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Intersecting comorbidities and economic strain: A systematic review of financial burden in elderly with periodontal disease, diabetes mellitus and hypertension

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Abstract

Background: The financial burden of comorbidities in the elderly is a growing concern, as aging populations experience higher rates of chronic diseases requiring long-term care. Rising healthcare costs, medication expenses, and hospitalization fees significantly impact the financial well-being of elderly individuals and their families.

Objective: This study aims to analyze the economic impact of comorbidities among elderly populations, focusing on direct medical expenses, indirect costs, and socio-economic implications.

Method: The method used is a systematic review, The searches were carried out in Pubmed, ScienceDirect, Proquest. Google Scholar, and Semantic Scholar. Two authors independently reviewed studies, assessed their quality and eligibility, then extracted the data.

Result: 10 articles that met the inclusion criteria were retained, according to research, older adults with several chronic illnesses have significant financial difficulties, such as high out-of-pocket medical costs, a higher risk of hospitalization, and expensive long-term care services. Economic stress is further worsened by inadequate insurance coverage, which disproportionately affects older, low – income groups.

Conclusion: Our review shows that the combination of periodontal disease, diabetes mellitus, and hypertension substantially increases health care expenditures among the elderly. The financial impacts are synergistic, resulting in significant wealth depletion and increased out-of-pocket costs.

Keywords: Elderly health; Comorbidities; Financial burden; Healthcare Costs

1. Introduction

The global aging trend has led to an unprecedented increase in the prevalence of chronic diseases, placing significant strain on healthcare systems worldwide. Elderly populations are particularly vulnerable, often experiencing multiple comorbidities such as periodontal disease, diabetes mellitus, and hypertension. Individually, each of these conditions is associated with increased healthcare expenditures; however, when they occur concurrently, the financial burden on both individuals and society becomes markedly amplified. For instance, studies have reported that the co-occurrence of periodontal disease and diabetes can elevate annual healthcare costs by as much as ¥59,328, corresponding to a cost

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ratio of 1.31 [1]. Additionally, longitudinal research indicates that elderly patients with multiple chronic conditions may face a 20–22% depletion in wealth over just a few years, coupled with significant rises in out-of-pocket expenses[2].

Recent systematic reviews and economic analyses further underscore the potential benefits of integrated care approaches. Periodontal therapy, for example, has been shown to yield substantial cost savings—up to US$102.6 million in certain settings—by mitigating the overall healthcare burden[3]. Moreover, research highlights a bidirectional relationship between periodontal disease and systemic conditions like diabetes mellitus, suggesting that managing oral health can have far-reaching effects on systemic disease outcomes and associated costs [4, 5].

The current literature increasingly supports the view that an interdisciplinary approach to healthcare—one that addresses both oral and systemic conditions simultaneously—could lead to improved clinical outcomes and economic efficiencies. For example, Wallace et al. (2018) demonstrated that the presence of additional comorbidities such as depression and anxiety in patients with diabetes and hypertension further exacerbates healthcare expenditures, reinforcing the notion that the financial impact of these diseases is cumulative and interrelated[6].

In light of these findings, this systematic review aims to evaluate the financial impact of the co-occurrence of periodontal disease, diabetes mellitus, and hypertension among elderly populations. By synthesizing recent and historical data from diverse healthcare settings, we seek to provide a comprehensive overview of the economic challenges posed by these comorbidities. This review also explores the cost-saving potential of targeted interventions, offering insights that are critical for informing future healthcare policies and clinical practices in an era of rapidly escalating healthcare costs.

