to participate voluntarily, and experiencing partial or complete tooth loss. Individuals with severe cognitive impairment, acute systemic illness, or those unwilling to provide informed consent were excluded from the study.

A total sampling technique was employed because the target population was relatively small and accessible. Consequently, all 29 eligible residents meeting the inclusion criteria were recruited, thereby minimizing sampling bias and improving the representativeness of the institutional population [23]. Unlike randomized controlled trials, no randomization or intervention allocation was performed

because this investigation was purely observational and intended to evaluate naturally occurring relationships between variables. The adoption of total sampling also increased statistical efficiency by utilizing the entire available population within the nursing home.

The independent variable was oral health maintenance knowledge, whereas the dependent variable was tooth loss, represented by the number of remaining functional teeth according to the World Health Organization (WHO) functional dentition criteria [24]. Sociodemographic characteristics, including age and sex, were also documented descriptively to characterize the study population.

D. VARIABLES AND MEASUREMENT INSTRUMENTS

Oral health maintenance knowledge was assessed using a structured questionnaire adapted from a previously validated instrument [25]. The questionnaire consisted of 20 dichotomous items covering six major domains: appropriate toothbrushing practices, brushing frequency and timing, correct brushing techniques, selection of oral hygiene products, dietary behaviors associated with oral health, and routine dental attendance. Each correct response received one point, whereas incorrect responses received zero points, resulting in total scores ranging from 0 to 20. Knowledge levels were subsequently categorized as good (76–100%), fair (56–75%), or poor (<56%) according to established classification criteria [26].

Tooth loss was evaluated through direct intraoral clinical examination performed by trained examiners using disposable dental mirrors and portable illumination while adhering to standard infection prevention procedures. The number of remaining functional teeth was recorded for each participant and classified into two categories: individuals retaining at least 20 functional teeth and those with fewer than 20 functional teeth, following WHO recommendations for functional dentition [24]. Prior to data collection, examiner calibration sessions were conducted to standardize examination procedures and ensure consistency in clinical observations.

E. DATA COLLECTION PROCEDURE

Ethical approval and institutional permission were obtained before commencing data collection. Eligible participants received a comprehensive explanation regarding the study objectives, procedures, confidentiality measures, voluntary participation, and their right to withdraw without consequences. Written informed consent was obtained from every participant before enrollment.

Questionnaire administration was performed through face-to-face interviews to minimize misunderstanding among older adults with limited literacy or visual impairment. When necessary, trained researchers provided clarification without influencing participants' responses. Following questionnaire completion, each participant underwent an oral examination to determine the number of missing and remaining functional teeth. Clinical findings were immediately documented using standardized examination forms designed specifically for the study. Throughout the entire data collection process, infection prevention protocols and participant privacy were strictly

maintained in accordance with institutional regulations and international ethical standards.

F. STATISTICAL ANALYSIS

Data processing and statistical analyses were conducted using IBM SPSS Statistics version 26. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participant characteristics, oral health knowledge levels, and tooth loss status. The association between oral health maintenance knowledge and tooth loss was evaluated using the Chi-square test because both variables were categorical. Statistical significance was established at a two-sided p-value of less than 0.05. Furthermore, the strength of the observed association was quantified using the Contingency Coefficient to provide additional interpretation regarding the magnitude of the relationship between the study variables [27], [28].

G. ETHICAL CONSIDERATIONS

This study received ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Surabaya (Approval No. EA/4107/KEPK-Poltekkes_Sby/V/2026). The investigation complied with the ethical principles outlined in the Declaration of Helsinki concerning research involving human participants [29]. Participant anonymity and confidentiality were rigorously protected by assigning identification codes instead of personal identifiers. Participation was entirely voluntary, and respondents retained the right to withdraw at any stage without affecting the healthcare services provided by the institution. All collected data were securely stored and used exclusively for academic and scientific purposes [30].

III. RESULTS

This study was conducted at the Hargo Dedali Nursing Home in Surabaya. Based on observations and an evaluation of the institutions operational programs, it was found that activities specifically related to oral health education and maintenance for the elderly had neither been scheduled nor regularly implemented within the facility.

