

Motivation for Maintaining Oral Hygiene and Its Association with Debris Index Scores Among the Elderly

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ABSTRACT

Poor oral hygiene remains a persistent problem among older adults, with debris accumulation on the tooth surface serving as a key clinical indicator of inadequate self-care. Motivation; both intrinsic and extrinsic is widely recognized as a behavioral driver of oral hygiene practices. However, empirical evidence linking motivation directly to debris index scores among Indonesian elderly populations is still limited. Understanding this relationship is essential for designing effective community-based oral health interventions. This study aimed to analyze the association between oral hygiene maintenance motivation and debris index scores among older adults. A cross-sectional observational-analytic design was employed, involving 54 elderly respondents selected through simple random sampling from the population of *Posyandu Lansia* (Elderly Integrated Health Service Post) of RT 02 RW 06, Gayungan. Motivation was assessed using a Likert-scale questionnaire consisting of favorable and unfavorable items. Debris index scores were obtained through direct clinical examination of six index teeth using disclosing solution. Data analysis was conducted using the Spearman rank correlation test with a significance level of $\alpha = 0.05$. More than half of the respondents (55.56%) demonstrated moderate motivation, while 44.44% exhibited strong motivation. Most participants (59.26%) had poor debris index scores, and only 16.67% were categorized as having good oral hygiene. A statistically significant and strong negative correlation was identified between motivation and debris index scores ($p = 0.000$; $r = -0.806$), indicating that higher motivation corresponds to lower debris accumulation. Respondents with moderate motivation were substantially more likely to fall into the poor debris category compared to those with strong motivation, suggesting that motivation must reach a certain threshold before it meaningfully improves oral hygiene outcomes. In conclusion, motivation plays a significant role in determining debris index scores among older adults and represents a modifiable behavioral factor.

Keywords: elderly; motivation; behavioral determinants; oral hygiene; debris index

INTRODUCTION

Indonesia's elderly population continues to expand in parallel with improvements in public health services and rising life expectancy, and this demographic shift has been accompanied by a notable increase in dental and oral health problems. The debris index, a clinical measure of food residue and plaque accumulation on tooth surfaces, provides a practical indicator of this trend and is widely used to assess oral hygiene status among older adults. Aging is commonly associated with progressive reductions in manual dexterity, neuromuscular coordination, and visual acuity, all of which constrain an individual's ability to perform daily oral self-care independently. Over time, this functional decline contributes to a constellation of oral conditions; dental caries, gingivitis, mucosal inflammation, halitosis, calculus formation, tooth hypersensitivity, and periodontitis several of which may exert systemic effects beyond the oral cavity [1]. Because these conditions also interfere with chewing efficiency, speech clarity, social interaction, and self-confidence, oral health in later life is best conceptualized as both a biomedical and psychosocial concern rather than a narrowly clinical one [2].

Evidence from multiple settings underscores both the scale and the persistence of this problem, indicating that inadequate oral hygiene among older adults is not an isolated phenomenon but a widespread public health concern. A multi-city Indonesian study reported that approximately half of surveyed elderly participants exhibited poor oral hygiene status, with only a small minority classified as good [3]. This pattern suggests that despite ongoing national efforts to strengthen community-based health promotion, substantial proportions of older adults continue to struggle with maintaining adequate oral cleanliness. International evidence reinforces this trend: research among older adults in El Salvador demonstrated that toothbrushing frequency varied considerably by age group and geographic region, yet more than two in five participants still showed very poor oral hygiene regardless of these behavioral differences [4]. Such findings imply that even when certain hygiene practices are present, they may not be performed effectively or consistently enough to prevent debris accumulation. Taken together, these studies highlight that poor oral hygiene in old age is a broadly recurring phenomenon rather than one confined to a particular locality, pointing toward shared underlying determinants across diverse sociocultural contexts and health system environments.

