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Research Article

Health-Related Quality of Life among Women with Diabetes

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Background

Women living with diabetes face unique biological, psychosocial, and socioeconomic challenges that significantly affect their health-related quality of life (HRQoL). Despite the growing global burden of diabetes, no comprehensive mapping of HRQoL research in this population has yet been conducted.

Objective

This study systematically maps global research trends, key contributors, thematic structures, and the intellectual development of HRQoL research among women with diabetes.

Methods

A bibliometric analysis was conducted using Scopus-indexed publications (n = 3,254) from 2000 to 2024. Performance analysis and science mapping techniques were applied using Biblioshiny (R package Bibliometrix).

Results

The field exhibited a compound annual growth rate of 10.71%, expanding from fewer than 20 publications in 2000 to more than 250 in 2024. Research output was concentrated in high-income countries, led by the United States, the United Kingdom, and China, with 25.6% of publications involving international collaboration. A small group of prolific authors shaped much of the discourse, while citation analysis highlighted influential but less prolific contributors. Thematic mapping identified patient-reported outcomes, comorbidities, aging, and psychosocial health as core themes, alongside emerging interest in digital health and socioeconomic determinants. However, geographic disparities persist, with limited contributions from low- and middle-income countries.

Conclusion

The field of HRQoL research among women with diabetes is rapidly expanding, multidisciplinary, and increasingly collaborative. Nonetheless, methodological limitations remain, including reliance on a single database (Scopus) and the predominance of cross-sectional designs. These gaps underscore the need for more diverse, longitudinal, and interventional research approaches.

1. INTRODUCTION

Chronic diseases continue to pose significant global health challenges, with diabetes emerging as one of the most prevalent and rapidly growing conditions worldwide. According to previous studies,[1] more than half a billion people are currently living with diabetes, and prevalence rates continue to rise at alarming levels. Among affected demographic groups, women face unique challenges in managing diabetes due to biological, psychosocial, and socioeconomic factors that collectively influence their health outcomes and overall quality of life.[2,3]

Health-related quality of life (HRQoL) has become a critical construct for evaluating the broader impact of chronic diseases, such as diabetes, beyond traditional

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clinical outcomes. HRQoL encompasses multiple dimensions, including physical functioning, emotional well-being, social relationships, and role limitations, all of which are profoundly affected in individuals living with diabetes.[4,5] For women, these dimensions often interact with life events, such as pregnancy, menopause, caregiving responsibilities, and gender-based disparities in healthcare access, creating unique vulnerabilities in managing their chronic condition.[6,7]

Gender-specific challenges in diabetes management are well documented. Women with diabetes often experience higher rates of depression, anxiety, diabetes-related distress, and social role strain compared to men.[8,9] In addition, hormonal fluctuations, pregnancy-related complications, such as gestational diabetes, and long-term cardiovascular risks contribute to a distinct clinical profile for women.[10] Consequently, understanding the quality of life in this population requires a gender-sensitive, multidisciplinary perspective.

As the body of research addressing HRQoL among women with diabetes continues to grow, synthesizing this dispersed literature becomes increasingly challenging. Studies are distributed across diverse disciplines—such as endocrinology, nursing, public health, psychology, and gender studies—making it difficult for traditional narrative or systematic reviews to capture the field's dynamic intellectual structure and thematic development.

Although the epidemiology of diabetes and gender-based disparities in health outcomes are well documented, the HRQoL literature remains highly fragmented across multiple domains. This dispersion complicates efforts to synthesize research progress or identify thematic trajectories. A bibliometric approach provides a unique advantage in this regard: It quantifies publication trends, reveals international collaboration structures, and maps the intellectual and conceptual foundations of the field. To date, however, no bibliometric assessment has systematically mapped the global HRQoL literature specifically for women with diabetes. Addressing this gap not only clarifies the present research landscape but also highlights underexplored themes, methodological patterns, and geographic disparities that require attention.

Bibliometric analysis offers a systematic, quantitative, and objective approach to evaluating the scholarly landscape.[11] Unlike conventional literature reviews, bibliometric methods allow for large-scale mapping of publication trends, leading contributors and journals, thematic clusters, and citation networks.

Despite the growing importance of HRQoL research related to women with diabetes, few studies have provided a comprehensive bibliometric assessment of the field's evolution, intellectual structure, and emerging research themes. This study addresses this gap by conducting a bibliometric analysis of global literature published between 2000 and 2024, with a specific focus on HRQoL among women with diabetes.

The study aims to answer the following research questions:

(i) What are the publication and citation trends in this field over the past two decades?
(ii) Who are the leading authors, journals, countries, and institutions contributing to this research?
(iii) What are the major research themes and clusters identified through keyword co-occurrence and bibliographic coupling?
(iv) How has the intellectual structure of this research area evolved over time?

By addressing these questions, this bibliometric review offers valuable insights to researchers, healthcare professionals, and policymakers. The findings will help guide future research directions and support the development of targeted interventions to improve the quality of life in women living with diabetes.

2. METHODOLOGY

2.1. DATA SOURCE AND SEARCH STRATEGY

The present study employed a bibliometric analysis to systematically examine the research landscape on HRQoL among women with diabetes. Data were retrieved from Scopus, one of the largest and most comprehensive multidisciplinary bibliographic databases. Scopus is widely used for bibliometric studies due to its extensive journal coverage, citation indexing, and metadata availability.[11]

The search was conducted in June 2025 using the advanced search interface of Scopus. A carefully constructed search string was applied to the title, abstract, and keywords fields to ensure inclusion of relevant literature. The search string used was:

TITLE-ABS-KEY("health-related quality of life" AND (women OR female) AND diabetes)

This search strategy was designed to capture all documents discussing HRQoL specifically in the context of women (or female populations) with diabetes, without restricting by diabetes type (type 1, type 2, or gestational). The search was limited to documents published between 2000 and 2024, covering the most recent two decades of research. No language restrictions were applied initially; however, subsequent filtering retained only English-language articles to ensure consistency in content analysis. Document types were restricted to peer-reviewed articles and review papers, while conference papers, book chapters, editorials, and notes were excluded to maintain quality and comparability. After filtering, the final dataset comprised 3,254 documents.

To ensure the robustness of the search strategy, the string was developed iteratively and validated in three steps: (i) Reviewing existing bibliometric studies on diabetes and HRQoL to identify commonly used keywords; (ii) pilot-testing the string in Scopus and verifying retrieval of seminal and frequently cited articles; and (iii) refining the string based on missing but relevant articles flagged during preliminary screening. This process ensured both sensitivity (capturing a broad range of studies) and specificity (excluding irrelevant records).

Beyond restricting the analysis to peer-reviewed articles and reviews, we applied the following inclusion and exclusion criteria:

- Inclusion criteria: (i) Studies explicitly addressing HRQoL in women or female populations with any type of diabetes (type 1, type 2, or gestational); (ii) articles with sufficient bibliographic metadata for analysis.
- Exclusion criteria: (i) Conference abstracts, editorials, letters, book chapters, and dissertations; (ii) studies referring to "quality of life" generically without connection to diabetes; (iii) duplicate records or incomplete metadata.

Exclusive reliance on Scopus represents a limitation, as relevant studies indexed only in Web of Science, PubMed, or regional databases may have been missed. However, Scopus was selected for its broad interdisciplinary coverage, citation indexing features, and compatibility with Bibliometrix,

making it especially suitable for bibliometric mapping. We recognize that this choice introduces potential bias toward English-language and internationally indexed journals, which we explicitly account for in interpreting geographic and thematic findings.

2.2. DATA EXTRACTION AND PREPARATION

The metadata of the retrieved documents, including information on authors, titles, abstracts, keywords, affiliations, sources, references, and citations, were downloaded in CSV format directly from Scopus. To prepare the data for bibliometric analysis, the raw CSV files were uploaded into the Biblioshiny platform, which is a user-friendly web interface built on the open-source Bibliometrix R package[12]

The uploaded data were converted into the Bibliometrix format, and basic data cleaning was performed to address missing values, duplicate entries, and inconsistencies in author names, keywords, and affiliations. After verifying data completeness and integrity, the dataset was saved in.rda format to ensure reproducibility and enable further analysis. All bibliometric analyses were performed using Biblioshiny version 5.0 running on RStudio version 2025.05.1.

