CATÓLICA
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VISEU

Characterization of oral health literacy and strategies for development in the future

Dissertação apresentada à Universidade Católica Portuguesa para obtenção do grau de Mestre em Medicina Dentária

Por:
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Co-orientador: Prof. Doutor Pedro Campos Lopes

Viseu, 2025

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Dissertation submitted to the Catholic University of Portugal to attain the Master's degree in Dental Medicine.

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I never walked a smooth road, nor did I seek one. It was along the rough, dust-filled paths where certainty was absent and comfort was rare that I discovered what truly matters: not avoiding the fall, but rising from it stronger, every single time.

Abbas Kiarostami

Dedications

To my family: my mom and dad, whose sacrifices and selflessness made it possible for me to pursue my path, and to my brother Ali, for the times I could not be by his side when he needed me most.

To Mahoor, for being the steady light in moments of doubt and difficulty.

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And to every Iranian student celebrating their milestones far from home, away from the presence of loved ones — this is for you

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Abstract

Background: Oral health literacy is a critical determinant of health outcomes, influencing personal behaviors, decision-making, and access to dental care. In many countries, including Portugal, insufficient oral health literacy is associated with preventable oral diseases and increasing health inequalities.

Methods: This study conducted a systematic review based on PRISMA guidelines, using multiple databases (PubMed, Scopus, Cochrane) to identify empirical studies from the past ten years that implemented interventions aimed at improving oral health literacy. The quality of the eligible studies was assessed using the Joanna Briggs Institute criteria.

Results: Eighteen studies were identified and analyzed. The strategies found included school-based interventions (such as the Childsmile program and Social Cognitive Theory-based programs), mobile health applications, educational initiatives targeted at caregivers, national policy frameworks, and training programs for dental health professionals. Most of these interventions demonstrated positive impacts on knowledge, behavior, and preventive oral health practices.

Conclusion: Global interventions to improve oral health literacy offer promising models for adaptation in Portugal. Key strategies such as the development of a national oral health literacy policy, integration into school curricula, professional training, and the use of digital tools can be tailored to the Portuguese context to reduce oral health inequalities, and promote better population health.

Keywords: Oral health literacy, health promotion, public policy, education, dental health

Resumo

Introdução:

A literacia em saúde oral é um determinante fundamental dos resultados em saúde, influenciando os comportamentos individuais, a tomada de decisões e o acesso aos cuidados de saúde dentária. Em muitos países, incluindo Portugal, níveis insuficientes de literacia em saúde oral estão associados ao desenvolvimento de doenças orais evitáveis e ao agravamento das desigualdades em saúde.

Métodos:

Este estudo realizou uma revisão sistemática com base nas diretrizes PRISMA, utilizando várias bases de dados (PubMed, Scopus, Cochrane) para identificar estudos empíricos publicados nos últimos dez anos que implementaram intervenções destinadas a melhorar a literacia em saúde oral. A qualidade dos estudos incluídos foi avaliada com base nos critérios do Instituto Joanna Briggs.

Resultados:

Foram identificados e analisados dezoito estudos. As estratégias encontradas incluíram intervenções escolares (como o programa Childsmile e programas baseados na Teoria Cognitiva Social), aplicações móveis na área da saúde, educação direcionada a cuidadores, quadros políticos nacionais e programas de formação para profissionais de saúde dentária. A maioria das intervenções demonstrou impactos positivos ao nível do conhecimento, dos comportamentos e das práticas preventivas.

Conclusão:

As intervenções globais destinadas a melhorar a literacia em saúde oral apresentam modelos promissores para aplicação em Portugal. Estratégias-chave, como a criação de uma política nacional de literacia em saúde oral, a integração nas escolas, a formação profissional e o uso de ferramentas digitais, podem ser adaptadas ao contexto português para reduzir as desigualdades em saúde oral e melhorar a saúde da população.

Palavras-chave: literacia em saúde oral, promoção da saúde, políticas públicas, educação, saúde dentária

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List of Abbreviations

ADA – American Dental Association

ECC – Early Childhood Caries

HL – Health Literacy

IDD – Intellectual and Developmental Disabilities

JBI – Joanna Briggs Institute

LEP – Limited English Proficiency

mHealth – Mobile Health

NIDCR – National Institute of Dental and Craniofacial Research

NVS – Newest Vital Sign

OHL – Oral Health Literacy

OSF – Open Science Framework

PICO – Population, Intervention, Comparison, Outcome

PMT – Protection Motivation Theory

PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analyses

REALD – Rapid Estimate of Adult Literacy in Dentistry

RoB 2.0 – Revised Cochrane Risk of Bias Tool

SCT – Social Cognitive Theory

SNS – Serviço Nacional de Saúde (Portuguese National Health Service)

S-TOFHLA – Short Test of Functional Health Literacy in Adults

TFA – Theoretical Framework of Acceptability

UOCNs – Unmet Oral Care Needs

1. INTRODUCTION

1.1. History of oral health literacy

The concept of "health literacy" originated in the 1970s, designed as a framework centering on individuals, their families, and communities within a learning process. This approach sought to strengthen preventive actions and encourage the adoption of healthier lifestyles.(1-3)

Health literacy refers to an individual's ability to obtain, comprehend, and apply health information to make well-informed decisions regarding their well-being. Its primary goal is to equip individuals with the skills needed to preserve their health or manage medical conditions effectively. Ultimately, health literacy seeks to empower individuals with the knowledge and abilities required to govern their health-related choices actively.(2, 3)

Health literacy is an individual's ability to access, understand, and use essential health information and services to make informed choices that support and enhance their overall well-being.(4) Empirical evidence on health disparities shows a strong correlation between lower education levels and poorer health outcomes.(5) However, the underlying mechanisms behind this association are still not fully understood.(6)

Oral health literacy (OHL) is a specialized subset of health literacy, first introduced in the year 2000 by *Healthy People 2010*. It emphasizes individuals' ability to access, comprehend, and utilize information pertinent to oral health to support and enhance their oral well-being.(7) and is regarded as a crucial determinant of good oral health. It refers to how individuals can access, process, and understand basic oral health information, use essential oral health services, and make informed decisions about their oral health based on this information and available resources.(8)

1.2. Key concepts in oral health literacy

The notion of oral health literacy is widely applied in research, with many scholars expanding upon this foundational definition in their studies. For example, the American Dental Association (ADA) has demonstrated that low levels of oral health literacy represent a major obstacle to preventing, diagnosing, and treating oral diseases.(9)

1.3. Barriers to oral health literacy

Oral diseases can impair not only the functionality of oral structures but also overall systemic health. For instance, children with a greater number of decayed teeth often have lower body weights, and advanced tooth decay can stunt their growth.(10)