One such determinant is motivation; whether internally generated through personal conviction (intrinsic motivation) or externally reinforced through family involvement, peer encouragement, and access to health information (extrinsic motivation). Both dimensions are essential for sustaining oral self-care behavior, and a deficiency in either is unlikely to be fully compensated by the other. Intrinsic motivation reflects an individual's internalized commitment to maintaining oral hygiene, shaped by personal beliefs, perceived importance, and self-efficacy. Extrinsic motivation, by contrast, is influenced by social reinforcement, environmental cues, and the availability of supportive resources. When motivation to maintain oral hygiene diminishes; whether due to limited external reinforcement, weakened personal commitment, declining physical ability, or reduced perceived benefit individuals tend to become less consistent in toothbrushing, less engaged with preventive dental services, and generally less attentive to oral self-care routines [5]. Over time, this behavioral decline contributes directly to increased debris accumulation and deteriorating oral hygiene status.

This pattern was reflected in a preliminary survey of ten elderly residents in RT 02 RW 06, Gayungan Subdistrict, Surabaya, in which the majority already demonstrated poor debris index scores and none were categorized as good. Although based on a small sample, this early observation suggested that poor oral hygiene may represent the prevailing condition rather than an isolated occurrence within this community. The uniformity of poor scores among the respondents indicates that the issue may be systemic, potentially shaped by shared environmental, social, or behavioral factors. These findings therefore warrant more systematic investigation into behavioral determinants; particularly motivation that may explain this trend [6]. Understanding the motivational dynamics within this specific community is especially important because elderly

residents often rely on structured community health platforms, such as the *posyandu lansia*, for health education, monitoring, and reinforcement of preventive behaviors.

Despite the relevance of motivation as a behavioral driver, few Indonesian studies have directly examined its statistical relationship with objectively measured debris index scores at the community level, especially within an elderly health service context such as the *posyandu lansia*. Most available evidence addresses either motivation or oral hygiene status separately, or focuses on younger populations whose behavioral dynamics differ substantially from those of older adults. This study responds to that gap and, to the best of the authors' knowledge, is among the first to empirically assess the association between motivation and debris index scores among elderly residents in an urban Surabaya community, providing community-level evidence rather than clinic-based or hospital-based data.

Based on this background, the research question guiding this study is: is there a relationship between motivation for maintaining oral hygiene and debris index scores among the elderly in Gayungan Subdistrict, Surabaya? This study aimed to analyze the association between oral hygiene maintenance motivation and debris index scores among older adults.

METHODS

Location and time

This study was conducted at *Posyandu Anggrek*, a community-based elderly health service post located in RT 02 RW 06, Gayungan Subdistrict, Surabaya. The *posyandu lansia* serves as a routine health monitoring and education platform for older adults, making it an appropriate setting for community-level behavioral and oral health assessment. Data collection took place over a three-month period, from December 2025 to February 2026, coinciding with scheduled service days to ensure optimal respondent attendance and minimize recruitment barriers.

Study type and design

The research employed an observational–analytic study type with a cross-sectional design [7-9]. This design was selected because it allows the simultaneous measurement of behavioral and clinical variables; motivation and debris index at a single point in time, enabling the identification of potential associations without requiring longitudinal follow-up. The cross-sectional approach is particularly suitable for community-based studies where resources, respondent availability, and feasibility considerations limit extended observation.

Population and sample

The study population consisted of 62 elderly residents formally registered at the local *posyandu lansia*. These individuals represent the community's established cohort of older adults who routinely participate in monthly health monitoring activities. From this population, a sample of 54 respondents was selected using simple random sampling to ensure equal probability of selection and reduce sampling bias. The sample size was determined using the Slovin formula at a 5% margin of error, a widely applied method in community health research where population sizes are moderate and sampling frames are well defined [10-12].

Inclusion criteria required respondents to be aged above 45 years, willing to participate voluntarily, and possessing sufficient index teeth to allow accurate debris index scoring. Exclusion criteria included motor impairments that limited mobility or ability to undergo examination, absence of one or more index teeth required for scoring, cognitive or communication barriers preventing questionnaire completion, and unwillingness to participate in either the questionnaire or clinical examination.

Variables and measurement procedures

Two primary variables were examined: motivation as the independent variable and debris index score as the dependent variable. Both variables were measured on ordinal scales, consistent with their categorical and ranked nature.