TABLE 1
Frequency Distribution of Oral Health Care Knowledge Scores Among the Elderly at the Hargo Dedali Nursing Home Surabaya.

Knowledge of Oral Health Care	N	%
Good	2	6,9
Fair	7	24,1
Poor	20	69
Total	29	100

TABLE 2
Distribution of Tooth Loss Among the Elderly at the Hargo Dedali Nursing Home Surabaya.

N	Lost Teeth				Total
	Having ≥ 20		Having < 20		
	functional teeth		functional teeth		
	n	%	n	%	
29	8	27.6	21	72.4	100%

According to the information in [TABLE 1](#), data compiled from the survey instruments reveal that most elderly residents

at the Hargo Dedali Nursing Home Surabaya have a level of knowledge regarding oral health care that falls into the “poor” category, specifically 20 residents (69%). Furthermore, 7 residents (24.1%) fall into the “adequate” category, and only 2 residents (6.9%) fall into the “good” category.

As illustrated by the empirical data compiled in [TABLE 2](#), literacy regarding oral hygiene preservation in that the majority of the elderly residents at the Hargo Dedali Nursing Home Surabaya have fewer than 20 functional teeth—specifically, 21 residents (72.4%)—while 8 residents (27.6%) have 20 or more functional teeth.

TABLE 3

The Relationship Between Knowledge of Oral Health Care and Tooth Loss at the Hargo Dedali Nursing Home Surabaya.

Knowledge	<20 Functional Teeth		≥ 20 Functional Teeth		p-value
	N	%	N	%	
Low	1	4,8	1	12,5	0.000
Adequate	0	0	7	87,5	
Good	20	95,2	0	0	
Total	21	100	8	100	

The statistical metrics presented in [TABLE 3](#) indicate that the derived asymptotic significance value is precisely reported as $p < 0.001$, which falls substantially below the predetermined alpha threshold ($\alpha = 0.05$). Consequently, the null hypothesis (H_0) is rejected, thereby sustaining the alternative hypothesis (H_1). This empirical evidence confirms a statistically significant correlation between oral health maintenance knowledge and tooth loss configuration among the elderly residents at Hargo Dedali Nursing Home in Surabaya. Although the distribution exhibits a limitation characterized by low expected frequencies in certain cells due to the constrained sample size, the methodological validity of this correlation is further reinforced by reporting an effect size via a Contingency Coefficient of 0.691, validating a robust strength of association between these variables.

IV. DISCUSSION

A. INTERPRETATION OF ORAL HEALTH MAINTENANCE KNOWLEDGE AMONG OLDER ADULTS

The present study demonstrated that most older adults residing at the Hargo Dedali Nursing Home had poor oral health maintenance knowledge, with 69.0% of participants categorized as having inadequate knowledge. This finding indicates that oral health literacy remains insufficient among institutionalized older adults and may negatively influence their ability to adopt appropriate oral hygiene practices. Knowledge is widely recognized as a fundamental determinant of health behavior because it shapes an individual's awareness, attitudes, and motivation to perform preventive healthcare activities. Consequently, inadequate knowledge may reduce compliance with recommended oral hygiene practices, delay the utilization of professional dental services, and ultimately increase the risk of oral diseases and tooth loss [31], [32].

Several factors may explain the low level of oral health knowledge observed in this study. First, physiological aging is

frequently accompanied by cognitive decline, impaired memory, and reduced information-processing capacity, which may limit older adults' ability to understand and retain oral health information. Second, institutionalized older adults generally depend on caregivers for their daily activities, including oral hygiene maintenance, making personal motivation less influential than caregiver support. Third, observations conducted during this study revealed that structured oral health education programs were not routinely implemented within the nursing home, thereby restricting opportunities for residents to receive updated information regarding preventive oral healthcare. These institutional characteristics may collectively contribute to the inadequate oral health literacy identified among the study participants.