Additionally, periodontal disease (periodontitis) has been associated with various systemic conditions, including arthritis, endocarditis, nephritis, and other health issues. Studies show that individuals with fewer sources of oral health information, due to factors

like lower education levels or restricted Internet access, both elements of health literacy, are more likely to miss dental appointments, which may worsen oral health problems.(9)

1.4. Impact of oral health literacy on public health

Health literacy plays a vital role in improving access to healthcare, ultimately contributing to better health outcomes for individuals and communities. As a branch of health literacy, oral health literacy (OHL) has also been found to help reduce oral health disparities by encouraging improved oral health practices. However, despite efforts by oral health professionals to employ educational strategies, patients and their families may sometimes misinterpret the information provided. Misunderstanding oral health instructions, along with challenges in listening, reading, and critically assessing both spoken and written materials like brochures, directly results from low OHL levels.(11)

Oral health literacy is a worldwide concern that is intricately connected to disparities in oral health. Socioeconomic factors, as well as attitudes, beliefs, and practices related to oral health, can significantly influence oral health outcomes. People with higher oral health literacy (OHL) scores tend to have better oral health status and are more inclined to adopt positive oral health behaviors.(12)

In contrast, individuals with lower levels of oral health literacy (OHL) are more likely to suffer from higher rates of oral diseases, such as dental caries and periodontal disease, often leading to tooth extractions and impaired oral function, Various tools have been created to assess OHL, many of which are adapted from general health literacy assessment methods. For example, the *Rapid Estimate of Adult Literacy in Dentistry (REALD)* is a widely used tool specifically developed to evaluate adult literacy within the context of oral health.(13)

Health literacy (HL) originates from the concept of literacy as a set of fundamental skills needed to perform everyday tasks, applying these skills specifically within a health context. Oral health literacy (OHL) builds on these same foundational principles, with the primary difference being its focus on an individual's ability to access, comprehend, and effectively navigate dental care systems.(14)

Low oral health literacy (OHL) is also linked to lower adherence to dental treatment recommendations, which results in poorer health outcomes and a heightened risk of oral diseases.(14) Furthermore, the National Institute of Dental and Craniofacial Research (NIDCR) recognizes that the generally low levels of oral health literacy (OHL) among the

population significantly contribute to oral health disparities across various demographic groups.(13)

As such, oral health literacy (OHL) is considered vital for promoting oral health and preventing oral diseases, as it empowers individuals to make informed choices, seek appropriate care, and adopt healthier oral habits.(15)

This complexity arises from the intricate interplay of culture, society, health systems, education, language, and oral health. Indeed, oral health literacy (OHL) is now widely acknowledged as a critical determinant of oral health. Continued research has deepened and broadened the concept, resulting in over 250 distinct definitions across academic literature, government reports, and organizational publications.(8)

Non-native speakers frequently face various communication barriers in healthcare settings. Even simple tasks, such as describing symptoms to a provider or asking questions, can present major challenges for individuals with limited English proficiency (LEP). English language learners, as well as racial and ethnic minorities, often experience some of the greatest disparities in health literacy (HL).(16)

Previous studies have proposed that oral health literacy (OHL) should be viewed as a multifaceted and dynamic concept. It encompasses a wide range of competencies and skills vital for maintaining oral health, including cognitive processing, reading and comprehension, numerical reasoning, communication, active listening, informed decision-making, and the practical application of knowledge.(8)

The varied interpretations of oral health literacy (OHL) often lead to conflicting research findings. Differences in how OHL is understood and applied can result in inconsistencies in

study outcomes, complicating efforts to develop cohesive strategies for enhancing oral health across diverse populations.(17, 18)

Health literacy is commonly defined at two main levels: personal and organizational. Personal health literacy refers to an individual's capability to obtain, process, and understand essential health information to make well-informed health decisions. In contrast, organizational health literacy relates to an organization's ability to design environments and systems that facilitate equitable access to health information, enabling individuals to effectively understand and apply this information to make sound health decisions and take appropriate actions.(19)

Consequently, health literacy extends beyond the basic abilities to read information and access healthcare services. It highlights community empowerment as a crucial factor in

fostering healthier daily habits, which, in turn, improves overall health and quality of life. By equipping individuals with the necessary skills and knowledge, health literacy encourages active involvement in community health initiatives focused on promotion and disease prevention, helping to build a more knowledgeable and health-conscious society.(2, 3, 20, 21)

Assessing the impact of functional health literacy is essential for gauging an individual's capacity to understand critical health information. Such an assessment reveals how effectively individuals can comprehend, interpret, and apply health knowledge to make informed choices about their well-being and health management. (22-25)

Low oral health literacy leads to a lower adoption of proper daily oral health practices. Strengthening communication between patients and healthcare providers can greatly improve oral health literacy, which, in turn, helps to alleviate anxiety during dental treatments and reduce hesitation in seeking care. Enhanced communication promotes a clearer understanding and adherence to oral health routines, ultimately supporting better health outcomes.(26, 27)

The impacts of oral diseases are far-reaching, potentially causing difficulties with concentration and speech, reduced self-esteem, challenges in eating, poor nutrition, and barriers to employment. Furthermore, these conditions lead to higher rates of absenteeism from work and school, further diminishing an individual's quality of life and overall well-being.(28)

As noted by Horowitz and Kleinman(29), individuals with low oral health literacy—such as ethnic minorities, older adults, and those with special needs—are at a heightened risk of oral diseases. These groups frequently encounter greater obstacles in accessing, understanding, and using oral health information, which increases their susceptibility to oral health problems.(30-32)

1.5. Strategies for improving oral health literacy

Enhancing oral health literacy within a community can be accomplished by implementing effective oral health promotion strategies. Such approaches equip individuals with the knowledge and skills needed to adopt healthier oral habits, ultimately resulting in improved oral health outcomes and a reduction in oral health disparities.(9)

Considering the strong link between health literacy levels and health outcomes, individuals are encouraged to actively engage in managing their own health. As a result,

coordinated efforts have been made at local, national, and international levels to improve health literacy across populations, with the goal of empowering individuals to make informed health choices and enhance public health overall.(9, 32)

Future healthcare providers will need to cultivate the skills to recognize gaps in patients' literacy and language comprehension, enabling them to provide care and instructions at an appropriate level. Research highlights an increasing need for health professionals equipped with the education and practical experience to support effective health communication, a crucial factor in enhancing patient outcomes and promoting health literacy.(33)

1.6. The importance of health promotion and literacy for oral health

As people increasingly understand that oral health is a vital part of overall well-being, there's been a growing push to bring health literacy into everyday dental care and research. By helping individuals better understand and manage their oral health, these efforts aim to support healthier habits, prevent disease, and make dental care more effective and accessible for everyone.(30, 34-37)

Research has shown that health literacy is linked to multiple health aspects, including knowledge, health status, outcomes, and service utilization.(38, 39)