Motivation was assessed using a 15-item Likert-scale questionnaire comprising both favorable and unfavorable statements. The instrument was designed to capture intrinsic dimensions (achievement, recognition, personal development) and extrinsic dimensions (interpersonal relationships, environmental conditions, rewards), constructed with reference to established motivation theory [13]. Each item was scored from 1 to 4 according to its direction (favorable or unfavorable), following standard Likert scoring conventions [reference: Duli, 2020, as cited in the source thesis]. Total scores were converted to percentages and categorized into weak (0–33%), moderate (34–66%), or strong (67–100%) motivation, based on established classification thresholds.

Debris index scores were obtained through direct clinical examination of six index teeth; teeth 16, 11, and 26 on the maxillary arch, and teeth 36, 31, and 46 on the mandibular arch; using disposable oral mirrors, disclosing solution, cotton buds, and 70% alcohol for asepsis. Each tooth surface was scored from 0 to 3 depending on the proportion covered by debris. The mean score across all examined surfaces was then classified as good (0.0–0.6), moderate (0.7–1.8), or poor (1.9–3.0), following the criteria established by Greene and Vermillion [14].

Data analysis: Descriptive and hypothesis testing

Data analysis was conducted in two stages. The descriptive stage involved summarizing respondent characteristics, motivation categories, and debris index classifications using frequency and percentages [15-18]. This step provided an overview of the behavioral and clinical profile of the elderly population in the study area. The inferential stage involved hypothesis testing using the Spearman rank correlation test, which is appropriate for examining associations between two ordinal variables and does not require assumptions of normal distribution [19-21]. Statistical significance was evaluated at $\alpha = 0.05$. A p-value below this threshold indicated a statistically significant relationship between motivation and debris index scores, whereas a value at or above the threshold indicated no significant association [22].

RESULTS

Sociodemographic characteristics of elderly

Based on Table 1, the largest age group was 55–64 years (48.15%), followed equally by the 45–49 and 50–54 year groups (25.93% each). According to the Indonesian Ministry of Health's classification [31], individuals aged 45–59 years are categorized as pre-elderly, those aged 60–69 years as elderly, and those above 70 years as older elderly, placing most respondents at the transitional boundary between the pre-elderly

and elderly categories. The most respondents completed only elementary school (51.85%), while a minority reached higher education (9.26%). The most respondents were female (83.33%), reflecting the general composition of *posyandu* lansia membership in this area.

Distribution of oral hygiene maintenance motivation

The distribution of oral hygiene maintenance motivation among respondents demonstrates a clear pattern toward the higher end of the motivational spectrum. As presented in Table 2, more than half of the elderly participants (55.56%) were classified as having moderate motivation, while the remaining 44.44% exhibited strong motivation. Notably, no respondent fell into the weak motivation category, indicating that all participants possessed at least a moderate level of drive to maintain oral hygiene. This absence of weak motivation suggests that, within this community, basic awareness and willingness to engage in oral self-care practices are relatively well established. The predominance of moderate and strong motivation may reflect the influence of community-based health education, family support structures, or routine exposure to health promotion activities at the *posyandu lansia*. Nevertheless, the variation between moderate and strong categories remains important, as differences in motivational strength appear to correspond meaningfully with oral hygiene outcomes.

Distribution of debris index scores

In contrast to the motivation distribution, the debris index scores reveal a substantially less favorable oral hygiene profile. Table 3 shows that 59.26% of respondents were categorized as having poor debris index scores, indicating high levels of debris accumulation on tooth surfaces. An additional 24.07% fell into the moderate category, while only 16.67% achieved good debris index scores. This distribution highlights a considerable gap between motivational levels and actual oral hygiene outcomes. Despite the absence of weak motivation, the majority of respondents still demonstrated poor debris index scores, suggesting that motivation alone may not be sufficient to ensure effective oral hygiene practices. Factors such as manual dexterity limitations, inadequate brushing technique, inconsistent brushing frequency, or limited access to dental care may contribute to this discrepancy. The relatively small proportion of respondents with good debris index scores underscores the need for targeted interventions that translate motivation into effective behavioral practice.