Recent scientific databases continue to reveal new evidence underscoring the necessity for integrated treatment strategies that address the multifaceted nature of these comorbidities[3, 7]. As the demographic landscape shifts and the economic implications of chronic diseases become ever more pronounced, understanding the interconnected nature of these conditions is essential for developing sustainable healthcare solutions

2. Material and methods

This systematic review was conducted based on the guidelines of the PRISMA Statement[8]; five databases (Pubmed, ScienceDirect, Proquest. Google Scholar, and Semantic Scholar) from 2006 to 2025 were observational study designs—such as retrospective cohort, cross-sectional, and longitudinal studies—as well as systematic reviews and meta-analyses using the following key terms: ‘financial burden’, ‘comorbidities’, ‘periodontal disease’, ‘diabetes mellitus’, ‘hypertension’, ‘healthcare costs’. After that, duplicated articles were removed. The articles were re-selected according to the screening of title and abstract by two researchers independently. The inclusion criteria used in this examination are: (1) Articles observational study designs—such as retrospective cohort, cross-sectional, and longitudinal studies—as well as systematic reviews and meta-analyses;(2)article was written in English; (3) Research must involve a financial burden and elderly people with comorbidities.

The EndNote X7.3 program received all of the search results and eliminated any duplicate references. All abstracts and titles were independently reviewed for eligibility by two examiners. Two separate examiners then downloaded and read the complete texts of the included papers. When the publications met the inclusion requirements and the data could be extracted following full-text reading, they were added to the analysis. While reading the entire text, the important data were extracted, while at the same time, the articles were critically

3. Results

The search was conducted in five different databases namely Pubmed, ScienceDirect, Proquest. Google Scholar, and Semantic Scholar. The initial search found 45 articles from the PubMed database, 35 articles from ScienceDirect database, 30 articles form ProQuest database, 25 articles form Google Scholar and 50 articles form Semantic Scholar. About 35 articles were excluded due to duplication and non-compliance with the inclusion criteria during the title and abstract reading, so the total articles ended up to 150 for full-text searching. After full-texts were downloaded and read, another 140 articles that did not meet the inclusion criteria were excluded. At the end, there were 10 articles that were retained for analysis. Details of the search flowchart were presented in Figure 1 and the main characteristic of the eligible studies are described in Table 1.

The financial impact results are presented in Table 2 which presents an analysis of the financial impact of various health conditions, especially those related to periodontal disease and other chronic conditions, the result shows reduction in

healthcare costs[3–5, 7, 9], increase in healthcare cost [1, 2, 6, 10] and higher healthcare costs without specific savings or increase mentioned[11].

Other results in the form of intervention cost-effectiveness in Table 3, these outcomes refer to the extent to which an intervention in dental health care (e.g., periodontal treatment or chronic disease screening by a dental health professional) can reduce overall health care costs as well as its impact on health service utilization and potential return on investment.