Health literacy is now acknowledged as a key determinant of health and a contributing factor to health disparities across various population groups.(30)

Individuals with low health literacy may find it challenging to understand and apply information from written materials, especially when they introduce new concepts or use unfamiliar terms. Conversely, those with higher health literacy more readily adhere to

instructions for self-care, postoperative precautions, medications, and follow-up appointments, supporting better health outcomes. However, many health instructions and brochures are written at a complexity level that exceeds the average patient's reading ability and often include professional terminology, making them harder to comprehend.(40)

Oral health literacy serves as a foundational element of preventive care.(41) When people fully understand the benefits of essential oral hygiene practices, such as brushing, flossing, and attending regular dental appointments, they are more likely to adopt these habits as consistent parts of their daily lives. By recognizing how these practices prevent cavities, gum disease, and other oral health issues, individuals feel more motivated to take proactive steps toward their health. This heightened awareness and commitment to oral

hygiene not only supports their well-being but also fosters healthier communities overall(42) However, a substantial part of the population lacks the essential knowledge to maintain good oral health.(43)

Common barriers include misconceptions about dental diseases, limited awareness of preventive measures, and uncertainty about when to seek care.(44)

Enhancing oral health literacy empowers individuals to make informed decisions, lower their risk of oral diseases, and seek timely treatment, thereby reducing the strain on healthcare systems.(26, 45)

Educational campaigns are essential for promoting oral health and building awareness about common issues, including cavities, gum disease, and the importance of proper oral hygiene practices. These initiatives not only inform people about preventive measures but also encourage them to adopt healthier habits, seek regular dental check-ups, and understand the long-term benefits of maintaining oral health. By addressing misconceptions and providing clear guidance, these campaigns contribute significantly to reducing oral health issues within communities.(46)

Campaigns also play a pivotal role in influencing behavior by delivering clear and consistent messages that motivate individuals to prioritize their oral health. Through repeated exposure to well-crafted messages, these campaigns can inspire lasting changes in daily habits, helping people understand the importance of preventive care and the impact of oral health on overall well-being.(47)

School-based programs are highly effective in promoting oral health literacy among young people. By teaching children proper oral hygiene practices, schools help build a foundation for lifelong health. Many programs use interactive elements, such as games, demonstrations, and take-home materials, to engage students and reinforce learning.(48)

Schools offer an ideal environment for reaching children from diverse socio-economic backgrounds. Integrating oral health promotion into broader health education can contribute to positive changes in students' health knowledge, beliefs, attitudes, and behaviors. However, it is essential to evaluate the effectiveness of school health promotion programs that use various strategies.(49)

Early prevention is essential for reducing health inequalities by addressing oral health issues before they progress. Programs targeting children and young adults, such as fluoride varnish applications, sealants, and dietary counseling, help prevent common issues like

cavities and gum disease. These early interventions are especially impactful in low-income or marginalized communities, where access to dental care may be limited. The benefits of early prevention extend beyond physical health; poor oral health can lead to pain, social stigma, and diminished quality of life, impacting school performance and social interactions. By tackling oral health issues early, prevention programs create a more equitable environment, allowing children from all backgrounds to concentrate on their education and social growth.(50)

Oral health requires attention across the lifespan, with education playing a key role in helping individuals sustain healthy practices as they age. Health promotion initiatives should offer tailored resources and support for adults and seniors, as each stage of life introduces specific oral health needs. For example, adults benefit from understanding how lifestyle factors like smoking and diet can affect their oral health, while older adults may need assistance managing conditions like dry mouth or guidance on caring for dentures. Continuous learning also enables people to stay up-to-date on new oral healthcare developments, such as innovations in treatments, updated preventive care guidelines, and evolving insurance options.(51)

1.7. Main challenges in promoting oral health literacy

1.7.1. Socioeconomic Inequality

Oral health requires attention across the lifespan, with education playing a key role in helping individuals sustain healthy practices as they age. Health promotion initiatives should offer tailored resources and support for adults and seniors, as each stage of life introduces specific oral health needs. For example, adults benefit from understanding how lifestyle factors like smoking and diet can affect their oral health, while older adults may need assistance managing conditions like dry mouth or guidance on caring for dentures. Continuous learning also enables people to stay up-to-date on new oral healthcare developments, such as innovations in treatments, updated preventive care guidelines, and evolving insurance options.(52)

Financial limitations further widen this access gap, restricting the ability to afford preventive care and resulting in higher rates of oral diseases within underserved communities. The lack of affordable dental services in low-income areas makes it

challenging for these populations to maintain regular dental visits, leading to persistent oral health problems and a decline in overall well-being.(53)

1.7.2. Education level and health literacy

Disparities in education also have a substantial impact on oral health literacy. Limited educational attainment can affect individuals' understanding of oral hygiene and restrict their access to oral health resources. In this context, health literacy encompasses the ability to locate, interpret, and comprehend fundamental health information needed to make informed choices. Low health literacy is especially prevalent in communities with high dropout rates or limited educational resources, leading to reduced adoption of essential oral health practices and, over time, poorer health outcomes.(54)

1.7.3. Cultural barriers and stigma

Cultural norms and beliefs heavily impact oral health behaviors. In certain communities, unfamiliarity with preventive dental care, shaped by diverse health perspectives, can foster skepticism or even mistrust toward dental services.(55)

In addition, stigma around seeking dental care, especially in rural and underserved areas, often deters individuals from pursuing early preventive treatment, raising the risk of more severe oral health problems over time. For health literacy programs to effectively reach diverse populations and address these obstacles, cultural sensitivity and awareness are crucial.(56, 57)

Stigma related to preventive care often causes individuals to postpone or avoid essential dental visits. For example, adults with past dental issues may feel embarrassed or judged, which can discourage them from seeking preventive care. This stigma is often intensified by low health literacy, as individuals may lack a clear understanding of the importance of early intervention in maintaining oral health.(58)

1.7.4. Lack of dedicated oral health professionals in rural and underserved areas

The limited availability of oral health professionals, particularly in rural and low-income regions, presents a major obstacle to advancing oral health literacy. Schools and

community centers in these areas often do not have access to dental practitioners who can offer education and preventive care for both children and adults.(59)

1.8. Objectives

To guide this systematic review, the following questions were developed to better understand oral health literacy in Portugal and how it can be improved:

1. How does the level of oral health literacy in Portugal compare to other countries?
2. What factors contribute to the differences in oral health literacy between Portugal and countries with better oral health outcomes?
3. What cultural, social, and healthcare challenges affect oral health literacy in the Portuguese population?
4. What strategies have been successfully used in other countries to improve oral health literacy?
5. Which of these strategies could be adapted to Portugal's specific context to make the greatest impact?
6. What are the main obstacles to improving oral health literacy in Portugal, and how can they be addressed?
7. How can global best practices help shape practical and effective guidelines for improving oral health literacy in Portugal?