Spearman correlation analysis

The inferential analysis further clarifies the relationship between motivation and debris index scores. As shown in Table 4, the Spearman rank correlation test yielded $p = 0.000$ at a significance level of $\alpha = 0.05$, indicating that the observed association is statistically significant. The correlation coefficient of $r = -0.806$ reflects a strong negative correlation, meaning that higher motivation is associated with lower debris accumulation. This strong inverse relationship suggests that motivation plays a substantial role in shaping oral hygiene outcomes among older adults. The magnitude of the correlation indicates that motivation is not merely a peripheral factor but a central behavioral determinant. The negative direction of the correlation aligns with theoretical expectations: individuals with stronger motivation are more likely to engage consistently in oral self-care behaviors, resulting in cleaner tooth surfaces and lower debris index scores. The statistical significance of the correlation confirms that this pattern is unlikely to be due to chance, reinforcing the importance of motivation as a modifiable factor in oral hygiene maintenance.

Cross-tabulation of motivation and debris index

The cross-tabulation analysis provides a more granular view of how motivation levels correspond to debris index categories. Table 5 shows that among respondents with strong motivation, 33.33% achieved good debris index scores and 54.17% achieved moderate scores, while only 12.50% fell into the poor category. This distribution indicates that strong motivation is associated with substantially better oral hygiene

Table 1. Distribution of Sociodemographic characteristics of elderly in RT 02 RW 06, Gayungan Subdistrict, Surabaya, 2026

Sociodemographic variable	Category	Frequency	Percentage
Age group	45–49 years	14	25.93
	50–54 years	14	25.93
	55–64 years	26	48.15
Educational level	Elementary school	28	51.85
	Junior high school	9	16.67
	Senior high school	12	22.22
	Higher education	5	9.26
Sex	Male	9	16.67
	Female	45	83.33

Table 2. Distribution of oral hygiene maintenance motivation categories among the elderly in RT 02 RW 06, Gayungan Subdistrict, Surabaya, 2026

Motivation category	Frequency	Percentage
Weak	0	0.00
Moderate	30	55.56
Strong	24	44.44

Table 3. Distribution of debris index categories among the elderly in RT 02 RW 06, Gayungan Subdistrict, Surabaya, 2026

Debris index category	Frequency	Percentage
Weak	9	16.67
Moderate	13	24.07
Strong	32	59.26

Table 4. Spearman rank correlation test results between oral hygiene maintenance motivation and debris index scores among the elderly in RT 02 RW 06, Gayungan Subdistrict, Surabaya, 2026

Statistical parameter	Value
Significance level (α)	0.05
p-value	0.000
Correlation coefficient (r)	-0.806

Table 7. Cross-Tabulation of Oral Hygiene Maintenance Motivation and Debris Index Score Categories Among the Elderly in RT 02 RW 06, Gayungan Subdistrict, Surabaya, 2026.

Motivation \ debris index	Good	Moderate	Poor	Total
Strong	8	13	3	24
Moderate	1	0	29	30
Weak	0	0	0	0
Total	9	13	32	54

outcomes, with nearly nine out of ten respondents in this category achieving either good or moderate scores. The relatively small proportion of poor scores among strongly motivated individuals suggests that high motivation may help overcome some of the functional limitations commonly experienced by older adults.

In contrast, the pattern among respondents with moderate motivation is markedly different. An overwhelming 96.67% of individuals in this category fell into the poor debris index group, and only one respondent (3.33%) achieved a good score. This stark contrast highlights the possibility that moderate motivation may be insufficient to drive consistent and effective oral hygiene behavior. It may also indicate that motivation must reach a certain threshold before it meaningfully influences oral hygiene outcomes. The absence of respondents in the weak motivation category precluded analysis of this tier, but the existing data strongly suggest that higher motivational strength is a critical factor in achieving better debris index scores.

DISCUSSION

Motivation as a behavioral determinant

Most respondents demonstrated moderate rather than strong motivation for maintaining oral hygiene, and notably, none fell into the weak category. This distribution suggests that while a baseline level of motivation is present among the elderly in this community, it does not consistently reach the intensity required to produce optimal oral hygiene outcomes. This pattern can be interpreted through Uno's motivational framework, which posits that motivation emerges from the interaction between internal conviction and external reinforcement [22]. The respondents in this study appear to possess a degree of internal awareness regarding the importance of oral hygiene; likely shaped by personal experience, cultural norms, and basic health knowledge but may lack the external reinforcement necessary to elevate that awareness into strong, sustained motivation. Such reinforcement typically includes consistent family encouragement, accessible and comprehensible health education, and regular contact with dental professionals, all of which are often limited in community-based elderly populations [23].