3. RESULTS

3.1. DESCRIPTIVE ANALYSIS

The bibliometric analysis retrieved a total of 3,254 scientific documents published between 2000 and 2024 on HRQoL among women with diabetes (Table 1). This 25-year period reflects substantial global growth in research activity, with an annual growth rate of 10.71%, indicating a consistent and notable increase in scholarly attention and reflecting the growing recognition of gender-specific health outcomes in chronic disease management.

The retrieved documents were published across 1,196 distinct sources, including journals, books, and conference proceedings. The cumulative citation counts across the dataset amounted to 113,327 references, reflecting a well-established intellectual foundation in this research domain. The average citation per document was 35.49, indicating strong global interest and a relatively high impact of the publications included in this analysis.

Authorship analysis revealed contributions from 18,661 unique authors, highlighting the field's multidisciplinary and collaborative nature. Only 47 documents were authored by a single researcher, while the majority of publications involved multiple collaborators, resulting in an average of 7.26 co-authors per document. Notably, 25.6% of publications involved international collaborations, indicating robust cross-national partnerships that facilitate knowledge sharing and comparative studies across diverse populations and healthcare systems.

Regarding content, the dataset included 4,628 Author Keywords and 10,822 Keywords Plus, suggesting the thematic diversity of this field. This keyword richness provided a strong foundation for subsequent science mapping to identify emerging themes and conceptual structures.

In terms of document types, original research articles (n = 3,114) accounted for the majority, followed by review articles (n = 140). This distribution suggests that empirical investigations dominate the literature, while review studies contribute to synthesizing existing knowledge and identifying emerging gaps.

Table 1. General characteristics of the bibliometric dataset used in the study

Description	Results
Main information about data	
Timespan	2000–2024
Sources (journals, books, etc.)	1,196
Documents	3,254
Annual growth rate (%)	10.71
Document average age	8.66
Average citations per document	35.49
References	113,327
Document contents	
Keywords plus (ID)	10,822
Author keywords (DE)	4,628
Authors	
Authors	18,661
Authors of single-authored documents	47
Authors collaboration	
Single-authored documents	48
Co-authors per document	7.26
International co-authorships (%)	25.6
Document types	
Article	3,114
Review	140

3.2. PERFORMANCE ANALYSIS

3.2.1. ANNUAL SCIENTIFIC PRODUCTION

The annual scientific production on HRQoL among women with diabetes demonstrated a strong upward trajectory over the 25-year period (2000–2024), as shown in Figure 1. In the early 2000s, research activity in this field was relatively limited, with fewer than 20 articles published annually. Output increased from 40 publications in 2005 to nearly 90 in 2010, representing the first phase of acceleration. A second and more pronounced surge occurred after 2020, when the number of publications (NP) rose from 180 in 2020 to more than 250 in 2024. Overall, the field expanded from fewer than 20 publications in 2000 to over 250 in 2024, reflecting a compound annual growth rate of 10.71%. These quantitative patterns demonstrate not only steady growth but also distinct periods of sharp expansion in global research activity, underscoring the evolving recognition of HRQoL as a critical outcome measure in chronic disease management, particularly for women. The observed growth trend aligns with broader global health priorities emphasizing patient-centered care and holistic evaluation of chronic disease outcomes.

This trajectory indicates more than a numerical increase; it reflects a shift in research priorities as HRQoL outcomes gained visibility alongside traditional biomedical endpoints in diabetes studies. The surges after 2010 and 2020 appear to coincide with major global health policy milestones emphasizing non-communicable diseases and patient-centered care, such as World Health Organization (WHO) action plans on chronic disease management.

3.2.2. AVERAGE CITATIONS PER YEAR

The analysis of average citations per year (Figure 2) reflects the citation dynamics of publications on HRQoL among

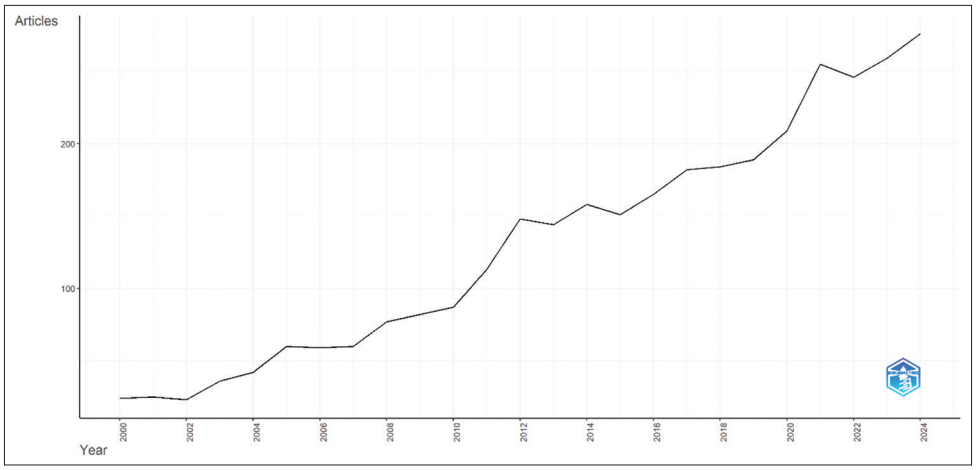

Figure 1. Annual scientific production on health-related quality of life among women with diabetes (2000–2024).

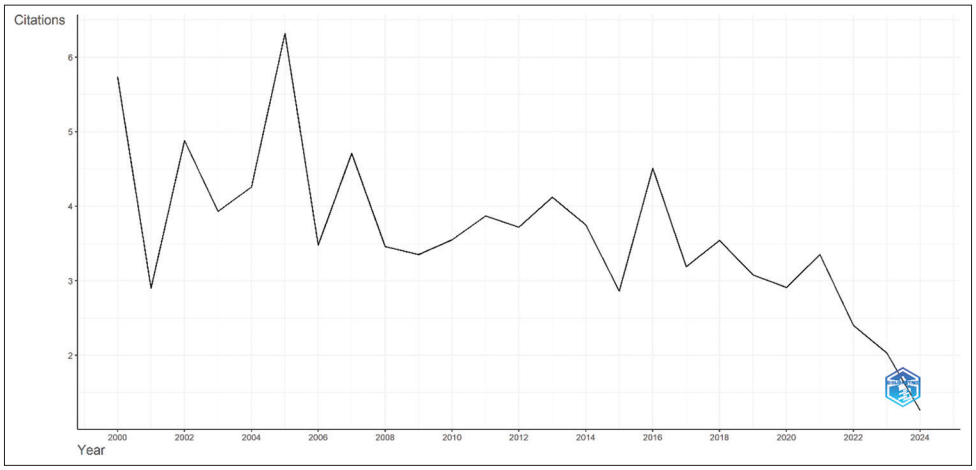

Figure 2. Average citations per document per year in studies on health-related quality of life among women with diabetes (2000–2024)

women with diabetes. Articles published earlier in the study period demonstrated higher average citation rates, with peaks observed in 2001, 2004, and 2006, where the average exceeded five citations per document per year.

This stronger performance for older publications reflects the cumulative advantage of earlier studies, which have had more time to be discovered, cited, and integrated into academic discourse. In contrast, articles published from 2020 onward exhibit lower average citation rates, as expected given their limited exposure time; newer publications typically require several years to accumulate substantial citations.

The overall declining trend in average citations per year after 2010 does not indicate decreasing quality or relevance but rather reflects the natural citation time lag common in bibliometric analyses. As shown in Figure 1, the rapid expansion of research output since 2010 has resulted in a large influx of newer publications, which dilutes average citation counts in the short term. This pattern underscores the dynamic growth of the field, with recent contributions poised to demonstrate greater impact as they gain visibility over time.

3.2.3. MOST PRODUCTIVE JOURNALS

The distribution of publication sources is presented in Figure 3, identifying the journals most actively contributing to research on HRQoL among women with diabetes.

Quality of Life Research leads with 163 publications, reflecting its primary focus on HRQoL measurements and its strong alignment with the study's central theme. This is followed by *Health and Quality of Life Outcomes* with 130 publications and *PLOS ONE* with 90 publications, demonstrating the field's interdisciplinary reach, which extends into open-access and general biomedical outlets.

Additional high-contributing journals include *BMJ Open* (47 publications), *Diabetes Care* (45 publications), *International Journal of Environmental Research and Public Health* (44 publications), and *Diabetes Research and Clinical Practice* (43 publications). Specialized diabetes journals, such as *Diabetic Medicine* (38 publications) and *Journal of Diabetes and Its Complications* (21 publications), further highlight the integration of clinical diabetes management with quality-of-life outcomes in scholarly discourse. Collectively, this diverse range of journals illustrates the multidisciplinary nature of HRQoL research in diabetes, encompassing clinical, public health, psychological, and patient-centered outcomes domains.