These questions aim to explore how Portugal can benefit from international experiences while addressing its unique challenges to improve oral health literacy and outcomes.

2. MATERIALS AND METHODOLOGY

2.1. Background and purpose

To organize current scientific knowledge on oral health literacy and its impact on health outcomes, a systematic search was carried out for studies available in the medical literature, in the electronic databases PubMed, Scopus, and Cochrane to identify relevant articles. Additionally, reference lists from relevant studies were manually reviewed to ensure comprehensive coverage of available literature.

2.2. Study overview

This systematic review will be conducted following the Preferred Reporting Items for Systematic reviews and Meta-analysis (PRISMA) guidelines (60) to answer a question formulated according to the Population, Intervention, Comparison, and Outcomes (PICO) strategy. This review has also been registered in the OSF database with the registration DOI: https://doi.org/10.17605/OSF.IO/2T5KD.

2.3. Search and evaluation tools

The search results were imported into Rayyan (61) to help visualize and operationalize the selection of articles and to evaluate the methodological quality of the studies. The evaluation tool - Joanna Briggs Institute (JBI)(62) will be used.

2.4. Search strategy

The search strategy was formulated using the PICO framework, designed to address the core research question: "How does oral health literacy influence oral health outcomes?"

The PICO components were defined as follows:

- Population: Individuals or populations with varying degrees of oral health literacy.
- Intervention: Efforts or assessments aimed at enhancing or assessing oral health literacy.
- Comparison: Different levels of literacy or various intervention approaches.
- Outcome: Measurable improvements in oral health behaviors or clinical indicators.
- Study Type: Literature review focusing on relevant empirical research.

The following search string was applied in PubMed:

(health literacy OR oral health literacy) AND (oral health promotion OR community oral health OR community-based learning OR service-learning).

A similar search strategy was employed for Scopus:

(health literacy OR oral health literacy) AND (oral health promotion OR community oral health OR community-based learning OR service-learning).

Search results from the databases were screened for duplicates and then combined for further evaluation.

2.5. Eligibility criteria

Studies were screened based on the following eligibility criteria:

- Articles focused on human participants.
- Published in English in the last 10 years.
- Investigating the influence of oral health literacy on oral health outcomes.
- Full-text availability.

Studies were excluded if they:

- Were systematic reviews of trials or narrative reviews.
- Focused on laboratory, in vitro, or animal research.
- They were letters to the editor or opinion pieces.

2.6. Study selection process

Two reviewers independently screened the studies (FF and PL), starting with titles and abstracts, to identify relevant research. Disagreements were resolved by consulting a third reviewer (NV). Extracted data included:

- Study title, authors, and publication year.
- Population characteristics and study design.
- Tools or methods used to assess oral health literacy.
- Key findings, including measurable outcomes and intervention details.

2.7. Quality assessment

To evaluate the reliability of the included studies, a quality assessment was conducted using the Revised Cochrane Risk of Bias Tool for Randomized Trials (RoB 2.0)(63). This process involved reviewing five domains:

1. Bias in randomization processes.
2. Bias arising from deviations in interventions.
3. Bias due to missing data.
4. Bias in measurement of outcomes.
5. Bias related to the selective reporting of results.

Each domain was assigned a rating of low risk, some concerns, or high risk, culminating in an overall evaluation of each study's methodological rigor.

3. RESULTS

3.1. Study Selection Process

A systematic literature search was conducted for studies published within the last 10 years, aiming to identify research evaluating interventions designed to improve oral health literacy (OHL).

A total of 677 records were retrieved: PubMed (n = 585), Scopus (n = 70), Cochrane (n = 22), and manual search (n = 3). After eliminating 36 duplicates, 644 unique articles were screened for relevance based on title and abstract. (Figure 1)

From this initial screening, 498 articles were excluded due to irrelevance, lack of focus on OHL, or being theoretical or review articles. Subsequently, 146 articles were selected for full-text evaluation. During this phase, 128 articles were excluded, 14 due to lack of full text and 114 due to insufficient relevance to OHL outcomes or missing key data. Ultimately, 18 studies met all inclusion criteria and were incorporated into the final qualitative synthesis.

