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Mapping the global research landscape and emerging trends on Community-Based Interventions for Diabetes prevention: A Bibliometric and Visual analysis

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Abstract:
Background: *Diabetes mellitus is a significant global public health challenge, with its prevalence rising sharply due to sedentary lifestyles, obesity, and healthcare disparities. Community-based interventions (CBIs) have emerged as effective strategies for diabetes prevention, promoting behavioral changes and addressing key risk factors. Understanding global research trends in CBIs for diabetes prevention is essential to inform policy, direct future research, and enhance intervention strategies.* ***Objective:*** *This study aims to map the global research landscape on community-based interventions for diabetes prevention from 2000 to 2024. It identifies key research themes, influential authors, institutions, and countries contributing to this field while exploring collaboration networks and thematic trends.* ***Methods:*** *A bibliometric and visual analysis was conducted using Scopus data. Biblioshiny (R package) and VOSviewer were employed to analyze publication trends, citation networks, co-authorship patterns, and thematic developments. Inclusion criteria required peer-reviewed articles focused on community-based interventions for diabetes prevention, published between 2000 and 2024 in English.* ***Results:*** *The findings indicate a rising research interest in CBIs for diabetes prevention, with a peak in publications post-2010. The United States, the United Kingdom, and India lead research contributions. Keyword co-occurrence analysis highlights evolving themes, including lifestyle modifications, behavioral interventions, and digital health integration. Co-authorship and institutional collaborations show a growing multidisciplinary research approach.*

Keywords: *Community based interventions, Diabetes Mellitus, Bibliometric and Visual analysis*

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I. INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. The global prevalence has risen sharply, particularly in low- and middle-income countries, due to sedentary lifestyles, obesity, and inadequate healthcare infrastructure. (1) The global prevalence of diabetes has reached 10.5%, affecting approximately 537 million adults, with India showing a prevalence ranging from 9.3% to 16.1%. (2)

Diabetes is a growing public health challenge in India, leading to significant morbidity and mortality. Enhancing surveillance mechanisms, encouraging early diagnosis, and improving access to quality healthcare are critical in managing this rising health crisis. Moreover, fostering cross-disciplinary collaborations and leveraging technological advancements can strengthen diabetes prevention and treatment strategies. (3)

Diabetes imposes a significant strain on healthcare systems, with the International Diabetes Federation estimating 537 million cases globally in 2021, leading to $966 billion in health expenditures, projected to exceed $1054 billion by 2045.(4) The Lancet Commission highlights that low- and middle-income countries face additional challenges, including poverty, inadequate nutrition, and physical inactivity. Underfunded healthcare systems further exacerbate the crisis, emphasizing the urgent need for precise data to develop effective intervention programs. Addressing these factors is crucial to mitigating the growing burden of diabetes worldwide. (5) Understanding emerging trends in diabetes research nationwide is crucial for informing healthcare policies, directing research priorities, and developing targeted intervention programs.

1.1 RATIONALE OF THE STUDY

A community-based approach has proven effective in lowering blood glucose levels among at-risk populations by promoting behavioral changes and addressing key risk factors. This strategy helps set realistic expectations for diabetes prevention while ensuring efficient use of limited financial resources. Recognizing its significance, the World Health Organization emphasizes the need for evidence-based, cost-effective, and

sustainable community-driven interventions to prevent and manage non-communicable diseases, including diabetes.(6)

By identifying popular research topics and collaboration networks**,** this study will support efforts to create and implement evidence-based diabetes prevention programs. Comprehensive bibliometric studies tracking global research trends on community-based treatments in diabetes prevention are scarce, despite their significance. Finding these patterns is crucial to filling in the current research gaps and guiding future diabetes preventive measures plans, especially in environments with limited resources.

1.2 AIM AND OBJECTIVES

- ✔ To map the global research landscape on community-based interventions for diabetes prevention from 2000 to 2024.
- ✔ To identify the key research themes, influential authors, institutions, and countries contributing to this field.
- ✔ To explore collaboration networks and co-authorship patterns among researchers and institutions.

II. METHODOLOGY

This study utilized a bibliometric and visual analysis approach to systematically explore global research trends on community-based interventions for diabetes prevention. **Biblioshiny R** is an interactive web-based application within the **Bibliometrix R package**, designed to conduct bibliometric analysis through an intuitive interface. It allows researchers to explore publication trends, citation networks, co-authorship patterns, and thematic developments in various research fields. (7) By providing statistical analysis and visual mapping tools, Biblioshiny helps identify key contributors, emerging topics, and knowledge structures within a dataset.