Beyond publication counts, the distribution of journals reflects distinct research orientations within the field. For example, *Quality of Life Research* and *Health and Quality of Life Outcomes* primarily publish quantitative studies emphasizing patient-reported outcomes, psychometric validation, and longitudinal quality of life measurement. These outlets strongly represent the methodological core of HRQoL scholarship. In contrast, general biomedical

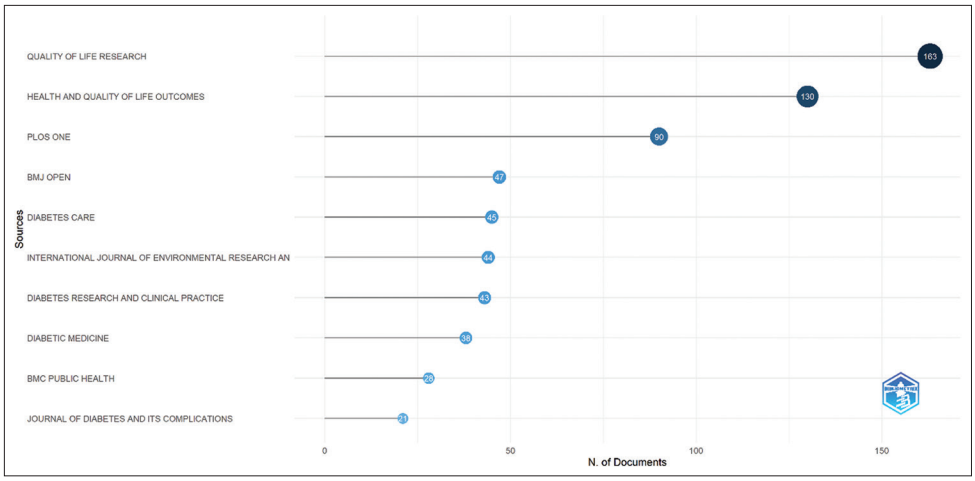

Figure 3. Most productive journals publishing research on health-related quality of life among women with diabetes (2000–2024)

journals, such as *PLOS ONE* and *BMJ Open,* showcase interdisciplinary contributions, often employing large-scale survey data or secondary analyses with broader population health relevance. Specialized diabetes journals, such as *Diabetes Care*, *Diabetes Research and Clinical Practice*, and *Diabetic Medicine,* focus predominantly on clinical and intervention-based research, frequently linking disease management strategies to patient quality-of-life outcomes. Meanwhile, public health-oriented outlets, such as the *International Journal of Environmental Research and Public Health,* incorporate socioenvironmental and lifestyle determinants of HRQoL, reflecting the field's expansion into social and environmental domains. Collectively, these patterns indicate that research on HRQoL among women with diabetes spans multiple orientations—ranging from clinical trials and disease-specific interventions to public health and psychosocial research—underscoring its multidisciplinary character.

Two journals warrant particular attention for their close alignment between scope and publication patterns. *BMC Women's Health* explicitly focuses on gender-specific health and well-being, making it a natural home for studies exploring how diabetes intersects with women's psychosocial, cultural, and reproductive health contexts. Contributions in this journal often emphasize mixed-methods or qualitative approaches that foreground women's lived experiences in managing diabetes. In contrast, *Quality of Life Research* is widely recognized as the leading outlet for methodological and psychometric advances in HRQoL measurement. Its publications on women with diabetes often emphasize quantitative research, including validation of patient-reported outcome measures, subgroup comparisons, and integration of HRQoL metrics into clinical trials. Together, these patterns demonstrate how journal scope directly shapes the types of studies published, reinforcing both gender-sensitive and methodological priorities within the broader HRQoL research landscape.

The concentration of publications in quality-of-life-focused outlets highlights the methodological grounding of the field in patient-reported outcome measurement. At the same time, the presence of clinical and public health journals underscores its interdisciplinary expansion. This dual orientation demonstrates how HRQoL research has evolved from niche psychometric work into a broader framework integrating medical, behavioral, and societal determinants.

3.2.4. MOST PRODUCTIVE AND INFLUENTIAL AUTHORS

The productivity and impact indicators for the leading authors in the field of HRQoL among women with diabetes are presented in Table 2. Johnson JA emerged as the most productive author with 22 publications (NP = 22), an h-index of 16, and a g-index of 22, reflecting both substantial publication volume and consistent citation performance. His research contributions span from 2003 onward.

Among the top authors, Varni JW achieved the highest total citation count (total citations [TC] = 2,821), despite a relatively smaller NP (13), indicating a strong citation impact per article. Similarly, Peyrot M and Pouwer F demonstrated significant citation influence, with TC of 1,164 and 1,089, respectively.

The m-index, which normalizes citation impact by years since an author's first publication, ranged from 0.4 to 0.714 across the listed authors. Lee J achieved the highest m-index (0.714), suggesting a rapid and strong impact relative to academic age, having published in this field only since 2012. Collectively, these findings highlight a group of highly influential researchers who have substantially shaped scholarly discourse on women's quality of life and diabetes, contributing both to conceptual development and empirical advances.

It is important to distinguish between author productivity and impact. For example, Johnson JA was the most prolific contributor with 22 publications, reflecting sustained engagement in HRQoL research among women with diabetes. However, Varni JW, with only 13 publications, achieved the highest citation count (2,821), indicating that his work exerted disproportionate influence relative to publication volume. Similarly, Peyrot M and Pouwer F combined moderate productivity with high citation impact, suggesting that their studies have become foundational references in the field.

This distinction illustrates that productivity (NP) and impact (TC, h-index, g-index, and m-index) do not always align. While a small group of authors contributes heavily to research output, other scholars exert significant intellectual influence through fewer but highly cited contributions. Together, these patterns highlight a balanced ecosystem of knowledge production, where both prolific publishing and high-impact research drive the development of HRQoL scholarship.

The expertise of the most influential authors further explains their prominence in this field. For instance,

Table 2. Productivity and citation impact of the most influential authors

Author	h_ index	g_ index	m_ index	TC	NP	PY_ start
JOHNSON JA	16	22	0.696	913	22	2003
JR	12	18	0.667	617	18	2008
VARNI JW	12	13	0.522	2821	13	2003
HOLLE R	11	13	0.647	587	13	2009
PEYROT M	11	12	0.524	1164	12	2005
YOUNOSSI ZM	11	15	0.423	843	15	2000
KOLOTKIN RL	10	12	0.4	961	12	2001
LEE J	10	16	0.714	326	16	2012
POUWER F	10	13	0.667	1089	13	2011
RUBIN RR	10	10	0.476	424	10	2005

Abbreviations: NP: Number of publications; PY_start: Publication year of the first article; TC: Total citations.

Johnson JA, a health outcomes researcher and epidemiologist, has extensively studied patient-reported outcomes and health utility measures, contributing methodological rigor to HRQoL assessments. Varni JW, a psychologist, is well known for developing and validating pediatric and adult quality-of-life instruments, which are widely applied in diabetes research. Peyrot M and Pouwer F, both psychologists with expertise in behavioral medicine, have focused on psychosocial determinants, such as depression, diabetes-related distress, and patient coping strategies, helping to integrate mental health into HRQoL frameworks. In contrast, authors, such as Younossi ZM, a clinician specializing in hepatology and metabolic disorders, and Kolotkin RL, a clinical psychologist focused on obesity and HRQoL, have expanded the field by linking diabetes with comorbidities, such as obesity and liver disease. These disciplinary differences underscore the multidisciplinary foundation of HRQoL research among women with diabetes, where contributions from epidemiology, psychology, and clinical medicine converge to shape the field's intellectual development.

3.2.5. AUTHORS' PUBLICATION TRAJECTORY OVER TIME

The temporal evolution of author contributions is visualized in Figure 4. This bubble plot demonstrates the publication activity of leading authors over the study period (2000–2024). Bubble size represents the NP in a given year, while color intensity reflects the TCs received for those publications.

Johnson JA, JR, Varni JW, and Younossi ZM exhibited sustained and consistent research productivity over extended periods. Notably, Johnson JA maintained active publication output for nearly two decades, highlighting his continued scholarly engagement in the field. Varni JW and Peyrot M showed strong early contributions with significant citation impact, while Lee J demonstrated a rapid rise in both productivity and impact within a shorter time frame beginning around 2012.