The findings are consistent with previous investigations reporting that institutionalized older adults generally possess limited knowledge regarding proper toothbrushing techniques, the importance of routine dental examinations, and strategies for preventing periodontal disease and dental caries [33], [34]. Li *et al.* [35] similarly reported that inadequate oral health literacy significantly predicted poorer oral health outcomes among older adults, emphasizing that knowledge represents a critical determinant of preventive behavior. Likewise, Hui *et al.* [36] concluded that multidisciplinary educational interventions involving dentists, nurses, and caregivers substantially improve oral health awareness and self-care practices among elderly populations.

Nevertheless, the present findings differ from several studies conducted in community-dwelling older adults, where participants demonstrated relatively satisfactory oral health knowledge because of greater accessibility to healthcare facilities, routine dental education, and higher educational attainment [37]. These discrepancies may reflect differences in study populations, healthcare infrastructure, socioeconomic characteristics, and the availability of preventive oral health programs. Older adults living independently generally have greater autonomy in seeking dental care and health information than residents of long-term care institutions.

The present findings reinforce behavioral theories suggesting that knowledge functions as a predisposing factor influencing health-related behaviors. Although knowledge alone does not guarantee behavioral change, it constitutes the essential foundation upon which positive oral hygiene practices are established. Therefore, improving oral health literacy among institutionalized older adults should become a priority within comprehensive geriatric healthcare programs.

B. TOOTH LOSS AND ITS ASSOCIATION WITH ORAL HEALTH MAINTENANCE KNOWLEDGE

The present investigation further revealed that approximately 72.4% of participants retained fewer than 20 functional teeth, indicating a high prevalence of tooth loss among residents of the Hargo Dedali Nursing Home. According to the World Health Organization, maintaining at least 20 natural functional teeth is essential for preserving adequate mastication, nutritional intake, speech, and overall quality of life. Therefore, the high proportion of participants failing to meet

this recommendation reflects a substantial oral health burden within the studied institution.

Tooth loss among older adults is widely recognized as a multifactorial condition resulting from cumulative biological, behavioral, environmental, and socioeconomic influences. Although aging itself contributes to degenerative changes affecting periodontal tissues, tooth loss is more directly associated with preventable conditions such as untreated dental caries and periodontal disease. Consequently, maintaining appropriate oral hygiene behaviors throughout life remains fundamental for preserving functional dentition [38].

The statistical analysis demonstrated a highly significant association between oral health maintenance knowledge and tooth loss ($p < 0.001$), with a Contingency Coefficient of 0.691, indicating a strong relationship between the two variables. Older adults with poor oral health knowledge were considerably more likely to experience severe tooth loss than participants possessing fair or good knowledge. These findings suggest that inadequate knowledge may indirectly contribute to cumulative oral disease progression by reducing preventive behaviors such as effective toothbrushing, routine dental examinations, and early treatment seeking.

These findings correspond closely with previous investigations demonstrating that oral health literacy significantly influences oral hygiene behaviors and long-term tooth retention [35], [39]. Puspawati *et al.* [39] similarly observed that elderly individuals with limited oral health knowledge exhibited substantially greater tooth loss than those with adequate knowledge. Comparable findings were reported by Susilawati *et al.* [40], who identified oral health literacy as an independent predictor of tooth retention among Indonesian older adults after considering several demographic characteristics.

Conversely, several previous studies have reported weaker or statistically insignificant associations between oral health knowledge and tooth loss because numerous additional variables contribute to tooth loss, including systemic diseases, smoking habits, socioeconomic status, nutritional deficiencies, medication use, and accessibility to dental care. These findings suggest that oral health knowledge should not be interpreted as the sole determinant of tooth loss but rather as one important component within a complex interaction of biological and behavioral factors.

From a public health perspective, the present findings emphasize the importance of integrating oral health education into comprehensive geriatric healthcare services. Regular educational interventions targeting both older adults and caregivers may improve oral hygiene practices, facilitate earlier detection of oral diseases, and reduce the incidence of preventable tooth loss. Furthermore, strengthening collaboration among dentists, nurses, caregivers, and public health professionals may substantially improve oral health outcomes within long-term care facilities.