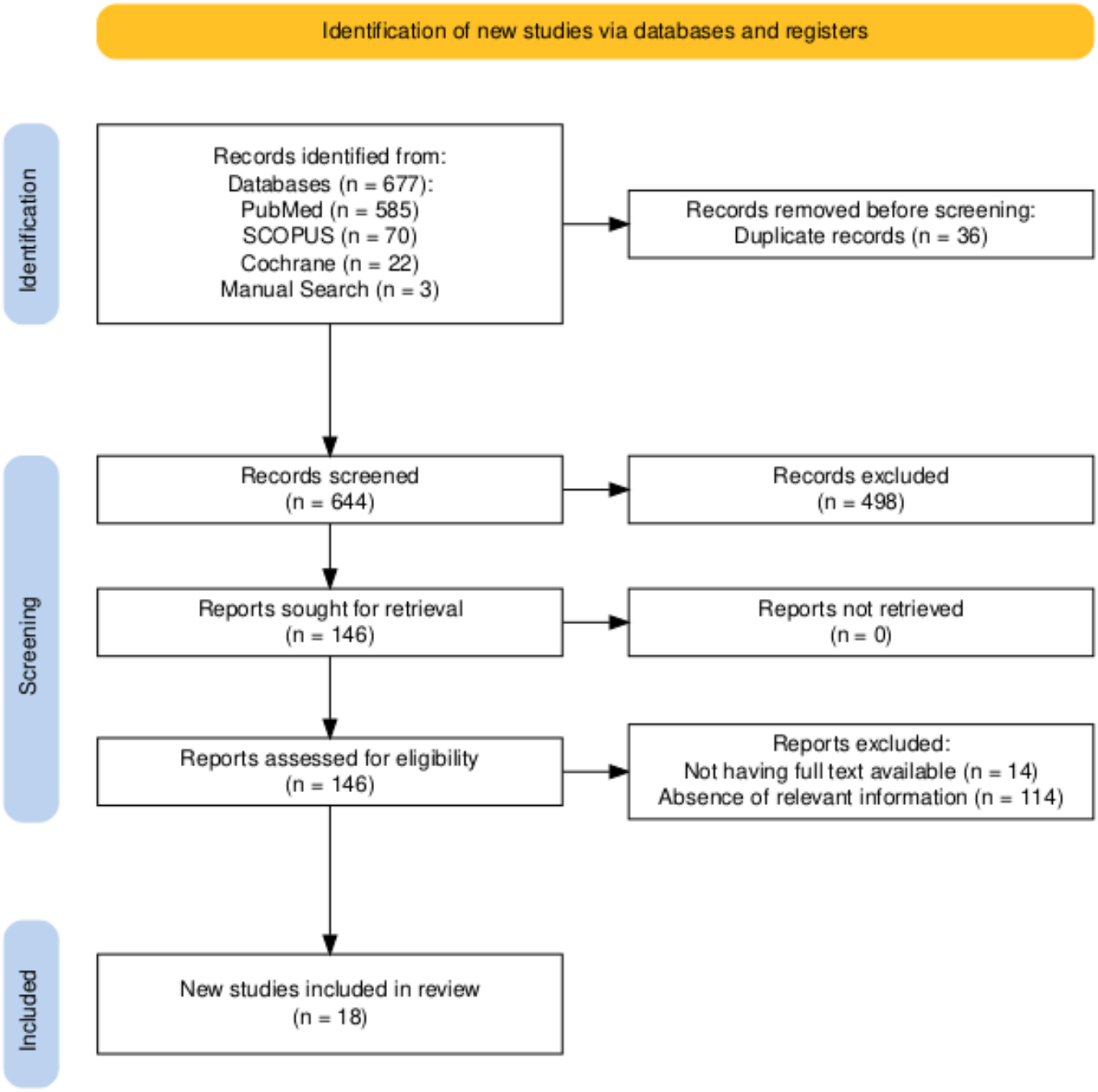

Figure 1. Overview of the article selection processes

3.2. Selected OHL strategies

Table 1. Summary of selected studies on oral health literacy (OHL) strategies and their applicability to the Portuguese context.

Author/ (Year)	Title	Country	OHL Strategy	Goals	Conclusion	Applicability to Portugal
mos. et al. (2019)	The development of a theory-based eHealth app prototype to promote oral health during prenatal care visits	USA	Prenatal Oral Health eHealth App – A digital application designed to support prenatal healthcare providers in implementing oral health promotion during prenatal visits.	To develop and test a theory-based eHealth application that helps prenatal healthcare providers educate and guide pregnant patients on oral health.	The app was found to be effective in providing oral health information and behavioral guidance. Key features included structured scripts, patient education prompts, and referral tools integrated into clinical practice. - Challenges included time constraints for providers and the need for more concise interactions.	Moderately Applicable: This model could be adapted to Portugal's maternal healthcare system to support prenatal oral health literacy. Localization to Portuguese, alignment with national guidelines, and integration with existing health record systems would be necessary for implementation.
Wilson et al. (2022)	Evaluation of Smiles for Life: A Caregiver Focused	Australia	Smiles for Life Program – A caregiver-focused	To evaluate the effectiveness of the Smiles for Life program	The program provided structured workshops on oral hygiene techniques, behavior	Moderately Applicable: A similar program could benefit Portugal's long-term care facilities,

	Oral Health Education Program		oral health education initiative for individuals with intellectual and developmental disabilities (IDD).	in improving oral health literacy among caregivers of individuals with intellectual and developmental disabilities (IDD).	management, and nutritional counseling. Caregivers appreciated the content but found it complex; some struggled with implementation. - Future recommendations: more hands-on training and follow-up support.	disability care centers, and home-based caregivers. Challenges include localized materials, partnerships with disability advocacy groups, and hands-on training.
Gordon et al. (2024)	Enabling educator oral health literacy: An impetus for oral health promotion in early childhood development	South Africa	Educator Oral Health Literacy (OHL) Intervention – A one-day interactive workshop for early childhood educators on oral health promotion.	To evaluate the effectiveness of an oral health promotion intervention for educators at ECD centers, assessing their oral health literacy, practices, and attitudes before and after the program.	Improved awareness and intention to change oral health habits. Many educators committed to embedding oral health activities in ECD centers. - Challenges included limited parental involvement and lack of structured oral health programs in schools.	Moderately Applicable: This educator training program could be adapted for Portugal's preschool education sector. Key challenges include language adaptation, government collaboration, and establishing monitoring mechanisms.

`Horowitz et al. (2016)	A Multi-level, Multi-Sector Oral Health Literacy Initiative to Reduce Oral Health Disparities and Achieve Health Equity: Early Lessons from the Maryland Model	USA (Maryland)	Maryland Oral Health Literacy Model A multi-sector approach integrating public policy, education, and community outreach to reduce oral health disparities.	To implement a statewide initiative addressing oral health disparities through policy changes, education programs, and community outreach, with a focus on low-income and underserved populations.	Creation of the Maryland Dental Action Coalition (MDAC) to unify efforts. - Expansion of Medicaid dental services and increased provider reimbursement. - Implementation of Healthy Teeth, Healthy Kids oral health literacy campaigns. Training of non-dental healthcare providers for integrated care. - Development of standardized oral health literacy toolkits. - Impact: Increased Medicaid dental access, improved preventive care utilization, and higher awareness among vulnerable communities. - Challenges: Sustaining long-term funding, policy integration, and overcoming literacy barriers.	.Highly Applicable: The Maryland model provides a structured framework that could be adapted to Portugal's national oral health literacy initiatives. Key adaptations would include forming a Portuguese oral health literacy coalition, expanding dental coverage policies, and customizing public education campaigns for cultural and linguistic relevance.

Al-Yaseen et al. (2024)	"I Just Wanted a Dentist in My Phone": Designing Evidence-Based mHealth Prototype to Improve Preschool Children's Oral and Dental Health	United Kingdom	App for Children's Teeth (ACT) – A co-designed mobile health (mHealth) app to provide parents with evidence-based information on children's oral health	To develop and test a prototype of an mHealth app that provides parents with accessible, evidence-based information on preschool children's oral health and evaluate its acceptability using the Theoretical Framework of Acceptability (TFA).	The app was found to be useful and intuitive, offering teething guides, oral hygiene instructions, brushing timers, and reminders. Parents liked the app but had concerns about screen time and long-term engagement. - The app needs continuous updates and potential integration of offline resources. - Parents preferred endorsement by a trusted health organization (e.g., NHS) for credibility.	Moderately Applicable: This approach could be adapted for Portuguese parents, with localized content and partnerships with public health institutions. Key adaptations include translation, collaboration with Portugal's national health system for credibility, and integration of local dental care resources.
Aldoory et al. (2016)	Comparing Well-Tested Health Literacy Measures for Oral Health: A Pilot Assessment	USA	Comparative Assessment of Health Literacy Tools (REALM, S-TOFHLA, NVS) – Evaluating different oral health literacy	To compare three widely used health literacy measurement tools (REALM, S-TOFHLA, NVS) in an oral health context, assess their correlation with perceived oral health	REALM and S-TOFHLA produced similar results, but NVS produced lower health literacy scores.- NVS was significantly associated with both perceived oral and general health status, while REALM and S-TOFHLA were not.- All three	Moderately Applicable: Understanding which health literacy tools are most effective can inform oral health literacy assessments in Portugal. Adaptation requires selecting an appropriate assessment tool, developing a Portuguese-