The diversity of these temporal patterns highlights the coexistence of longstanding contributors and emerging scholars who are actively advancing research on HRQoL in women with diabetes. The increasing concentration of publications in the recent decade suggests both growth and diversification of the research community.

3.2.6. AUTHOR PRODUCTIVITY ANALYSIS THROUGH LOTKA'S LAW

The distribution of author productivity in the field of HRQoL among women with diabetes follows Lotka's Law of scientific productivity, as depicted in Figure 5. The figure demonstrates that a small number of authors are highly productive, contributing multiple papers, while the majority of authors have contributed only a single publication. Specifically, over 80% of authors published only one document, whereas very few authored more than five papers. This pattern aligns closely with Lotka's classical inverse-square law, in which author productivity declines exponentially as the NP increases.

In Figure 5, the solid line represents the observed author productivity distribution, while the dashed line depicts the theoretical Lotka distribution. The close alignment between these two lines indicates that the dataset conforms well to Lotka's Law. This suggests that the field is characterized by a typical core-periphery structure: A small core group of prolific authors drives the field, while many others contribute sporadically. Such a pattern reflects a healthy and established research community, balancing long-term leadership with diverse contributions from occasional participants.

3.2.7. GLOBAL DISTRIBUTION OF RESEARCH OUTPUT

The global distribution of research on HRQoL among women with diabetes is illustrated in Figure 6. The map highlights substantial contributions from North America, Europe, and parts of Asia and Oceania. The United States dominates global production, evidenced by its darkest shading, reflecting its leadership in publication volume. Significant research output also originates from China, the United Kingdom, Germany, the Netherlands, Canada, Australia, and South Korea, indicating broad international engagement in this domain. By contrast, relatively limited research activity is observed in many developing regions, particularly across Africa, parts of South America, and the Middle East. These disparities suggest uneven geographic capacity, resource allocation, and academic focus related to women's diabetes and quality of life, warranting greater attention to ensure global representation and equity in knowledge production.

Equally important is the relative absence of contributions from many low- and middle-income countries (LMICs), particularly in Africa, South Asia, and parts of Latin America. This underrepresentation likely reflects structural barriers, including limited research funding, weaker academic infrastructures, language restrictions in leading journals, and lower visibility of regional publications in international indexing systems. The lack of data from these regions constrains the global generalizability of HRQoL findings, as women in LMICs often face unique social, cultural, and healthcare challenges in managing diabetes. Their absence from the literature risks reinforcing knowledge gaps and overlooking population groups that may bear disproportionate burdens of poor quality of life outcomes.

The geographic concentration of output in North America and Europe underscores persistent imbalances in research capacity. Underrepresentation of LMICs means that findings are disproportionately shaped by high-income settings, potentially limiting their generalizability. This contextual

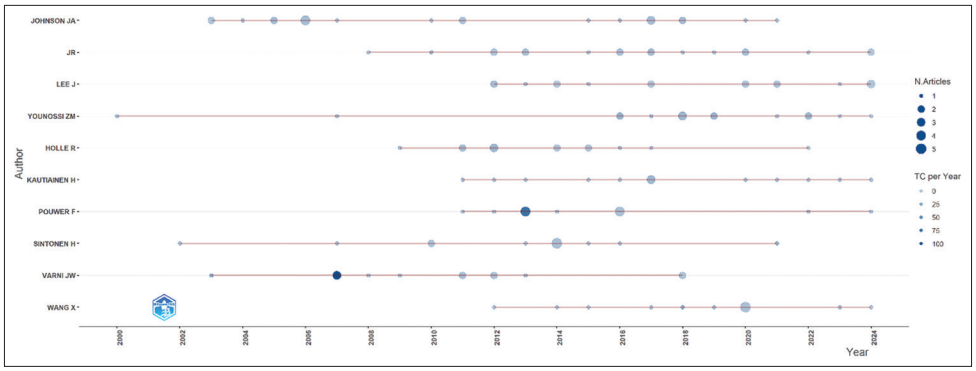

Figure 4. Temporal distribution of publications and citation impact among leading authors
Abbreviation: TC: Total citations.

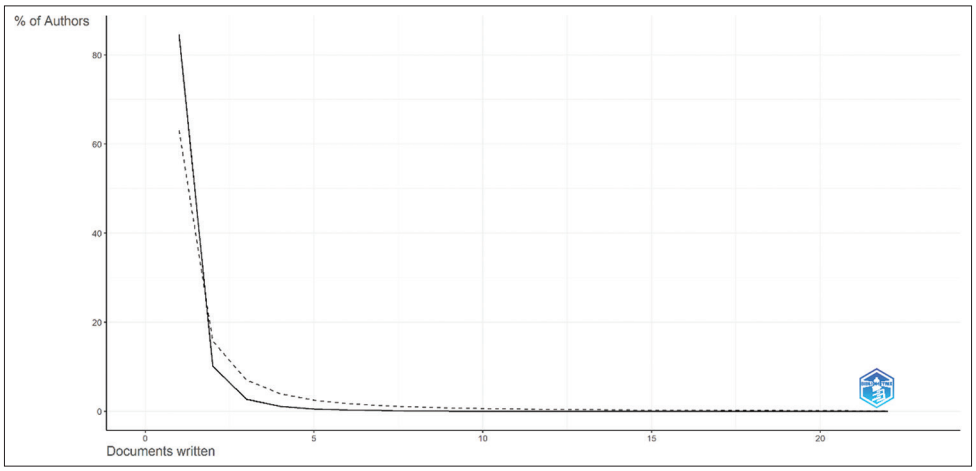

Figure 5. Author productivity distribution following Lotka's Law
Notes: Solid line: Observed distribution; Dashed line: Theoretical Lotka distribution.

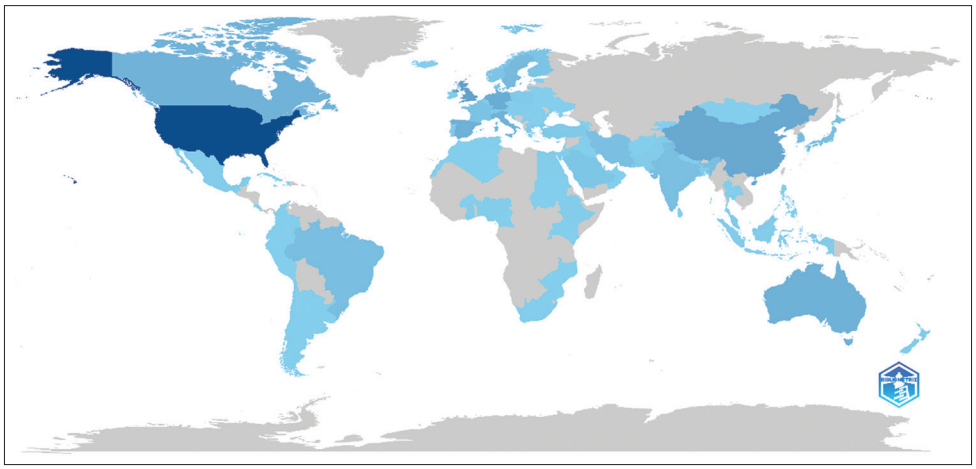

Figure 6. Global scientific production on health-related quality of life among women with diabetes (2000–2024)
Notes: Lighter blue: Lower publication output; Darker blue: Higher publication output.

gap points to the need for capacity-building initiatives and regionally grounded research.

3.2.8. COUNTRY-WISE PUBLICATION GROWTH TRENDS

The longitudinal growth of scientific production by leading countries is depicted in Figure 7. The United States has consistently maintained its leadership position throughout the 25-year period, with a steep and steady increase in publication volume.

The United Kingdom, Germany, the Netherlands, and China have also shown consistent growth, particularly in the past decade, reflecting increasing global interest and research investment in women's quality of life and diabetes. Notably, China demonstrates an accelerating trajectory, indicating rapidly expanding engagement in recent years. These trends highlight both the sustained leadership of developed Western nations and the emerging prominence of Asian countries, reflecting broader shifts in global scientific output related to chronic disease and gender-focused healthcare research.