VOSviewer, developed by **Van Eck and Waltman (2010)**, is widely used for constructing and visualizing bibliometric networks. It enables researchers to analyze co-authorship, keyword co-occurrence, and citation relationships using advanced clustering techniques. This software helps reveal thematic patterns and the intellectual structure of a research field, making it an essential tool for bibliometric and Scientometrics studies. (8)

A comprehensive literature search was conducted using the Scopus database to identify relevant publications from 2000 to 2024. Keywords such as "Community-based interventions," "Diabetes prevention," and "Lifestyle interventions" were applied. Boolean operators (AND, OR, NOR) were incorporated to refine the search and ensure relevant studies were included.

Studies were selected based on specific inclusion criteria, which required articles to be published in peer-reviewed journals, focus on community-based interventions for diabetes prevention, be published between 2000 and 2024, and be written in English. Relevant data, including author details, publication year, journal name, keywords, and citation metrics, were extracted in CSV format.

The following research questions were explored:

1. What are the global publication trends, key contributors, and major research collaborations in community-based interventions for diabetes prevention from 2000 to 2024?
2. How have research themes, keyword trends, and intervention strategies evolved in community-based diabetes prevention, and what are the major thematic clusters identified through bibliometric analysis?
3. What are the most influential articles, journals, and funding agencies in this field, and what research gaps exist that can inform future studies and policy-making?

III. RESULTS

3.1 Publication Output Analysis:

Figure 1: Annual Scientific Production

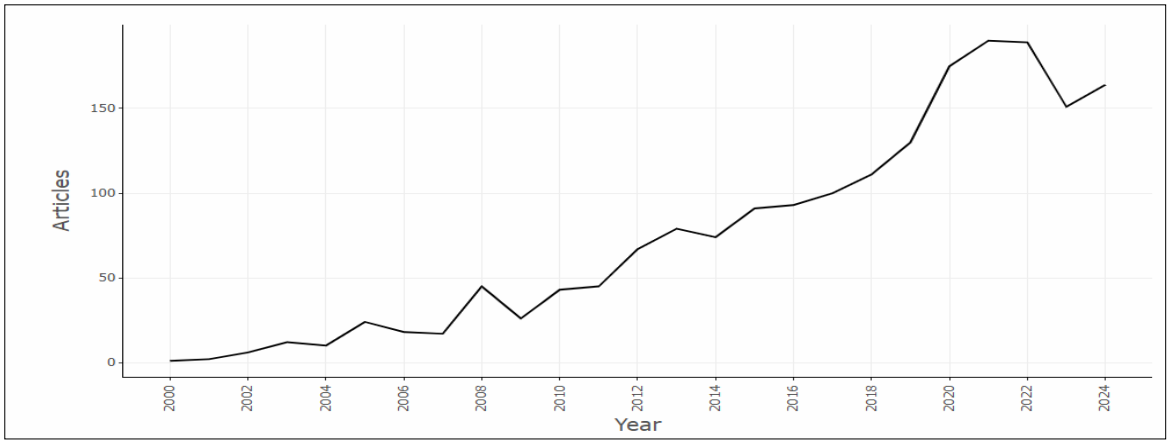

Figure 1 shows the number of research articles published each year on community-based interventions for diabetes prevention from 2000 to 2024. The number of publications gradually increased over time. A sharp growth occurred between 2018 and 2022, reaching a peak of over 150 articles per year. There was a slight drop in 2023, but the numbers started to recover in 2024. This trend suggests a growing interest in this area of research, likely due to rising awareness and the increasing impact of diabetes, highlighting the need for further studies and effective interventions.

Table 1: Top 10 Most Relevant Sources Based on Number of Published Documents

Rank	Source Name	Number of Documents
1	BMJ OPEN	99
2	BMC PUBLIC HEALTH	91
3	INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AN	65
4	DIABETES CARE	45
5	TRIALS	43
6	PREVENTING CHRONIC DISEASE	37
7	CONTEMPORARY CLINICAL TRIALS	31
8	BMC HEALTH SERVICES RESEARCH	27
9	FRONTIERS IN PUBLIC HEALTH	20
10	AMERICAN JOURNAL OF PREVENTIVE MEDICINE	19