			measurement tools.	status and self-efficacy, and explore whether these tools provide different insights into oral health literacy.	tools were linked to self-efficacy in preventing periodontal disease, but only REALM was associated with self-efficacy for preventing cavities.- The tools measure different aspects of health literacy and are not interchangeable.- Choice of assessment tool influences research outcomes in oral health literacy.	specific OHL assessment instrument, and integrating cultural and language-specific factors in measurement.
Movaseghi Ardekani et al. (2022)	The Effect of an Educational Intervention on Oral Health Literacy, Knowledge, and Behavior in Iranian Adolescents: A Theory-Based Randomized Controlled Trial	Iran	Protection Motivation Theory (PMT)–Based OHL Intervention – A structured oral health education program designed using behavior change theory.	To evaluate the effectiveness of a PMT-based educational intervention on oral health literacy, knowledge, and behavior among adolescents.	The intervention significantly improved OHL, knowledge, and behavior in the intervention group compared to the control group. Behavioral improvements were validated through self-reports and a dental plaque index. - Findings support the use of theory-driven interventions for more effective OHL education.	Moderately Applicable: This structured, theory-based intervention could be adapted for Portugal's adolescent population. Key adaptations include cultural translation, integration into school health programs, and collaboration with educational and public health institutions.

Basir et al. (2017)	Four-level evaluation of health promotion intervention for preventing early childhood caries: a randomized controlled trial	Iran	Maternal OHL Education & SMS Follow-Up – A multi-component intervention targeting mothers to prevent early childhood caries (ECC) through education and behavior change strategies.	To evaluate the effectiveness of an educational intervention in improving oral health literacy, perceived threat, and preventive behaviors among mothers of young children (12-36 months old).	The intervention significantly improved oral health literacy, perceived threat, and preventive behaviors. Caries incidence was significantly lower in the intervention group (13%) compared to the control group (35%). - The program combined in-person education, biweekly SMS reminders, and visual materials to reinforce learning. - Challenges included the sustainability of behavioral changes beyond six months.	Moderately Applicable: This structured maternal OHL intervention could be adapted for Portugal's maternal and child health programs. Adaptation would require localization of educational materials, integration into primary healthcare settings, and ensuring long-term behavioral reinforcement.
Kleinman et al. (2023)	The 2030 Healthy People Initiative and Framework: Health Literacy's Impact on Oral Health Promotion and Disease	USA	Healthy People 2030 Oral Health Initiative – A national policy framework that integrates oral health literacy	To examine how the Healthy People 2030 framework incorporates health literacy to enhance oral health promotion and disease	The initiative emphasizes multisectoral engagement, integrating oral health literacy into national public health efforts. Focuses on reducing oral health disparities, increasing access to care, and improving prevention	Highly Applicable: The Healthy People 2030 framework provides a policy model for integrating OHL into Portugal's public health initiatives. Adaptation would involve national-level policy

	Prevention Objectives for the Nation		(OHL) into public health strategies.	prevention across the United States	strategies. - Supports the development of policy-based OHL interventions that align with broader health literacy goals	development, integration with healthcare education, and multisector collaboration.
Tseng et al. (2020)	Barriers and Facilitators to Promoting Oral Health Literacy and Patient Communication among Dental Providers in California	USA (California)	Dental Provider OHL Training & Communication Strategies – Identifying provider-side barriers and facilitators to effective OHL communication.	To explore the challenges dental providers face in promoting OHL and improving patient communication, and to identify strategies for better implementation.	Dental providers face barriers such as limited training, time constraints, lack of incentives for prevention, and language/cultural barriers. Providers use simple language and visual models, but few utilize teach-back or motivational interviewing. Recommendations include standardized OHL training, development of OHL toolkits, and policy incentives for preventive education.	Highly Applicable: This study provides key insights into dental provider training gaps, communication challenges, and strategies that can be adapted to enhance OHL implementation in Portugal's dental sector. Policy adaptations and structured OHL training programs could strengthen provider-patient interactions.
Shirahmadi et al. (2024)	Effectiveness of theory-based educational interventions of	Iran	Social Cognitive Theory (SCT)-Based OHL Program – A	To evaluate the effectiveness of a structured, SCT-based oral health education	The intervention significantly improved toothbrushing and flossing behaviors among students. Plaque levels	Highly Applicable: A similar school-based OHL intervention could be adapted for Portugal's education system. Key

	promoting oral health among elementary school students		school-based oral health education program integrating gamification, digital engagement, and community involvement.	intervention in improving oral hygiene behaviors among elementary school students.	decreased (38.1%), and gum bleeding rates declined (6.3%). - Gamification, digital engagement (Telegram groups), and community support contributed to behavior change. - The SCT framework effectively guided the intervention strategy.	adaptations would involve cultural translation, integration into school curricula, and collaboration with public health institutions for sustained engagement.
Kaper et al. (2019)	Implementation and Long-Term Outcomes of Organisational Health Literacy Interventions in Ireland and The Netherlands: A Longitudinal Mixed-Methods Study	Ireland & Netherland -s	Hospital-Based Organisational Health Literacy (OHL) Interventions – System-wide health literacy improvements in hospitals, including better patient communication,	To assess the implementation, long-term impact, and sustainability of OHL interventions in hospitals, focusing on communication, patient navigation, and engagement.	The intervention led to long-term improvements in hospital-wide OHL, enhancing patient navigation, written communication, and digital tools. Key barriers: Limited resources, variability in hospital structures, and difficulties in systemic change. - Facilitators: Leadership support, phased implementation, and embedding OHL strategies into routine	Highly Applicable: This study provides a structured framework for improving OHL in Portuguese hospitals. Key adaptations could include OHL audits, healthcare staff training, and system-wide integration of health literacy-friendly policies.

			signage, and staff training		hospital procedures. - The study highlights sustained improvements in healthcare OHL when integrated into hospital operations.	
Høiseth & Jasbi (2024)	Adolescents' views on oral health care and promotion in Norway: everyday practices, recommendations, and future visions	Norway	Youth-Centered OHL Strategies – Exploring adolescent perspectives on oral health care, barriers, and future recommendations for engaging young people in oral health literacy.	To investigate how adolescents perceive oral health care, identify barriers to engagement, and suggest strategies for improving oral health literacy among young people.	Adolescents showed varied attitudes toward oral health, influenced by family, motivation, and personal experiences. Recommended gamified, digital, and interactive educational tools over traditional approaches. Highlighted the need for better communication in dental visits, school-based OHL programs, and socially inclusive health promotion. - Addressed barriers related to socioeconomic status and access to care.	Highly Applicable: Findings could inform youth-centered OHL initiatives in Portugal. Key adaptations include school-based programs, digital engagement tools, and culturally tailored communication strategies to improve adolescent oral health literacy.