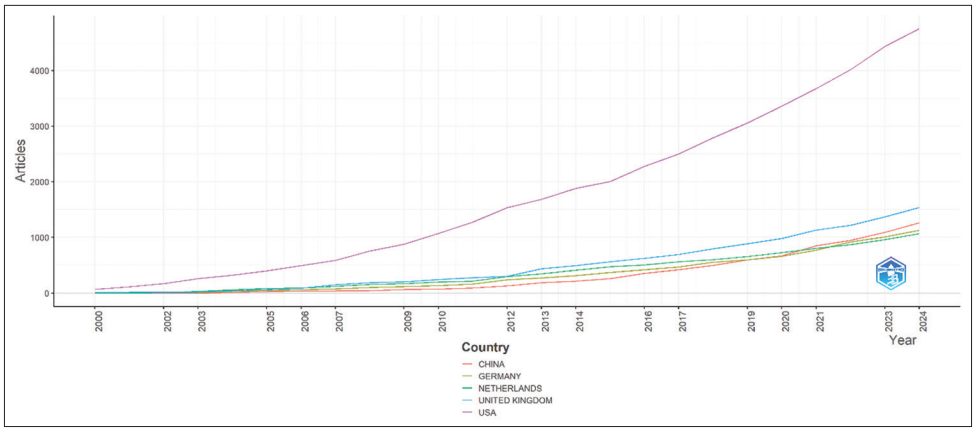

Figure 7. Growth trajectory of scientific production by leading countries

The concentration of HRQoL research in certain countries reflects not only research capacity but also structural and policy factors. For instance, the United States and the United Kingdom benefit from longstanding public health research funding mechanisms (e.g., National Institutes of Health, UK Research and Innovation) that prioritize patient-centered outcomes and chronic disease management, creating fertile ground for HRQoL studies. Similarly, countries, such as Germany and the Netherlands, have strong traditions of psychosocial and behavioral health research, which aligns naturally with quality-of-life frameworks. In China, the sharp rise in publications over the past decade corresponds with government investment in chronic disease research and population health initiatives, alongside the growing diabetes burden in its large and aging population.

Cultural and demographic contexts also shape research priorities. Countries with greater awareness of gender-specific health challenges or more established healthcare infrastructure for women (e.g., reproductive health programs, menopause support, and patient advocacy groups) are more likely to produce research focused on HRQoL in women with diabetes. In contrast, countries with fewer resources or lower prioritization of psychosocial outcomes tend to lag behind, reinforcing global disparities.

3.2.9. INTERNATIONAL COLLABORATION PATTERNS BY COUNTRY

The distribution of corresponding authors' countries and the extent of international collaboration are presented in Figure 8. The United States leads with the highest total number of corresponding author publications, followed by the United Kingdom, China, Australia, and the Netherlands.

A substantial proportion of publications from the United States are single-country publications (SCP), indicating that much of the research is led and completed within national institutions. In contrast, several other leading countries, such as the United Kingdom, the Netherlands, Germany, Sweden, and Canada, display relatively higher proportions of multiple-country publications (MCP), highlighting stronger international collaborative networks.

Notably, emerging contributors, such as India, Brazil, Iran, and Saudi Arabia, are also represented, although their output remains lower compared to leading Western nations. For many of these developing and middle-income countries, international collaborations (MCP) constitute a significant portion of total output, reflecting growing but still globally interconnected research capacity. These data suggest that while global research on HRQoL among women with diabetes is expanding geographically, research leadership remains concentrated in a few high-income countries, with other regions expanding their global research footprint through international partnerships.

Beyond publication counts and proportions of SCP versus MCP, network analysis provides further insight into collaboration dynamics. Betweenness centrality analysis reveals that the United States occupies the most central position in the global network, acting as a major hub that connects diverse countries and facilitates cross-regional collaborations. The United Kingdom, the Netherlands, and Germany also exhibit high centrality scores, reflecting their roles as bridges between North American, European, and emerging Asian contributors. In contrast, countries, such as India, Brazil, and Iran show increasing participation but relatively lower centrality, suggesting that while they contribute to international publications, they are less frequently positioned as connectors in the global research network.

This network-centric perspective indicates that research on HRQoL among women with diabetes is not only geographically concentrated but also structurally dependent on a few countries that mediate much of the global collaboration. Expanding network connectivity to include underrepresented regions may therefore be crucial for ensuring more equitable knowledge exchange and culturally diverse insights.

The collaboration map shows not only which countries publish together but also which act as structural bridges within the network. The prominence of the United States and United Kingdom as central hubs reflects their resource advantages, while emerging collaborations in Asia and the Middle East point to gradual diversification, though often mediated by established hubs rather than South-South linkages.

As illustrated in Figure 8, the collaboration network is characterized by a dense core dominated by high-income countries, including the United States, the United Kingdom, Germany, and the Netherlands, which serve as central hubs in global knowledge exchange. These countries form tightly interconnected clusters that account for a large proportion of cross-national publications. Surrounding this core are semi-peripheral contributors, such as China, Australia, and Canada, which exhibit strong bilateral collaborations with leading hubs but relatively fewer connections with one another. At the network periphery, emerging contributors, such as India, Brazil, Iran, and Saudi Arabia, are visible. While these countries show increasing participation, their weaker interconnections and lower centrality scores suggest

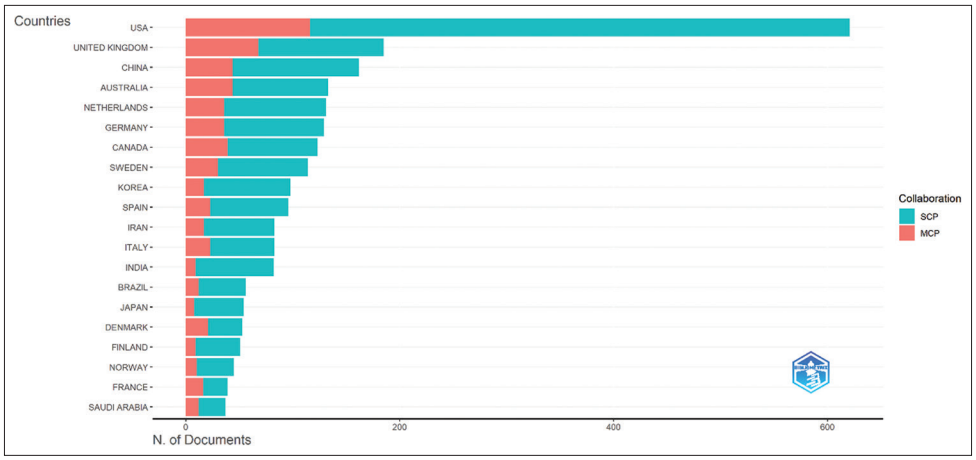

Figure 8. Country-wise distribution of corresponding authors and international collaboration
Abbreviations: MCP: Multiple-country publication; SCP: Single-country publication.

dependence on partnerships with established hubs rather than serving as bridges themselves. Notably, large parts of Africa and South Asia remain underrepresented, indicating persistent geographic gaps.

Thus, the network diagram highlights not only the dominance of a small set of core countries but also the reliance of emerging regions on these hubs for global visibility. Greater diversification of collaborative ties will be critical to reducing dependency and ensuring that HRQoL research among women with diabetes reflects a broader range of cultural and health system contexts.

3.3. SCIENCE MAPPING (INTELLECTUAL AND CONCEPTUAL STRUCTURE)

3.3.1. THREE-FIELD PLOT

The three-field plot (Figure 9) presents a comprehensive visualization of the interrelationships among author keywords (DE), authors (AU), and journals (SO) in the field of HRQoL among women with diabetes.

On the left side of the diagram, the most frequently occurring keywords include "health-related quality of life," "quality of life," "diabetes," "diabetes mellitus," "depression," "obesity," "type 1 diabetes," and "type 2 diabetes." These terms reflect the central thematic focus of the field, combining both disease-specific (diabetes types) and outcome-related (quality of life, mental health) dimensions.

The middle section highlights the most active contributing authors. Among these, Johnson JA, Pouwels F, Holle R, Wang X, and Varni JW emerged as the leading researchers in this domain, indicating their significant contributions to advancing knowledge on HRQoL outcomes in diabetes research.

On the right, the most productive journals in disseminating research on this topic include *Health and Quality of Life Outcomes*, *Quality of Life Research*, *Diabetic Medicine*, *Diabetes Care*, *PLOS ONE*, *Journal of Diabetes and Its Complications*, *BMC Public Health*, and *Diabetes Research and Clinical Practice*. These outlets serve as the primary channels of scholarship in this area, spanning both clinical and interdisciplinary public health perspectives.