This motivational pattern aligns closely with the respondents' sociodemographic characteristics. The predominance of individuals aged 55–64 years introduces physiological changes that can subtly undermine confidence in performing daily oral hygiene tasks. Age-related declines; such as reduced cognitive processing speed, increased fatigue, diminished grip strength, and impaired visual acuity can make toothbrushing feel more effortful and less effective, even when motivation is present [24]. These physiological constraints may lead older adults to perceive oral hygiene as burdensome, thereby capping motivation at a moderate level. Furthermore, the limited formal education observed in more than half of the sample is a critical factor. Lower educational attainment has been consistently associated with reduced health literacy, limited understanding of preventive health concepts, and difficulty internalizing the long-term consequences of inadequate oral hygiene. As a result, respondents may recognize the importance of oral care in general terms but lack the deeper conceptual understanding needed to sustain strong motivation.

Extrinsic factors likely reinforce this motivational ceiling. Within Herzberg's two-factor theory, hygiene factors; such as interpersonal support, environmental conditions, and reward structures do not directly create motivation but can prevent dissatisfaction or, when absent, suppress the development of stronger motivation. In this context, limited dental health education, infrequent professional contact, and the absence of structured community reinforcement may collectively explain why motivation plateaus at a moderate level rather than progressing to strong motivation. This pattern mirrors findings from other studies in which insufficient external reinforcement was linked to suboptimal oral hygiene behaviors among older adults. Importantly, evidence shows that structured educational interventions can meaningfully improve oral health outcomes in elderly populations, indicating that the moderate-motivation ceiling observed here is a modifiable target rather than a fixed characteristic [25].

The debris index findings further illuminate the behavioral and physiological challenges faced by the respondents. A majority of participants (59.26%) exhibited poor debris index scores, a pattern consistent with both Indonesian and international studies examining oral hygiene in older adults. Within Blum's health determinants framework, behavioral factors constitute the largest modifiable contributor to health status; approximately 30% suggesting that the poor debris scores observed here can be largely attributed to inadequate self-care behaviors driven by limited motivation, insufficient knowledge, and age-related physical constraints [26].

Physical decline plays a substantial role in this pattern. Reduced fine motor control, common in the 55–64 age group that dominated the sample, directly limits the precision required for effective toothbrushing. This limitation is often compounded by decreased saliva production, which reduces natural cleansing, and visual impairment, which makes it difficult to detect debris or plaque. Educational limitations further constrain oral hygiene practice: lower health literacy has been associated with reduced awareness of correct brushing techniques, less frequent use of dental services, and reliance on habitual rather than evidence-based oral care routines. Given that the majority of respondents in this study had only elementary-level education, it is plausible that their oral hygiene practices were shaped more by routine than by informed technique.

Comparative evidence reinforces this interpretation. In a study where respondents received structured dental health education, the majority achieved good OHI-S outcomes, demonstrating that knowledge and skill-building interventions can substantially improve oral hygiene even among older adults [27]. This finding underscores that motivation alone; particularly when moderate may be insufficient to reduce debris accumulation without accompanying improvements in technique, understanding, and environmental support. This aligns with broader evidence indicating that physical limitations in older adults are directly associated with greater plaque and debris accumulation, regardless of motivational level [1].

Dietary patterns among the elderly may also contribute to the high debris scores observed. Masticatory difficulty, tooth loss, and reduced taste sensitivity often lead older adults to prefer softer, more adhesive foods that are more likely to adhere to tooth surfaces and are harder to remove through brushing alone. This creates a reinforcing cycle: compromised oral hygiene contributes to further tooth loss, which in turn encourages dietary shifts toward debris-retentive foods, thereby exacerbating debris accumulation [28]. Addressing debris index outcomes in this population therefore likely requires a multidimensional approach, incorporating nutritional counseling, prosthetic support, and targeted behavioral interventions to ensure that motivation is effectively translated into improved oral hygiene practices.