C. STUDY LIMITATIONS, PRACTICAL IMPLICATIONS, AND FUTURE DIRECTIONS

Several limitations should be considered when interpreting the findings of this study. First, the cross-sectional design only allows the identification of associations between oral health maintenance knowledge and tooth loss and does not permit conclusions regarding causal relationships. Although participants with poorer oral health knowledge exhibited a significantly higher prevalence of tooth loss, it cannot be concluded that inadequate knowledge directly caused tooth loss because both variables were measured simultaneously. Future longitudinal cohort studies are therefore recommended to examine temporal relationships and determine whether improvements in oral health knowledge can effectively reduce the incidence of tooth loss over time [41].

Second, the relatively small sample size ($n = 29$) may have limited the statistical power and generalizability of the findings. Since all participants were recruited from a single nursing home in Surabaya, the study population may not adequately represent institutionalized older adults in other regions with different demographic characteristics, healthcare systems, socioeconomic conditions, or cultural backgrounds. Consequently, caution should be exercised when extrapolating these findings to broader elderly populations. Future multicenter investigations involving larger and more heterogeneous samples are necessary to improve external validity and strengthen the generalizability of the evidence [42].

Third, tooth loss is a multifactorial condition influenced by numerous biological, behavioral, environmental, and socioeconomic determinants. Although this study specifically examined oral health maintenance knowledge as the independent variable, other potential confounding factors including educational attainment, smoking habits, systemic diseases such as diabetes mellitus, medication use, nutritional status, oral hygiene behaviors, frequency of dental visits, caregiver support, and financial accessibility to oral healthcare were not simultaneously evaluated. These variables may have contributed to the observed tooth loss patterns and should be incorporated into future multivariable analytical models to obtain a more comprehensive understanding of the determinants of functional dentition among older adults [43], [44].

Despite these limitations, the present study possesses several important strengths. It specifically investigated institutionalized older adults, a population that remains relatively underrepresented in oral health research despite experiencing a disproportionately high burden of oral disease. Furthermore, the study combined questionnaire-based assessment of oral health maintenance knowledge with direct clinical examination of functional teeth, thereby providing both behavioral and objective clinical measurements. The application of standardized assessment procedures and total population sampling also enhanced the internal consistency of the findings and minimized selection bias within the study setting.

The findings have important implications for clinical practice, nursing home management, and public health policy. The strong association identified between oral health maintenance knowledge and tooth loss suggests that oral

health education should become an integral component of comprehensive geriatric care. Routine educational programs delivered by dentists, dental hygienists, nurses, and caregivers could substantially improve older adults' understanding of appropriate toothbrushing techniques, dietary practices, fluoride utilization, denture hygiene, and the importance of periodic dental examinations. Educational interventions should also involve caregivers because many institutionalized older adults depend on caregiver assistance for daily oral hygiene activities. Strengthening caregiver knowledge may therefore indirectly improve oral health outcomes among nursing home residents [45].

From a public health perspective, nursing homes should establish structured preventive oral healthcare programs that include regular dental screening, individualized oral health risk assessment, early management of dental caries and periodontal disease, caregiver training, and continuous oral health promotion activities. Integrating oral healthcare into routine geriatric services may help preserve functional dentition, improve nutritional status, reduce oral discomfort, and ultimately enhance the quality of life of institutionalized older adults. Such multidisciplinary preventive strategies are increasingly recommended as part of healthy aging initiatives worldwide [46], [47].

Future research should expand beyond cross-sectional analyses by conducting prospective cohort studies or randomized controlled educational interventions to evaluate the effectiveness of oral health promotion programs in reducing tooth loss among institutionalized elderly populations. In addition, future investigations should incorporate multivariate statistical analyses to simultaneously evaluate demographic, behavioral, systemic, psychosocial, and environmental determinants of tooth loss. Exploring caregiver-related factors, oral health service utilization, health literacy, and quality-of-life outcomes would further enrich the evidence base and support the development of comprehensive, evidence-based oral healthcare strategies for aging populations.