The visual mapping of these interconnected fields underscores the multidisciplinary and multi-thematic nature of HRQoL research in women with diabetes. The involvement of mental health (e.g., depression, obesity), disease-specific complications, and psychosocial outcomes demonstrates the complexity and holistic approach characterizing this research domain.

3.3.2. BIBLIOGRAPHIC COUPLING

The intellectual structure of HRQoL research among women with diabetes, based on bibliographic coupling of documents, is presented in Figure 10. Bibliographic coupling identifies clusters of articles with shared reference lists, thereby revealing the intellectual proximity among publications. In this analysis, two primary clusters were identified, indicating a relatively coherent core of shared knowledge with modest differentiation across sub-themes.

The first cluster, located on the left side of the map, includes topics, such as "health-related quality of life" (37.3% confidence), "quality of life" (28.8% confidence), and "diabetes" (57.7% confidence). This cluster reflects the central conceptual axis of the field, combining core elements of chronic disease (diabetes) with patient-centered outcomes (quality of life). The dominance of these terms suggests that much of the research in this area builds upon a common theoretical and methodological foundation, emphasizing the critical role of HRQoL assessment as a primary outcome in diabetes management among women.

The second cluster, located on the right quadrant, contains overlapping themes, such as "quality of life" (71.2% confidence), "health-related quality of life" (62.7% confidence), and "diabetes mellitus" (68.2% confidence). While conceptually close to the first cluster, this group appears to represent studies with a stronger clinical orientation, focusing on comorbidities, healthcare interventions, or disease-specific management strategies. The relatively small dispersion across clusters indicates that the field is intellectually cohesive, with limited fragmentation into highly divergent research streams.

Overall, this bibliographic coupling analysis reveals that HRQoL research among women with diabetes is structured around a highly interconnected body of literature supported by consistent theoretical perspectives and shared research priorities. While the field rests on a stable intellectual base, opportunities remain for further thematic diversification through interdisciplinary integrations with mental health, socioeconomic determinants, and digital health interventions.

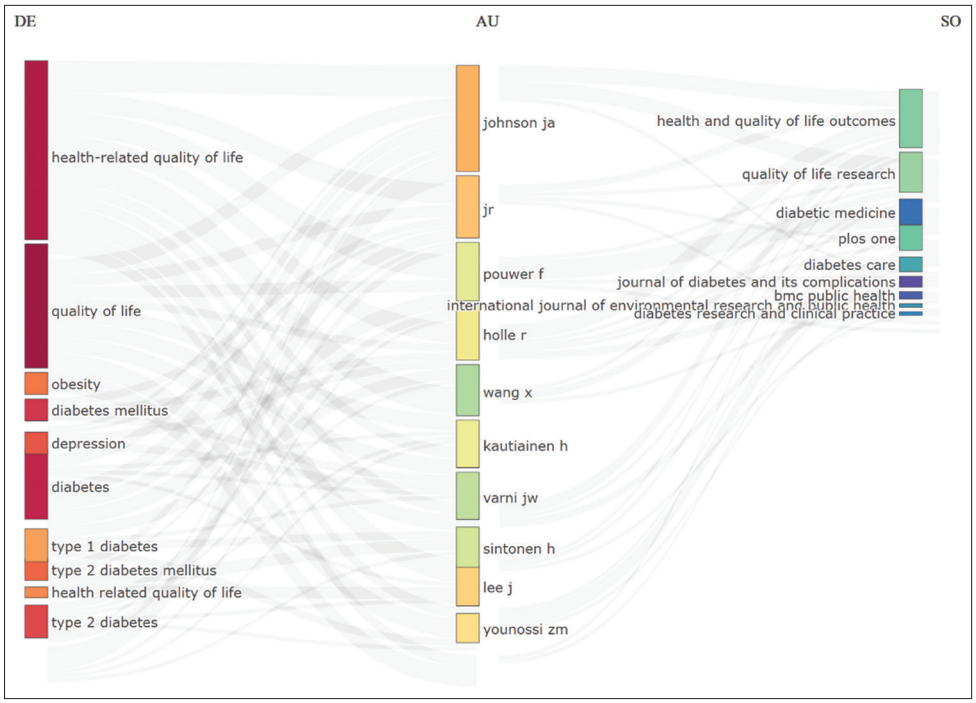

Figure 9. Three-field plot illustrating the relationships between keywords (DE), authors (AU), and journals (SO)

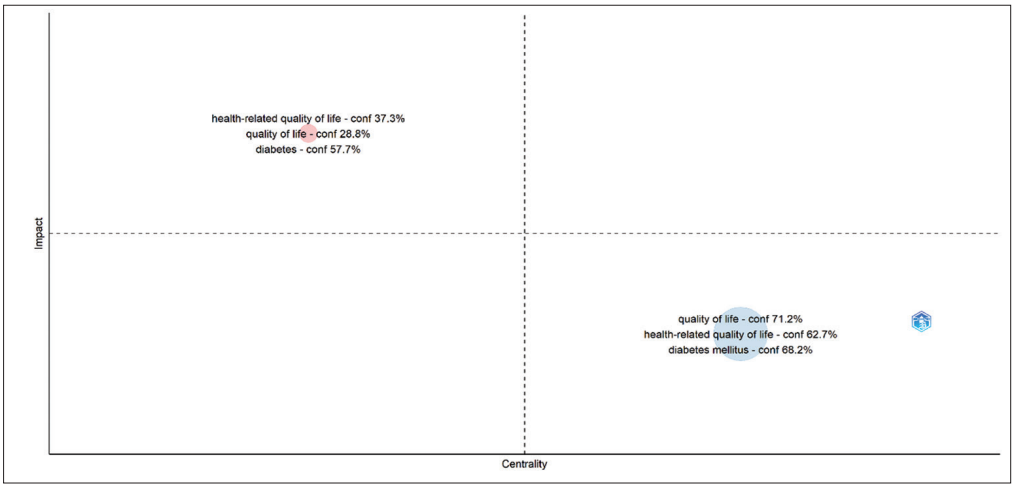

Figure 10. Bibliographic coupling clusters based on shared references

3.3.3. THEMATIC MAPPING

The thematic map presented in Figure 11 provides a visual representation of the conceptual structure of research on HRQoL among women with diabetes. The map organizes keywords into four quadrants based on two dimensions: Centrality (relevance to the field) and density (internal development of the theme). This strategic diagram offers insights into the maturity, coherence, and relevance of various research themes.

In the lower-right quadrant, classified as Basic Themes, terms, such as "quality of life," "female," and "human" dominate. These themes represent the fundamental core of the research domain, consistently forming the conceptual backbone across a wide array of studies. Their positioning reflects both high relevance and moderate development, indicating their central role in framing the literature, while also suggesting that despite extensive attention, they remain fertile ground for broad investigation.

The upper-right quadrant, known as Motor Themes, includes keywords, such as "aged," "diabetes mellitus," and "hypertension." These themes are both highly developed and strongly central to the field. Their position underscores their role as driving forces in the research landscape, integrating clinical complexities, such as aging populations, comorbidities, and chronic disease management, with broader quality-of-life assessments. The strong development of these topics suggests that researchers are increasingly focusing on the interplay between physiological conditions and patient-centered outcomes in women with diabetes, especially in light of rising life expectancy and compounded health burdens.