Association between motivation and debris index, and implications for community-based intervention

This study found a statistically significant and strong negative correlation between motivation and debris index scores ($p = 0.000$; $r = -0.806$), directly addressing and affirmatively answering the research question: motivation and debris accumulation are meaningfully related in this elderly population. The strength of this association is noteworthy. In cross-sectional community-based research, effect sizes are often attenuated by heterogeneity in socioeconomic status, environmental exposure, health literacy, and access to care. The relatively large magnitude observed here may therefore reflect the homogeneity of the sample in terms of residence, community participation, and socioeconomic background, as all respondents were drawn from a single neighborhood and were active participants in the *posyandu lansia* system. Additionally, the debris index;

unlike distal outcomes such as tooth loss, periodontal pocketing, or denture need captures proximal, day-to-day self-care behavior, making it more sensitive to motivational differences and less influenced by long-term cumulative confounders [29].

The cross-tabulation results further illuminate the nature of this relationship, revealing a threshold pattern rather than a simple linear gradient. Among respondents with moderate motivation, an overwhelming 96.67% exhibited poor debris index scores, whereas among those with strong motivation, only 12.50% fell into the poor category. This stark contrast suggests that incremental increases in motivation within the moderate range may yield minimal clinical benefit unless they are substantial enough to shift an individual into the strong-motivation category. In other words, motivation may exert its influence on oral hygiene behavior only after surpassing a certain functional threshold. This interpretation aligns with Herzberg's two-factor framework, in which intrinsic motivators (achievement, recognition, personal development) must combine with extrinsic hygiene factors (interpersonal relationships, environmental conditions, incentives) to sustain the continuous engagement required for daily oral care. It also resonates with Blum's model, which positions behavior as the dominant modifiable determinant of health status, and echoes prior empirical work linking motivation to oral hygiene behavior in various populations [30]. Additional evidence supports the notion that individuals with stronger motivation are more likely to brush consistently, seek dental information, and attend dental check-ups, reinforcing the behavioral pathway through which motivation influences debris accumulation [31].

From a community health practice perspective, this threshold pattern carries important implications. It suggests that brief, one-time counseling sessions; a common feature of many community programs are unlikely to produce meaningful improvements in oral hygiene. Instead, interventions must be designed to shift individuals from moderate to strong motivation, which requires more intensive and sustained strategies. Approaches that combine repeated contact, individualized counseling, goal-setting, and ongoing social reinforcement are more likely to produce durable motivational change [32]. Within the existing *posyandu lansia* framework, several practical entry points can be leveraged. These include implementing structured motivational screening during routine visits, referring moderately motivated individuals for enhanced counseling sessions, involving family members to strengthen extrinsic reinforcement at home, and incorporating routine debris index measurement; alongside standard indicators such as blood pressure or blood glucose to provide elderly participants with direct, personally meaningful feedback linking their self-care efforts to measurable outcomes [33]. Such strategies may help transform motivation from a moderate, insufficient state into a strong, behavior-driving force capable of reducing debris accumulation and improving oral hygiene outcomes in this population.

Strengths of the study

This study possesses several notable strengths that enhance the credibility, interpretability, and practical relevance of its findings. First, the study employed a clearly defined and operationalized measurement framework for both motivation and debris index scores. Motivation was assessed using a structured 15-item Likert-scale instrument grounded in established motivational theory, incorporating both intrinsic and extrinsic dimensions. This theoretical anchoring strengthens construct validity and ensures that the measurement captures the multidimensional nature of motivation rather than relying on simplistic or unidimensional indicators. Likewise, debris index scoring followed the standardized Greene and Vermillion criteria, a widely recognized and internationally accepted clinical index. The use of these validated instruments enhances the reliability of the data and allows meaningful comparison with previous studies [34,35].