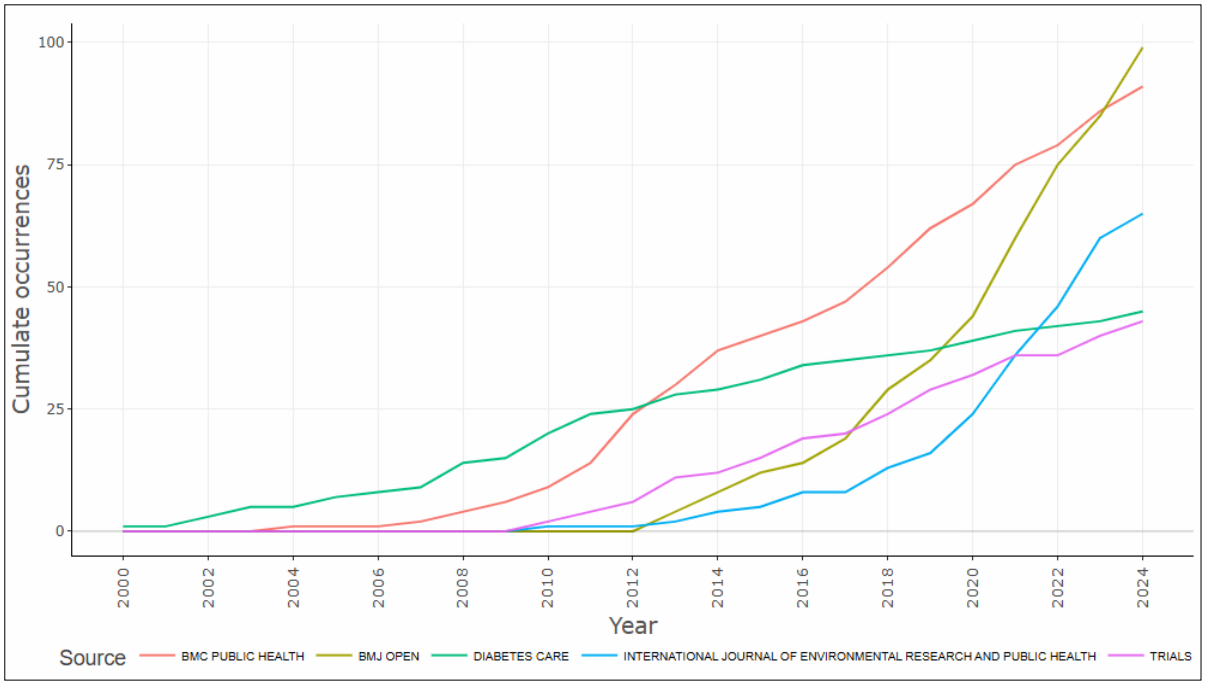

Figure 2: Sources production over time

Figure 2 illustrates the cumulative growth of research publications in five key journals from 2000 to 2024.

BMJ Open and **BMC Public Health** exhibit the most significant upward trends, indicating a sharp rise in published studies in recent years. The **International Journal of Environmental Research and Public Health** also shows a notable increase, particularly after 2015, reflecting a growing focus on environmental and public health research. Meanwhile, **Diabetes Care** and **Trials** have maintained a steady but slower growth pattern. Overall, the trend highlights an increasing research interest in public health, clinical trials, and disease prevention, with publication rates accelerating in the last decade.

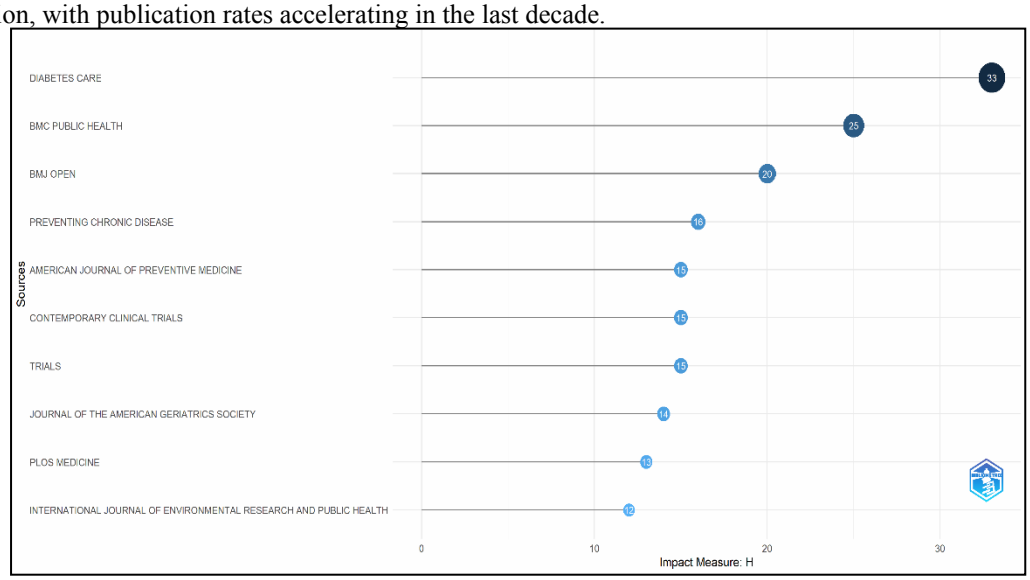

Figure 3:
Impact of the articles by H-Index

Figure 3 presents the **local impact of sources based on the H-index**, which measures both the productivity and citation impact of publications within each journal. **Diabetes Care** leads with the highest H-index of **33**, indicating strong influence and citation impact in the field. **BMC Public Health (25)** and **BMJ Open (20)** also exhibit significant scholarly impact. Other notable journals include **Preventing Chronic Disease (16), American Journal of Preventive Medicine (15), and Contemporary Clinical Trials (15)**, all

showing moderate citation influence. Meanwhile, journals such as **PLOS Medicine (13)** and **International Journal of Environmental Research and Public Health (12)** have relatively lower H-index values.