Overall, the present study provides meaningful evidence that oral health maintenance knowledge is strongly associated with functional tooth retention among institutionalized older adults. Although tooth loss is influenced by multiple interacting determinants, improving oral health literacy represents a feasible and modifiable strategy that may contribute to healthier aging through better preventive behaviors, earlier utilization of dental services, and enhanced preservation of natural dentition. These findings provide valuable evidence for healthcare professionals, nursing home administrators, and policymakers seeking to strengthen preventive oral healthcare programs for older adults.

V. CONCLUSION

This study aimed to examine the association between oral health maintenance knowledge and tooth loss among older adults residing at the Hargo Dedali Nursing Home, Surabaya, to determine whether oral health knowledge is related to the preservation of functional dentition in an institutionalized elderly population. The findings demonstrated that oral health

maintenance knowledge among the participants was generally inadequate, with 69.0% of respondents classified as having poor knowledge, while only 6.9% demonstrated good knowledge. In addition, 72.4% of the participants retained fewer than 20 functional teeth, indicating a high prevalence of tooth loss and failure to achieve the World Health Organization recommendation for functional dentition among older adults. Statistical analysis using the Chi-square test revealed a highly significant association between oral health maintenance knowledge and tooth loss ($p < 0.001$), with a Contingency Coefficient of 0.691, indicating a strong relationship between the two variables. These findings suggest that older adults with lower levels of oral health knowledge are considerably more likely to experience severe tooth loss than those with better knowledge, emphasizing the importance of oral health literacy as a modifiable determinant of preventive oral health behavior. Although tooth loss is influenced by multiple biological, behavioral, and socioeconomic factors, improving oral health knowledge represents a practical strategy to encourage appropriate oral hygiene practices, promote regular dental attendance, and support the preservation of natural teeth among institutionalized older adults. Therefore, integrating structured oral health education, routine dental examinations, caregiver training, and multidisciplinary preventive oral healthcare into nursing home services may contribute to healthier aging and improved quality of life. Future studies should employ longitudinal or interventional research designs involving larger and more diverse populations to establish causal relationships and evaluate the long-term effectiveness of oral health education programs. Furthermore, subsequent investigations should incorporate additional determinants, including systemic diseases, educational level, socioeconomic status, caregiver support, health service utilization, and oral hygiene behaviors, to develop more comprehensive predictive models of tooth loss among older adults and provide stronger evidence for evidence-based geriatric oral health policies.

ACKNOWLEDGEMENTS

The author is deeply indebted to the senior residents at the Hargo Dedali Nursing Home for their essential cooperation and engagement as study respondents. Sincere gratitude is likewise directed toward the faculty members for their invaluable guidance and academic mentorship during this investigation. Furthermore, the author expresses heartfelt thanks to family and friends, whose unwavering encouragement, prayers, and emotional support provided a foundational source of resilience throughout this research endeavor.

FUNDING

This investigation received no specific grants or financial sponsorship from any public, commercial, or non-profit entities. Authors independently sustained all costs associated with the study.

DATA AVAILABILITY

No separate datasets were generated or evaluated during the execution of this study.

AUTHOR CONTRIBUTION

Tiara Muda Galuh Ayu Dewanti formulated the research concept, designed the study methodology, executed data collection and statistical analysis, interpreted the outcomes, and drafted the initial manuscript. Imam Sarwo Edi provided academic supervision and continuous mentorship throughout the investigation, contributed to the study design, assisted in interpreting the findings, and critically evaluated the manuscript. Dwi Septiarni offered methodological expertise, enriched the discussion and interpretation of the data, and conducted critical revisions of the text. All authors have read, approved the final version of the manuscript, and accepted full accountability for the accuracy and integrity of this study.

DECLARATIONS

ETHICAL APPROVAL

Under the administrative and ethical oversight of the Institutional Review Board of Poltekkes Kemenkes Surabaya (No. EA/4107/KEPK-Poltekkes_Sby/V/2026), this study upheld the highest standards of human subject protection. Agreement to participate was institutionalized through formal written consent and assent procedures. Furthermore, safeguard for vulnerable groups was strictly maintained by guaranteeing complete confidentiality and reinforcing the respondents right to withdraw from the trial at any stage without penalty.

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