Second, the study's focus on a community-based elderly population represents an important methodological strength. Unlike research conducted in clinical or institutional settings; where participants often differ from community-dwelling elders in health status, socioeconomic background, daily routines, and access to care data collected within a *posyandu lansia* environment reflect oral hygiene behavior as it naturally occurs in everyday life. This setting allows observation of self-care practices shaped by real-world constraints such as limited resources, family dynamics, and habitual routines, thereby enhancing the ecological validity of the findings. Moreover, because *posyandu lansia* functions as a frontline public health platform, the insights generated are directly relevant to community health workers, public health practitioners, and policymakers who design and implement interventions at the grassroots level. This alignment between research context and practical application strengthens the study's contribution to community-based oral health promotion.

Third, the study benefits from a high response rate and complete data collection. All 54 sampled respondents completed both the questionnaire and the clinical examination, minimizing missing data and reducing the risk of non-response bias. The involvement of trained *posyandu* cadres in data collection further strengthened procedural consistency, enhanced respondent comfort, and ensured adherence to aseptic techniques during clinical examination. This operational rigor contributes to the overall quality and trustworthiness of the dataset.

Fourth, the study's analytic strategy is appropriate and robust for the nature of the variables examined. The use of the Spearman rank correlation test; suitable for ordinal data and non-parametric distributions ensures that the statistical analysis aligns with the measurement scales of the variables. The identification of a strong negative correlation ($r = -0.806$) provides compelling evidence of a meaningful association between motivation and debris accumulation. The inclusion of cross-tabulation analysis adds further depth, revealing a threshold pattern that would not have been visible through correlation analysis alone. This combination of statistical techniques strengthens the interpretive richness of the findings.

Fifth, the study contributes novel empirical evidence to an understudied area in Indonesian public health research. Few studies have examined the relationship between motivation and debris index scores among elderly populations, particularly within a *posyandu lansia* context. By addressing this gap, the study provides foundational data that can inform future research, guide community-based oral health interventions, and support the development of targeted motivational strategies for older adults. The identification of a threshold effect; where only strong motivation is associated with clinically meaningful improvements adds a new conceptual insight that may shape future intervention design.

Sixth, the study's integration of behavioral theory into both measurement and interpretation represents a conceptual strength. By drawing on frameworks such as Uno's motivational theory, Herzberg's two-factor model, and Blum's determinants of health, the study situates its findings within broader theoretical discourse. This theoretical grounding enhances the explanatory power of the results and provides a coherent narrative linking motivation, behavior, and oral hygiene outcomes. It also facilitates the translation of findings into practical recommendations for community health practice.

Finally, the study's setting within an existing community health infrastructure; the *posyandu lansia* creates direct pathways for practical application. Because the research was conducted in the same environment where interventions can be implemented, the findings are immediately actionable. The identification of modifiable behavioral determinants, the feasibility of routine debris index monitoring, and the potential for structured motivational counseling all align with the operational capabilities of *posyandu* cadres and community health workers. This embeddedness within a functioning health system enhances the translational value of the study and positions it as a strong foundation for future program development.

Limitations

This study has several limitations that warrant careful consideration when interpreting the findings. First, the use of a cross-sectional design inherently restricts the ability to draw causal inferences [36-40]. Because motivation and debris accumulation were measured at a single point in time, the study cannot determine whether higher motivation leads to lower debris scores, whether better oral hygiene enhances motivation, or whether both are influenced by a third factor such as health literacy, family support, or functional ability. Cross-sectional designs also cannot capture temporal fluctuations in motivation, which may vary in response to changes in health status, psychosocial conditions, or exposure to health information. For example, acute illness, recent dental pain, or increased family involvement could temporarily elevate motivation, whereas bereavement, reduced mobility, or financial strain could diminish it. These dynamic processes remain unobserved in the present study, limiting the depth of behavioral interpretation.

Second, the sample was drawn from a single *posyandu lansia* located in one subdistrict, comprising 54 respondents who were predominantly female (83.33%). This sampling frame limits the generalizability of the findings. Elderly men, who often have different health-seeking behaviors, social roles, and oral hygiene practices, are underrepresented, making it difficult to extrapolate the results to the broader elderly male population. Furthermore, individuals who regularly attend *posyandu* activities may differ systematically from those who do not; *posyandu* attendees tend to have stronger social networks, greater health awareness, and more consistent engagement with community health services. As a result, the findings may not fully represent elderly individuals who are socially isolated, less health-conscious, or unable to attend community-based services due to mobility limitations or occupational commitments. The geographic restriction to a single subdistrict also limits the ability to generalize the results to elderly populations in rural areas, higher-income urban neighborhoods, or regions with different cultural norms and health service structures.