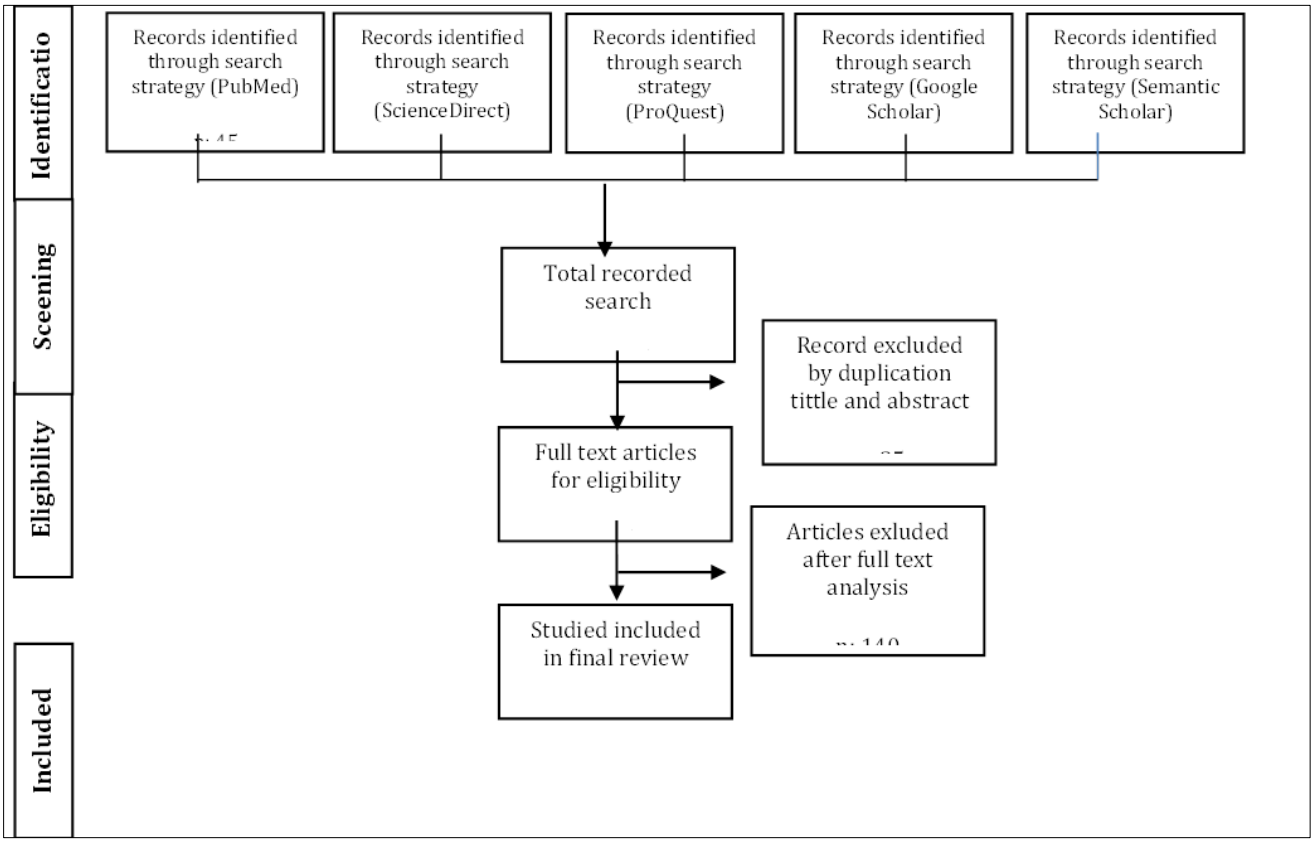

Figure 1 PRISMA chart of study selection process

Table 1 Characteristics of Included Studies

Study	Study Design	Population Demographics	Condition studied	Cost Measurement Approach
Albert et al., 2006 [11]	Retrospective cohort study	116,306 enrollees; Mean age: Diabetes Mellitus (DM): 57.2, Coronary Artery Disease (CAD): 63.5, Cerebrovascular Disease (CVD): 68.5 years; Gender: 52% female overall	Diabetes Mellitus (DM), Coronary Artery Disease (CAD), Cerebrovascular Disease (CVD), Periodontal disease	Per Member Per Month (PMPM) medical costs
Blaschke et al., 2020[5]	Retrospective cohort study	23,771 individuals; Age: 18 years	Diabetes, Periodontal disease	Total healthcare costs, inpatient costs, diabetes- related drug costs, other drug costs
Jeffcoat et al., 2014 [4]	Retrospective observational cohort study	338,891 individuals	Type 2 diabetes (T2D), coronary artery disease, cerebral	Total allowed medical costs