Anticona et al. (2024)	Inequities in Unmet Oral Care Needs after a Swedish Subsidization Reform: An Intersectional Analysis	Sweden	Health Policy & Financial Access to Dental Care – Evaluating the impact of a national oral health subsidy reform on access to care and financial barriers.	To assess the effectiveness of Sweden's 2008 oral health subsidy reform in reducing unmet oral care needs (UOCNs) and identify disparities based on socioeconomic and demographic factors.	Initial improvements in dental care access post-reform were followed by a rebound in unmet oral care needs, particularly among low-income, low-education, and immigrant groups. - The reform did not significantly reduce financial inequities in dental care access. Policy recommendations include "proportionate universalism" – maintaining universal access while increasing support for vulnerable populations. - Intersectional analysis revealed compounded inequities for individuals facing multiple disadvantages.	Moderately Applicable: Findings provide insights into how oral health policies affect accessibility and can inform discussions on financial barriers in Portugal's OHL initiatives. Adaptation would require tailoring subsidy models to ensure equitable access to dental care, particularly for vulnerable groups.
Blake et al. (2015)	School-Based Educational Intervention to	United Kingdom	School-Based Oral Health Education	To evaluate the effectiveness of a brief, school-based oral health	The intervention significantly improved oral health knowledge, with effects maintained at 6-	Highly Applicable: This model could be adapted for Portugal's school-based OHL initiatives.

	Improve Children's Oral Health-Related Knowledge		Program – A short, interactive classroom session delivered by dental professionals, supported by take-home educational materials.	education intervention in improving children's oral health knowledge and behaviors.	week follow-up. Flossing frequency increased, but no significant changes were observed in toothbrushing or dietary habits. - Children found the session engaging and useful. - Limitations: Short-term study, no clinical assessments, and lack of parental involvement.	Key adaptations include incorporating long-term follow-ups, parental involvement, and clinical oral health assessments to maximize impact.
Ross et al. (2023)	Evaluating Childsmile, Scotland's National Oral Health Improvement Programme for Children	Scotland	Childsmile Program – A national oral health promotion initiative integrating supervised toothbrushing, fluoride varnish, and targeted	To evaluate the effectiveness, implementation, and long-term impact of Childsmile in improving children's oral health and reducing inequalities.	Significant reduction in childhood caries (from 60% to 26% in 5-year-olds). - Supervised toothbrushing and regular dental visits were the most effective interventions. - Fluoride varnish had mixed results, depending on application consistency. - Cost-effective program, saving ~£3 million GBP annually. - Challenges: Socioeconomic	Highly Applicable: Childsmile provides a strong model for Portugal's OHL strategy. Key adaptations include implementing supervised toothbrushing programs, integrating dental education into early childhood care, and ensuring equitable access to preventive care.

			home interventions.		disparities persist, and program disruptions due to COVID-19.	
Buunk-Werkhoven & Burrekers (2018)	Oral Health Awareness, Promotion of Home Oral Self-Care, and Professional Oral Health Care Among Young Mothers and Their Babies: A Pilot Project	Netherland-s	Community-Based Oral Health Education for Young Mothers – Interactive workshops promoting oral self-care and preventive dental visits for mothers and babies.	To assess the effectiveness of a community-based, low-threshold oral health promotion approach targeting young mothers and their babies.	The workshops improved oral health awareness, particularly for early childhood oral care. - Behavior change was limited, with low uptake of free oral hygiene consultations. - Challenges included parental reluctance and low engagement in follow-up dental care. - Recommendations include structured follow-ups, motivational reinforcement, and community-based support for sustained impact.	Highly Applicable: This intervention model could be adapted for maternal and child oral health initiatives in Portugal. Key adaptations involve integrating community health workers, reinforcing follow-up care, and embedding OHL strategies into family health programs.
Marquillier et al. (2020)	Social Inequalities in Oral Health and Early Childhood Caries: How Can They Be Effectively	France	Parental Oral Health Literacy & Community-Based ECC Prevention –	To analyze key predictors of ECC and recommend effective strategies for reducing oral health disparities,	Low parental OHL strongly predicts ECC, with a direct link to children's caries risk. - Psychosocial factors (stress, social support, discrimination)	Highly Applicable: Findings support the development of family-centered and community-based OHL interventions in Portugal. Key adaptations

	Prevented? A Scoping Review of Disease Predictors		Identifying predictors of early childhood caries (ECC) and strategies to reduce oral health inequalities.	particularly in vulnerable populations.	also impact child oral health. - Recommended universal and targeted OHL interventions for parents, combining education, clinical care, and community-based support. - Emphasized a multilevel approach integrating public health policies with family-focused oral health strategies.	include integrating OHL education into maternal and child healthcare programs and targeting at-risk families through social and public health services.

As shown in Table 1, this review includes 18 studies conducted across a wide geographic range, including North America (USA), Europe (UK, Ireland, Netherlands, France, Sweden, Norway), Asia (Iran), Africa (South Africa), and Oceania (Australia). This geographic diversity reflects a growing global commitment to improving oral health literacy (OHL) within various cultural and healthcare settings.

The interventions summarized span multiple strategic approaches, including school-based education programs, caregiver-focused workshops, mobile health (mHealth) applications, national policy initiatives, and system-level organizational reforms. Target populations range from young children and adolescents to pregnant women, parents, educators, individuals with disabilities, and healthcare professionals.

Collectively, these studies demonstrate not only the range of available OHL strategies but also their practical relevance and adaptability.

They provide a valuable evidence base for informing the design of effective, locally appropriate, and sustainable OHL interventions in Portugal.

While each study is shaped by its specific context, many share common features such as the use of behavior change theories, interactive and participatory learning methods, and collaboration across sectors (education, health, social care). Notably, culturally tailored materials and communication tools were emphasized as essential components in enhancing OHL outcomes.