In contrast, the lower-left quadrant, representing Emerging or Declining Themes, includes specialized terms, such as "insulin-dependent diabetes mellitus," "type 2 diabetes mellitus," and "hemoglobin A1c." Their placement indicates either nascent research directions beginning to attract attention or topics of declining emphasis. For

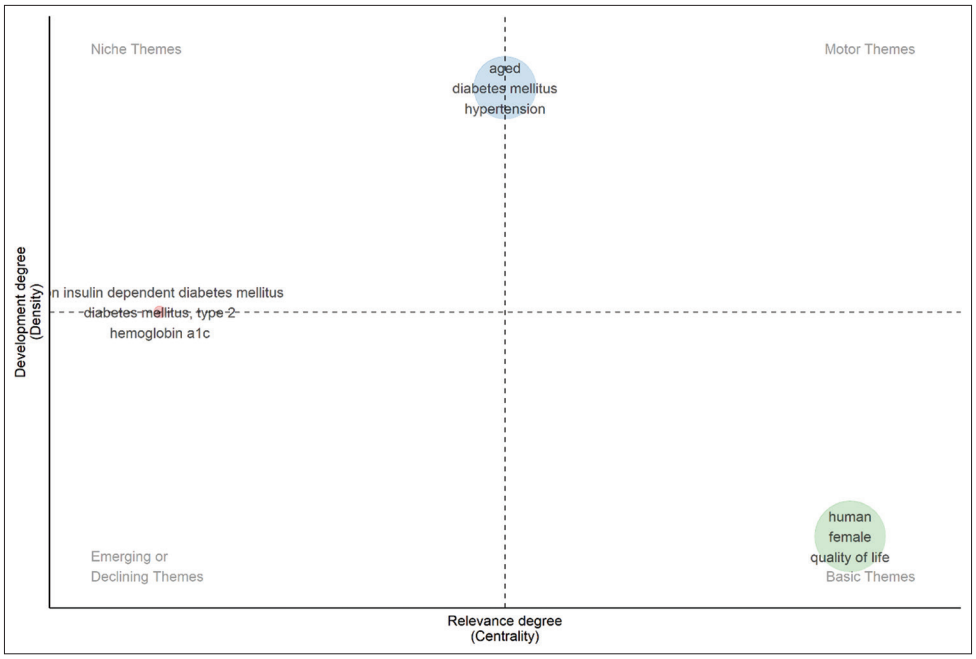

Figure 11. Thematic map illustrating conceptual structures

example, while biomarkers, such as hemoglobin A1c, remain clinically critical, their standalone focus in HRQoL research may be diminishing as more integrative approaches gain prominence.

The upper-left quadrant, typically reserved for Niche Themes, remains relatively unpopulated in this analysis. This absence suggests that the field currently exhibits limited fragmentation into highly specialized but isolated subtopics and instead emphasizes a broad, integrated research focus rather than narrowly segmented research islands.

Collectively, this thematic map depicts a research domain firmly grounded in core clinical and psychosocial concepts, with strong ongoing development around aging, comorbidities, and the complex interplay between diabetes management and women's overall well-being. The structure suggests a mature yet dynamic field, with opportunities for future exploration into personalized care pathways, socioeconomic determinants, mental health integration, and emerging healthcare technologies that could further enrich understanding of HRQoL in diabetic populations.

3.3.4. CONCEPTUAL STRUCTURE

The conceptual structure map presented in Figure 12 offers a multidimensional scaling visualization of the key themes and research clusters derived from keyword co-occurrence in studies addressing HRQoL among women with diabetes. This map, generated through Correspondence Analysis, positions keywords along two main dimensions, reflecting their interrelationships based on shared conceptual content across publications.

Prominently positioned in the lower-right quadrant is the term "health-related quality of life," which anchors the core intellectual framework of the field. Its central placement indicates that much of the literature revolves around this core concept, serving as the primary lens through which the impact of diabetes on women's well-being is examined. Closely associated with this core are methodological terms, such as "questionnaire" and "cross-sectional study," reflecting the dominant use of survey-based research designs in assessing patient-reported outcomes in this area.

In the upper-right quadrant, a tightly linked cluster includes clinical terms, such as "hypertension," "depression," and "diabetes mellitus." This grouping suggests that comorbid conditions, particularly cardiovascular and mental health disorders, are frequently studied alongside diabetes to evaluate their compounded effects on women's quality of life. The co-occurrence of these terms emphasizes the importance of adopting a multi-morbidity framework to fully capture the burden of disease experienced by this population.

The upper-left quadrant features additional terms, such as "controlled study," "priority journal," and "aged," which point toward specific subgroups and study designs that have gained attention in the field. The prominence of "aged" reflects the growing significance of older women in HRQoL research, given the intersection of chronic diseases, functional limitations, and psychological well-being.

Finally, the lower-left quadrant contains the term "non-insulin-dependent diabetes mellitus" (type 2 diabetes). Its relatively peripheral placement suggests that while type 2 diabetes is a central clinical category, it is often studied within broader, integrative frameworks rather than in isolation.

Overall, this conceptual structure map portrays a research domain that is firmly grounded in clinical realities while being methodologically anchored in patient-reported outcomes. The field demonstrates strong central cohesion around HRQoL as a principal construct, while also addressing the multifactorial complexities of aging, comorbidities, and diverse research designs. The structure indicates a balanced blend of clinical, psychological, and methodological emphases, highlighting both the richness and consistency of scholarly inquiry in this area.

4. DISCUSSION

The present bibliometric analysis provides a comprehensive overview of the global scientific landscape concerning HRQoL among women with diabetes over a 25-year period (2000–2024). By systematically analyzing publication trends, author

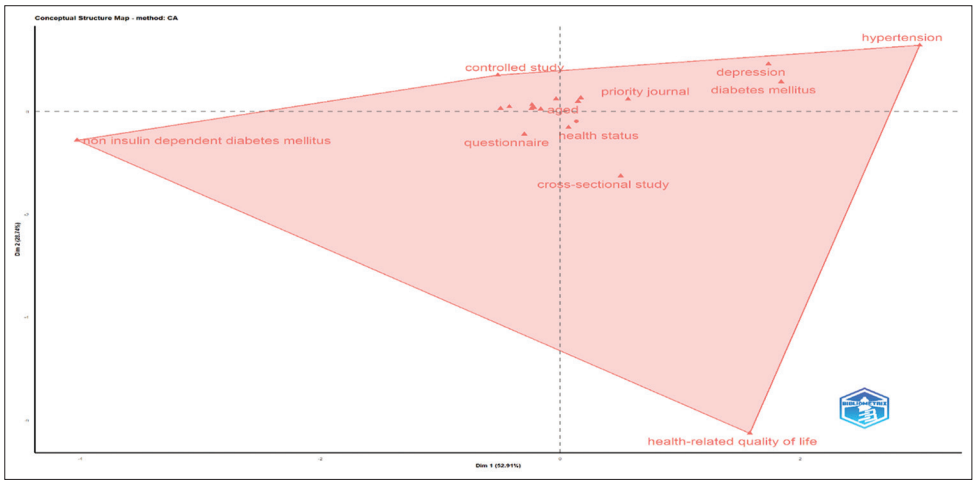

Figure 12. Conceptual structure map of research, generated through correspondence analysis

productivity, journal performance, country contributions, collaboration patterns, and thematic structures, this study offers important insights into the intellectual development and research priorities of this increasingly important field.

The results demonstrate steady and substantial growth in publication output, with an annual growth rate exceeding 10%. This rise reflects both the growing global burden of diabetes and the increasing awareness of its gender-specific implications for women's quality of life. Notably, the sharp acceleration in research output since 2020 may also reflect a broader shift in global health research priorities toward patient-centered care, psychosocial outcomes, and holistic chronic disease management, aligning with the WHO's emphasis on quality of life as a key health indicator.

The authorship analysis highlights a well-established yet evolving research community. The field is characterized by a highly collaborative structure, with an average of over seven co-authors per document and nearly 26% of publications involving international collaborations. The dominance of a relatively small number of prolific authors, as confirmed by Lotka's Law, is consistent with patterns observed in other mature scientific fields. Key contributors, such as Johnson JA, Varni JW, and Pouwer F, have played prominent roles in shaping intellectual discourse, while newer researchers, such as Lee J, demonstrate emerging leadership and growing influence in recent years.

From a geographical perspective, the research landscape remains largely concentrated within high-income countries, particularly the United States, the United Kingdom, China, Australia, and several European nations. While emerging economies, such as China and India, have increased their contributions in recent years, significant geographic disparities persist. Underrepresentation of studies from developing regions likely reflects ongoing structural barriers, including resource constraints, differences in healthcare systems, and limited research capacity. These findings underscore the need for expanded global research partnerships to ensure that diverse cultural, socioeconomic, and healthcare contexts are adequately represented in HRQoL research.

The analysis of journal sources reinforces the multidisciplinary nature of this research domain. Specialized journals, such as *Quality of Life Research* and *Health and Quality of Life Outcomes,* dominate publication output, while broader biomedical journals, including *PLOS ONE*, *BMJ Open*, and *Diabetes Care,* also contribute substantially. This cross-disciplinary publication pattern reflects the complex interplay between clinical management, psychological well-being, public health, and social determinants of health that shapes women's experiences of diabetes.

The intellectual structure of the field, revealed through bibliographic coupling and thematic mapping, exhibits a stable and cohesive foundation anchored around the core concept of HRQoL. The literature is unified by a consistent focus on patient-reported outcomes, survey-based research designs, and psychosocial dimensions, such as depression, anxiety, and social role strain. Motor themes identified in the thematic map, including aging, hypertension, and comorbidities, reflect well-developed and highly relevant research areas that increasingly recognize the multi-morbidity challenges faced by aging female populations with diabetes. Meanwhile, emerging or potentially declining themes, such as type 2 diabetes mellitus and biomarkers, such as hemoglobin A1c, suggest a shift away from isolated clinical endpoints toward more integrated, patient-centered approaches.