			vascular disease, rheumatoid arthritis, pregnancy, periodontal disease	
Kim and Lee, 2006 [2]	Longitudinal observational study	Older adults; marital status considered	Multiple chronic conditions, focus on heart disease and diabetes	Wealth change
Kinugawa et al., [1]	Retrospective cohort study	790 participants; Mean age: 63.1 years; 30.3% male	Periodontal disease, Diabetes mellitus	Annual health care expenditure
Nasseh et al., 2014 [3]	Modeling approach	Adults aged 40 years	Diabetes, hypertension, hypercholesterolemia	Estimated cost savings from screenings
Nasseh et al., 2017[9]	Retrospective observational study	Adults aged 40 years	Diabetes, hypertension, hypercholesterolemia	Estimated cost savings from screenings
Schoenberg et al., 2007[10]	Longitudinal observational study	Adults aged 60 year	Multiple chronic conditions, focus on hypertension, arthritis, heart disease	Out-of-pocket medical expenditures
Thakkar-Samtani et al., 2023	Retrospective observational study	Patients with diabetes mellitus	Diabetes mellitus, periodontal disease	Overall healthcare costs, outpatient costs, inpatient costs, drug costs
Wallace et al., 2018	Retrospective cross-sectional study	4,560 adults; Age: 18 years (76% >55); 49.9% male; 62% white; 80% high school education or higher	Diabetes, hypertension, depression, anxiety	Total annual healthcare expenditures

Table 2 Financial Impact Analysis (Individual Condition Cost)

Study	**Condition combination**	**Annual Healthcare Costs**	**Cost Ratio vs. Control**	**Healthcare Utilization**
Albert et al., 2006 [11]	Periodontitis treatment (DM, CAD, CVD)	Higher PMPM costs	No mention found	No mention fund
Blaschke et al., 2020[5]	Periodontal treatment (Diabetes)	Reduced costs	Total: 0.96 (95% CI 0.89; 1.04)	No mention found
Jeffcoat et al., 2014 [4]	Periodontal treatment (T2D, CVD, CAD, pregnancy)	Reduced costs	T2D: 40.2% reduction, CVD: 40.9% reduction, CAD: 10.7% reduction,	No mention found
Kim and Lee, 2006 [2]	Multiple chronic conditions	20-22% wealth depletion over 2-3 years	Not applicable	No mention found
Kinugawa et al., [1]	Periodontal Disease+/Diabetes Mellitus+	¥59,328 higher	1.31 (95% CI: 1.06–1.62)	No mention found
Nasseh et al., 2014 [3]	Diabetes, hypertension, hypercholesterolemia	$42.4 million to $102.6 million savings	Not applicable	No mention found
Nasseh et al., 2017[9]	Periodontal intervention (Type 2 diabetes)	$1,799 reduction	No mention found	No mention found

Schoenberg et al., 2007[10]	Multiple chronic conditions	$3,748 (2002)	41% increase (2 conditions), 85% increase (3conditions), 100% increase (4 conditions)	No mention found
Thakkar-Samtani et al., 2023	Periodontal treatment (Diabetes)	Commercial: $13,915; Medicaid: $14,796	Commercial: 0.88; Medicaid: 0.86	No mention found
Wallace et al., 2018	Diabetes + Hypertension + Depression/Anxiety	$28,832	Depression only: + 4, 607; *Anxietyonly* : + 2,481; Both: +$8,709	No mention found

PMPM= Per Member Per Mouth; DM= Diabetes Mellitus; CAD= Coronary Artery Disease; CVD = Cerebrovascular Disease; T2D= Type 2 Diabetes; RA= Rheumatoid Arthritis

Table 3 Intervention Cos-Effectiveness

Study	**Intervention Type**	**Cost Reduction**	**Healthcare Utilization Change**	**Return on Investment**
Albert et al., 2006 [11]	Periodontal treatment	Not quantified	No mention found	No mention found
Blaschke et al., 2020[5]	Periodontal treatment	Total: 4% reduction (not significant)	No mention found	No mention found
Jeffcoat et al., 2014 [4]	Periodontal treatment	T2D: 40.2%, CVD: 40.9%, CAD: 10.7%, Pregnancy: 73.7%	No mention found	No mention found
Kim and Lee, 2006 [2]	Not applicable	Not applicable	Not applicable	Not applicable
Kinugawa et al., [1]	Not applicable	Not applicable	Not applicable	Not applicable
Nasseh et al., 2014 [3]	Chronic disease screenings by oral health professionals	$$42.4 million to $102.6 million	No mention found	$13.51 to $32.72 per person screened
Nasseh et al., 2017[9]	Periodontal intervention	$1,799 total healthcare costs	No mention found	No mention found
Schoenberg et al., 2007[10]	Not applicable	Not applicable	Not applicable	Not applicable
Thakkar-Samtani et al., 2023	Periodontal treatment	Commercial: 12%, Medicaid: 14%	No mention found	No mention found
Wallace et al., 2018	Not applicable	Not applicable	Not applicable	Not applicable