4. DISCUSSION

Oral health literacy (OHL) plays a fundamental role in shaping public health outcomes by influencing preventive behaviors, access to care, and health equity. Numerous studies have demonstrated that populations with higher OHL levels exhibit better oral health status, greater adherence to preventive care, and lower incidences of dental diseases.(11-13, 29)

Consequently, public policies and structured health programs aimed at improving OHL have shown measurable success in reducing oral health disparities and enhancing overall community well-being.(2)

However, Portugal faces significant challenges in oral health. Studies indicate that oral health outcomes in Portugal lag behind those of many European countries, with persistent issues related to accessibility, preventive care, and public awareness. Recognizing these shortcomings, this study aims to examine successful OHL strategies from other countries and adapt them to Portugal's unique healthcare and socio-cultural context. By learning from well-established policies and interventions, Portugal has the opportunity to implement evidence-based solutions that can bridge existing gaps in oral healthcare.(64)

Several key recommendations emerge for improving OHL in Portugal, drawing from global best practices. One of the most important steps is the development of a National Oral Health Literacy Strategy, inspired by the Maryland model (65). This model in the U.S. successfully coordinated OHL initiatives through a coalition of government agencies, dental associations, and public health educators. The program significantly improved public awareness and engagement in preventive oral health behaviors. Given Portugal's fragmented approach to OHL, a national strategy like this would provide structure and ensure long-term policy commitment. However, its success in Portugal would depend on strong governmental support and collaboration among stakeholders.

Integrating oral health education into school curricula is another crucial strategy, modeled after Scotland's Childsmile program(66). This project provides supervised toothbrushing, fluoride varnish applications, and structured oral health education in schools, which has led to a significant decline in childhood dental caries. In Portugal, where childhood oral health remains a concern, a similar initiative could be highly effective. However, implementation challenges include ensuring sufficient funding, training teachers, and maintaining long-term engagement from families and school staff. If these barriers are addressed, this strategy could have a substantial impact on improving early oral health habits.

Digital health initiatives, such as mobile health (mHealth) applications, offer an innovative way to promote OHL. The UK's App for Children's Teeth (67) successfully provided accessible oral health information and reminders for parents, resulting in better adherence to preventive care. A Portuguese version could integrate with SNS to provide educational materials and appointment tracking. However, digital literacy and engagement levels among different socioeconomic groups in Portugal could affect its effectiveness. While this approach has proven successful in countries with high smartphone penetration, targeted efforts would be needed to ensure adoption in lower-income populations.

Community and caregiver training programs have been effective in several countries. Australia's Smiles for Life program (68) provided structured training to caregivers of children and vulnerable adults, increasing awareness and preventive behaviors. A similar program in Portugal could be adapted for parents, elderly caregivers, and social workers. However, Portugal's existing healthcare infrastructure would need to integrate these programs into community health centers to ensure long-term impact. Success in Portugal would largely depend on engaging local organizations and securing funding for continuous education.

Dental provider training is another critical aspect of improving OHL. In California, standardized OHL training for dentists (69) significantly improved patient communication and treatment adherence. A similar training program in Portugal could enhance dentist-patient interactions, particularly in underserved communities.

Financial accessibility is a key determinant in improving oral health outcomes. Sweden's oral health subsidy model (70) effectively increased access to preventive care among low-income populations by covering essential dental treatments. Implementing a similar financial support system in Portugal could help reduce inequalities in access to care. However, budgetary constraints and healthcare priorities may limit the feasibility of a fully subsidized program. A targeted model focusing on high-risk groups could be a more practical approach.

Norway provides another important perspective by examining youth-centered oral health strategies. Research has shown that adolescents have specific barriers to oral health engagement, including a lack of motivation and limited awareness of long-term consequences. Norway's approach emphasizes interactive health promotion strategies tailored for young people, such as gamification, peer-led education, and digital engagement tools (71),These strategies could be valuable in Portugal, where adolescent oral health behaviors often decline due to lower parental supervision. Implementing youth-focused

interventions could increase engagement and reinforce positive oral health habits from an early age.

Despite the benefits of these strategies, their implementation presents several challenges in Portugal. Cultural and linguistic adaptations are necessary to ensure that programs designed in other countries are suitable for Portuguese populations. A study by Shirahmadi, Bashirian (72) demonstrated the effectiveness of theory-based educational interventions in promoting oral health among elementary school students, highlighting the importance of structured and context-specific approaches to OHL improvement. This suggests that Portugal could benefit from adapting similar educational frameworks tailored to its own student population.

Maintaining public engagement is also a challenge, particularly with digital health tools, which require behavioral science techniques such as gamification and personalized notifications to ensure user adherence over time (71).

Furthermore, many healthcare providers currently lack formal training in OHL communication strategies, highlighting the need for mandatory training modules (69).

Digital health solutions have also emerged as promising tools for enhancing OHL. The Prenatal Oral Health eHealth App (USA) (73) was designed to assist prenatal healthcare providers in delivering oral health education to pregnant women. While the app was effective in improving awareness, challenges included time constraints for providers and the need for concise interactions. If adapted to Portugal, localization, integration with maternal healthcare guidelines, and alignment with existing health record systems would be necessary.

In South Africa, the Educator Oral Health Literacy Intervention (74)provided a one-day interactive workshop for early childhood educators. The initiative improved awareness and motivated educators to incorporate oral health activities into early childhood education. However, challenges such as limited parental involvement and the absence of structured school-based oral health programs were observed. Portugal could adapt this model by integrating oral health literacy modules into teacher training curricula and developing monitoring mechanisms.

Several theory-based educational interventions have also shown promise. In Iran, a Protection Motivation Theory (PMT)-Based OHL Intervention (75) significantly improved oral health behaviors among adolescents. Findings suggest that theory-driven interventions

may be more effective than general awareness campaigns. Similarly, a Social Cognitive Theory (SCT)-Based OHL Program (72) in Iran utilized gamification and digital engagement tools to enhance oral health behaviors among elementary school students. Portugal could benefit from integrating behavior change models into its school-based OHL programs.

In France policies addressing social inequalities in oral health have focused on reducing early childhood caries, particularly among underserved communities. These interventions have included public health campaigns, community-based education, and integration of oral health services into maternal and child health programs.(76). These strategies highlight the role of targeted public health campaigns and parental engagement, which could be valuable for similar populations in Portugal.

A Dutch study on community-based oral health education for young mothers, implemented through group sessions and peer-led discussions, demonstrated improvements in maternal knowledge and children's oral hygiene(77). A similar approach in Portugal could address gaps in early childhood oral care and parental involvement, especially in low-income communities.

5. CONCLUSION

This study emphasizes the importance of oral health literacy (OHL) as a critical component of public health and a key factor in reducing inequalities in oral health outcomes. Despite significant challenges in oral health currently faced in Portugal, the examination of international experiences shows that structured, evidence-based strategies, when adapted to local realities, can significantly improve public awareness, prevention, and access to care. The findings suggest that Portugal can benefit from integrating such approaches into its own health system, particularly through coordinated policy frameworks, community-based education, digital tools, and professional training. While each context is unique, common elements such as early intervention, culturally appropriate messaging, and multi-sector collaboration are essential for success. To move toward a more equitable and preventive model of oral health, future efforts in Portugal should focus on adapting, piloting, and evaluating proven strategies, with strong political support and sustained public engagement. Only through a comprehensive and inclusive approach can lasting improvements in oral health literacy be achieved.

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