The conceptual structure analysis further reinforces the multifactorial nature of HRQoL research in women with diabetes. The central positioning of "health-related quality of life," closely associated with terms, such as "questionnaire" and "cross-sectional study," highlights the prevailing reliance on patient-reported outcomes as both primary endpoints and research tools. The co-occurrence of clinical, psychological, and sociodemographic variables within closely clustered themes reflects a growing recognition that quality of life is shaped by a complex interplay of biological, emotional, social, and cultural factors.

Importantly, this analysis also identifies several gaps and opportunities for future research. First, much of the existing literature focuses on Western populations, underscoring the need for culturally diverse, region-specific investigations that account for variations in healthcare systems, gender roles, social support structures, and health literacy. Second, longitudinal and interventional studies remain underrepresented compared to cross-sectional designs, highlighting opportunities to strengthen causal inferences regarding interventions that can improve HRQoL outcomes. Third, the limited development of highly specialized niche themes indicates potential opportunities for future interdisciplinary integration, including digital health technologies, telemedicine interventions, personalized medicine, and patient empowerment frameworks that may further enhance quality of life in diabetic women.

From a health psychology perspective, the findings underscore the importance of systematically integrating HRQoL assessments into diabetes care for women. The prominence of psychosocial themes, such as depression, anxiety, and

social role strain, suggests that HRQoL outcomes cannot be separated from mental health. Health psychologists can play a central role in designing screening protocols for psychological distress, developing coping interventions, and training clinicians to address gender-specific vulnerabilities in diabetes management. Furthermore, the reliance on cross-sectional designs highlights a missed opportunity to examine psychological adaptation processes over time, calling for more longitudinal psychological research.

In terms of policy implications, the dominance of high-income countries in HRQoL research raises concerns about global equity. Women in LMICs face structural barriers—including limited healthcare access, cultural constraints, and financial stressors—that may exacerbate poor quality of life but remain underexplored in the present research. Policies that fund South-South collaborations, strengthen local research capacity, and promote culturally sensitive HRQoL tools are therefore essential. In addition, the strong presence of clinical and biomedical journals in this literature points to the need for funding mechanisms that explicitly support interdisciplinary work bridging medical, psychological, and social perspectives.

Taken together, these implications suggest that HRQoL research among women with diabetes should not remain a purely academic exercise but should actively inform both clinical practice and policy agendas. Embedding HRQoL as a standard outcome in diabetes programs, prioritizing psychosocial care alongside biomedical management, and ensuring more equitable global research participation would align future work with the holistic needs of this population.

The present study offers the first comprehensive bibliometric mapping of global research activity related to HRQoL among women with diabetes. The field has grown rapidly, is highly collaborative, and increasingly integrates psychosocial and clinical complexities into its conceptual frameworks. Continued efforts to expand research in underrepresented regions, diversify study designs, and incorporate emerging healthcare technologies will be essential to fully address the multidimensional challenges faced by women living with diabetes in diverse global contexts.

5. CONCLUSION

This bibliometric analysis provides a comprehensive and systematic overview of global research trends related to HRQoL among women with diabetes over the past 25 years. The findings reveal a steady and significant growth in scholarly output, reflecting increasing global attention to the multidimensional challenges faced by women living with diabetes. The field is marked by strong international collaboration, active contributions from a core group of leading authors, and concentrated publication activity within specialized quality-of-life and diabetes journals.

The intellectual and conceptual structure of the literature is anchored by core themes, such as patient-reported outcomes, comorbidities, aging, and psychosocial factors, alongside growing attention to the complex interactions between clinical management and broader social determinants of health. While the field is intellectually cohesive, opportunities exist to diversify research across cultural contexts, develop longitudinal and interventional study designs, and expand interdisciplinary collaborations that incorporate emerging healthcare innovations.

By mapping the scientific landscape of this domain, the present study not only synthesizes the existing body of knowledge but also identifies critical directions for future research. Addressing these gaps will be essential for advancing comprehensive, patient-centered care models that meaningfully improve the quality of life for women living with diabetes worldwide.

Beyond mapping scholarly trends, these findings also offer translational guidance for clinical and psychological practice. For clinicians, incorporating HRQoL measures into routine diabetes management can help identify psychosocial distress, role strain, and comorbid conditions that standard biomedical markers may overlook. For health psychologists, the prominence of themes, such as depression and diabetes-related distress, underscores the need to develop gender-sensitive coping strategies, behavioral interventions, and patient education programs tailored to women's lived experiences. Strengthening the link between HRQoL research and practice can ensure that evidence generated in the academic domain directly informs patient care, leading to more holistic and person-centered approaches to managing diabetes.

6. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

While this study offers a comprehensive bibliometric overview of research on HRQoL among women with diabetes, several limitations should be acknowledged.

First, the analysis was restricted to the Scopus database. Although Scopus is extensive, it may not capture all relevant publications indexed in other databases, such as Web of Science, PubMed, or regional indexing services. As a result, certain valuable studies, particularly those published in local or non-English language journals, may have been inadvertently excluded.

Second, bibliometric analyses inherently rely on publication metadata, which limits the depth of content-specific insights. While this study successfully mapped publication trends, author productivity, thematic clusters, and intellectual structures, it did not assess the methodological quality, clinical rigor, or real-world applicability of the included studies. Therefore, the findings reflect the quantitative landscape of research activity but not necessarily the substantive or clinical quality of the evidence base.

Third, the analysis reveals a predominance of cross-sectional observational studies, as evidenced by the conceptual structure and thematic mapping. The relative underrepresentation of longitudinal and interventional research designs limits the ability to fully understand causal relationships between diabetes management strategies and HRQoL outcomes in women.

Finally, the strong concentration of publications from high-income countries underscores persistent global disparities in research capacity and output. The underrepresentation of studies from LMICs restricts the generalizability of findings across diverse healthcare systems, cultural contexts, and socioeconomic environments, where women may experience unique barriers and challenges in managing diabetes and maintaining quality of life.

In addition, bibliometric analysis has inherent interpretive constraints, particularly in fields, such as health psychology. While bibliometrics can identify publication trends, influential authors, and thematic clusters, it does not assess the methodological rigor, theoretical depth, or clinical applicability of individual studies. Highly cited articles may reflect visibility or disciplinary citation practices rather than scientific quality or practical relevance.

Moreover, bibliometric mapping often simplifies complex psychosocial constructs into keyword networks, potentially obscuring context-specific meanings that are critical for interpreting HRQoL among women with diabetes.

To address these interpretive constraints, future research could complement bibliometric mapping with systematic reviews, meta-analyses, and qualitative evidence syntheses that assess study quality and contextual insights. Such mixed-methods approaches would provide a more holistic understanding of how HRQoL research translates into psychological practice and policy.

Given these limitations, several avenues for future research emerge. First, there is a clear need to expand bibliometric investigations to include multiple global databases and regional indexing systems to ensure more comprehensive literature coverage. Second, future studies should move beyond descriptive bibliometric mapping and integrate systematic reviews or meta-analyses to assess the quality and effectiveness of interventions aimed at improving HRQoL in women with diabetes. Third, there is an urgent need for more longitudinal and interventional studies that can provide stronger evidence on the long-term impacts of various medical, psychological, and lifestyle interventions. Fourth, interdisciplinary research approaches integrating digital health technologies, personalized medicine, mental health interventions, and patient empowerment models hold significant potential to advance this field. Finally, strengthening international collaborations, particularly involving underrepresented regions, will be essential to foster culturally sensitive, globally applicable insights that address the complex and diverse experiences of women living with diabetes.

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CONFLICT OF INTEREST

The authors declare they have no competing interests.

AUTHOR CONTRIBUTIONS

Conceptualization: All authors
Formal analysis: Zeeshan Zeeshan
Investigation: Zeeshan Zeeshan
Methodology: Zeeshan Zeeshan
Writing – original draft: All authors
Writing – review & editing: All authors

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

CONSENT FOR PUBLICATION

Not applicable.

DATA AVAILABILITY STATEMENT

The data supporting this study are available from the SCOPUS Database. The derived dataset is available from the corresponding author on reasonable request.

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