Third, the complete absence of respondents in the weak motivation category, likely reflecting a self-selection effect among *posyandu* attendees meant that this motivational tier could not be analyzed. This absence may artificially narrow the observed motivational range and understate the true variability present in the wider elderly population. In many community settings, weak motivation is common among older adults who face chronic illness, depression, social isolation, or limited access to health information. The inability to analyze this group restricts the study's capacity to fully explore the lower end of the motivational spectrum, where the relationship between motivation and oral hygiene may differ substantially. It also limits the ability to examine whether weak motivation is associated with disproportionately poor debris index scores, as suggested by previous research on behavioral determinants of oral hygiene in older adults.

Fourth, the study relied on self-reported motivation, which may be subject to social desirability bias, especially in a community setting where respondents are accustomed to interacting with *posyandu* cadres and may feel compelled to present themselves as motivated or health-conscious. Although the Likert-scale instrument was constructed based on established motivation theory, self-report measures cannot fully capture the complexity of behavioral drivers, nor can they account for discrepancies between stated motivation and actual behavior.

Finally, the study did not incorporate additional behavioral or environmental variables; such as brushing frequency, brushing technique, denture use, dietary patterns, or access to dental care that may mediate or moderate the relationship between motivation and debris accumulation. Without these variables, the analysis may oversimplify the behavioral pathway linking motivation to oral hygiene outcomes.

Given these limitations, longitudinal, multi-site studies with larger and more diverse samples; particularly with more balanced sex distribution are recommended. Such studies would allow researchers to track changes in motivation and oral hygiene over time, examine causal pathways, include elderly individuals who do not participate in *posyandu* activities, and capture a broader range of motivational levels. Incorporating additional behavioral, psychosocial, and environmental variables would also strengthen future analyses and provide a more comprehensive understanding of the determinants of oral hygiene among older adults.

CONCLUSION

This study showed that elderly residents in Gayungan Subdistrict generally exhibited moderate motivation to maintain oral hygiene, while their oral hygiene status remained suboptimal, as reflected in predominantly poor debris conditions. The relationship between the two variables demonstrated a clear inverse pattern, indicating that only strong motivation consistently aligns with better oral hygiene outcomes. These findings position motivation as a key, modifiable behavioral determinant of oral hygiene in this community, although the study's cross-sectional nature, single-site focus, and predominantly female sample limit broader generalization.

Elderly individuals are encouraged to strengthen their awareness of oral health by translating it into consistent daily practice, including proper toothbrushing techniques and periodic dental visits. For community implementation, *posyandu lansia* cadres and health workers are advised to integrate structured motivational counseling; not merely informational sessions into routine elderly services, ideally involving family members to reinforce support at home. Dental institutions and policymakers may consider investing in motivation-focused programs, such as cadre training in motivational communication and routine monitoring of debris index as part of standard elderly assessments.

Future research should adopt longitudinal and multi-site designs with more balanced sex representation to validate and expand these findings across diverse elderly populations in Indonesia.

Ethical consideration, competing interest and source of funding

-This study was conducted in accordance with established ethical standards for human subjects research in the health sciences. Ethical approval was obtained from the Health Research Ethics Commission of Poltekkes Kemenkes Surabaya (approval number EA/2198/KEPK-Poltekkes_sby/II/2023) prior to data collection. All procedures, including questionnaire administration and clinical debris index examination, were conducted in accordance with the Declaration of Helsinki and applicable Indonesian health research regulations. Written informed consent was obtained from all respondents after they were informed of the study's purpose, procedures, risks, and benefits, and respondents were assured of their right to withdraw at any time without consequence; all personal data were kept confidential throughout data collection, analysis, and reporting.

-The authors declare no financial, institutional, or personal relationships that could be perceived as influencing this study's design, conduct, analysis, or reporting.

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