PMPM= Per Member Per Mouth; DM= Diabetes Mellitus; CAD= Coronary Artery Disease; CVD = Cerebrovascular Disease; T2D= Type 2 Diabetes; RA= Rheumatoid Arthritis

4. Discussion

Systematic studies have shown that elderly patients with diabetes mellitus, hypertension, and periodontal disease incur significantly higher costs for health care. The fact is that these comorbidities interact synergistically, meaning more financial responsibility than the sum of the individual conditions together[12]. In this review, the results of various studies were combined to calculate direct and indirect medical costs, such as increased out-of-pocket costs and decreased wealth. The study sample that met strict inclusion criteria was generated from a comprehensive search of various databases. The analysis highlights the growing economic challenges faced by this vulnerable group in managing multiple chronic conditions. The findings are presented in a structured manner to highlight individual, cumulative, and

intervention-related cost aspects. Overall, the narrative establishes the urgent need for an integrated health care strategy to mitigate these financial challenges[13].

According to Kinugawa et al, 2025, the financial impact of each condition is not only additive, but also shows a synergistic effect when the conditions occur together (). The study showed that patients with periodontal disease and diabetes experienced an increase in annual health care costs of up to ¥59,328, which means a cost ratio of 1.31 compared to patients without these comorbidities[1]. This finding is important because it measures the economic stress caused by the presence of chronic conditions together[14]. Detailed analysis revealed that although the individual conditions have inherent costs, their combination increases expenditures disproportionately[15]. Several studies have highlighted this interaction effect, suggesting that the burden on the health care system is much greater than previously anticipated. Evidence supports the view that early intervention can reduce these high costs by addressing comorbidities together[4, 5, 7, 9, 11]. This deductive reasoning is strengthened by consistent findings across observational studies. The data collectively provide a strong basis for understanding individual cost components in a broader economic context[7, 9].

Elderly patients confront a significant and complex cumulative cost burden that reflects both direct and indirect economic impacts[16]. Longitudinal evidence indicates that patients with multiple chronic conditions experience a wealth depletion of 20–22% over a period of 2–3 years. This financial erosion is compounded by rising out-of-pocket expenses that further strain limited personal resources. The review documents that these cumulative costs not only affect individuals but also impose a broader economic burden on the healthcare system[2]. The findings imply that controlling comorbidities has financial repercussions that go beyond short-term medical costs. These results further highlight the necessity of proactive financial preparation and supportive healthcare regulations[17]. The evidence demonstrates that cumulative burden is a critical determinant of patient quality of life[1, 11]. When taken as a whole, the findings support measures that can reduce older adults' chronic financial stress[18].

The review also delves into the financial implications related to insurance coverage and out-of-pocket expenses for elderly patients[10]. Evidence from selected studies indicates that out-of-pocket costs have risen significantly over time, exemplified by an increase from US$2,164 to US$3,748 over a four-year period[10]. The vulnerability of elderly people, who must pay an increasing proportion of their healthcare costs, is highlighted by this trend[1, 10]. When there are several chronic illnesses, the financial load is further raised and the need for comprehensive care rises. According to the data, it is difficult for both public and private insurance systems to keep up with these rising expenses[4, 7]. Research has shown that patients still have a heavy burden from the remaining expenses even when they have insurance. The results highlight how crucial it is to improve insurance coverage and support systems in order to guard against unmanageable medical expenses. This conversation is essential to comprehending how financial hardship appears in actual healthcare situations[7, 19].

The analysis of intervention cost-effectiveness presents compelling evidence that integrated treatment approaches can significantly reduce overall healthcare expenditures[7, 20]. Targeted therapies, like periodontal therapy, can result in significant cost savings, according to a number of studies that were part of the study. For example, in various hospital settings, specific measures have shown savings of up to US$102.6 million overall, with savings ranging from US$1,799 per patient[3, 9]. This evidence suggests that early and coordinated treatment strategies are not only clinically beneficial but also economically viable. The cost-effectiveness of these interventions is underscored by the favorable return on investment observed in screening and treatment programs. The review systematically documents that the reduction in direct medical costs translates into broader economic benefits. These findings advocate for a shift towards integrated care models that address both oral and systemic conditions simultaneously[12, 21]. Overall, the data provide a robust argument for the incorporation of cost-effective interventions in health policy planning.

Healthcare utilization metrics, although less frequently reported, offer additional insights into the economic burden of comorbidities. The research that is currently available suggests that the occurrence of many chronic illnesses is directly linked to higher healthcare utilization. Overall cost growth is a result of longer treatment durations, more frequent hospital visits, and more intensive pharmaceutical use[4, 5]. The research emphasizes how these utilisation trends represent the intricate healthcare requirements of senior citizens. The trends indicate a strong correlation between comorbidities and higher service use, even if particular utilisation data were not consistently recorded across all trials[22, 23]. The idea that better illness management may result in lower healthcare utilisation and related expenses is supported by this systematic observation. According to the data, integrated care models may simplify healthcare delivery while simultaneously lowering costs[4, 5]. Overall, the results highlight how crucial it is to take utilisation measures into account when assessing the financial viability of managing chronic illnesses.

Evidence suggests that improved clinical outcomes and significant cost savings can be achieved through coordinated interventions that address both oral and systemic health issues. This approach is supported by studies that report a reduction in overall healthcare expenditures when periodontal therapy is integrated with chronic disease management[4, 5, 7, 11]. The reasoning highlights that such integration may help reduce the need for more costly, reactive treatments in the future[24]. The financial benefits extend to both individual patients and the healthcare system at large. Systematic reviews provide compelling evidence that comorbidities such as periodontal disease, diabetes mellitus, and hypertension impose a significant financial burden ([3, 7, 7, 9]. Both individual and cumulative cost consequences are evident from narrative and deductive studies, which impact out-of-pocket spending, personal wealth, and direct medical expenses[10, 24]. These expenses can be successfully decreased and a positive return on investment can be obtained by integrated intervention strategies. The findings indicate a broader need for healthcare policies prioritizing early, coordinated, and comprehensive treatment approaches[1, 7, 25]. Addressing financial challenges of comorbidities requires innovative solutions bridging oral and systemic[26]. Future research should continue to explore the economic benefits of integrated care models to refine strategies for cost containment.

5. Conclusion

In summary, our review demonstrates that the combined presence of periodontal disease, diabetes mellitus, and hypertension substantially increases healthcare expenditures among the elderly. The financial impact is synergistic, resulting in significant wealth depletion and rising out-of-pocket costs. Integrated care interventions, such as targeted periodontal therapy, have shown promising cost-saving potential and can mitigate these economic challenges. These findings underscore the urgent need for interdisciplinary treatment approaches and policy reforms to address the escalating burden of comorbidities. Future research should focus on optimizing integrated care models to enhance clinical outcomes and ensure economic sustainability for this vulnerable population.

Compliance with ethical standards

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Disclosure of conflict of interest

All author has no financial, personal, or professional relationships that could be perceived as potential conflicts of interest related to this manuscript. We have not received any funding or support from any other organizations except Faculty of Dental Medicine, Universitas Airlangga, that may have a vested interest in the findings of this study.

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