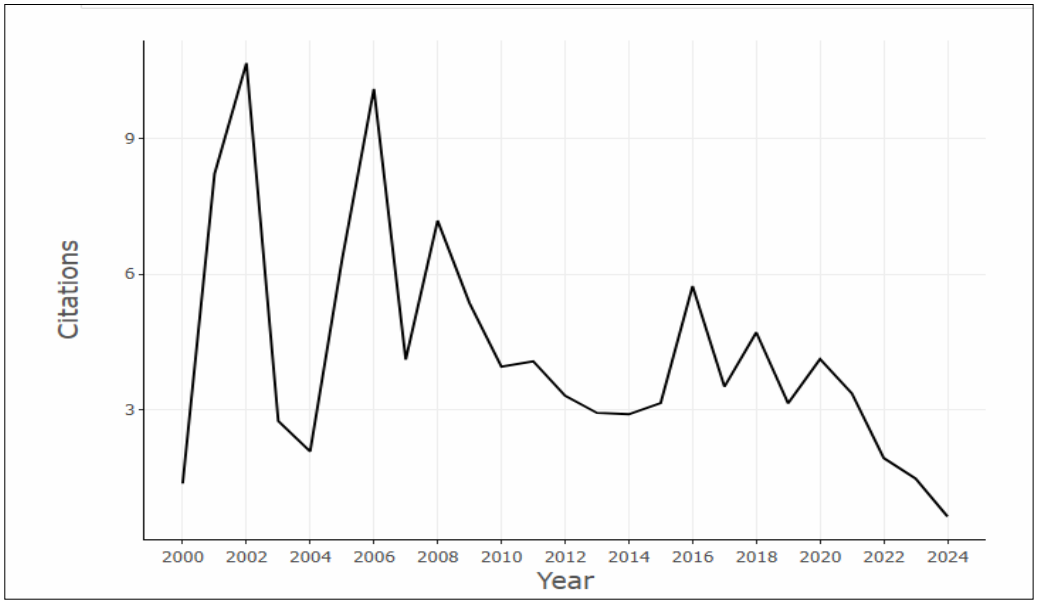

Figure 4: Average citations per year

The graph (Figure 4) illustrates the trend of citations per year from 2000 to 2024. Initially, there is a sharp rise in citations, reaching a peak around 2002, followed by a sudden decline. Another peak is observed around 2006, but after that, citations gradually decrease with some fluctuations. From 2010 onwards, the number of citations remains relatively stable, with occasional small increases. However, after 2020, a downward trend is noticeable, indicating a decline in citation impact in recent years. This pattern suggests that while the research had strong early influence, its relevance or citation rate has diminished over time.

3.2 Author output analysis:

Table 2: Top 10 authors with most publications and citations

Author	h - index	g - index	m - index	TC	NP	PY_start
JR	15	19	0.625	2544	19	2002
ABSETZ P	10	15	0.625	410	15	2010
ACKERMANN RT	10	13	0.526	758	13	2007
OLDENBURG B	10	15	0.556	439	15	2008
WANG Y	10	19	0.833	569	19	2014
KHUNTI K	9	10	0.500	1122	10	2008
LI J	9	14	1.286	238	14	2019
LI Y	9	14	0.750	309	14	2014
PRABHAKARAN D	9	11	0.750	441	11	2014
VITOLINS MZ	9	11	0.563	466	11	2010

The table presents the local impact of various authors based on bibliometric indicators, such as **h-index, g-index, m-index, total citations (TC), number of publications (NP), and the starting year of publications (PY).**

- **Highest Impact Author:** The author "JR" has the highest **h-index (15), g-index (19), and total citations (TC = 2544),** indicating a significant contribution to the field over a long period (since 2002).
- **Emerging Researchers:** "LI J" has the highest **m-index (1.286)** despite a relatively low h-index (9), suggesting a rapid impact in a short time (since 2019).

- **Consistently Productive Authors:** Authors like "WANG Y" (h-index = 10, g-index = 19, TC = 569) and "ACKERMANN RT" (h-index = 10, g-index = 13, TC = 758) show steady contributions to the field over time.
- **Established Contributors:** "KHUNTI K" (h-index = 9, TC = 1122, PY_start = 2008) has fewer papers but a high citation count, indicating influential work.
- **Recent Contributors:** Authors like "LI J" and "LI Y" (both started in 2014 or later) have promising m-index values, suggesting potential future impact.

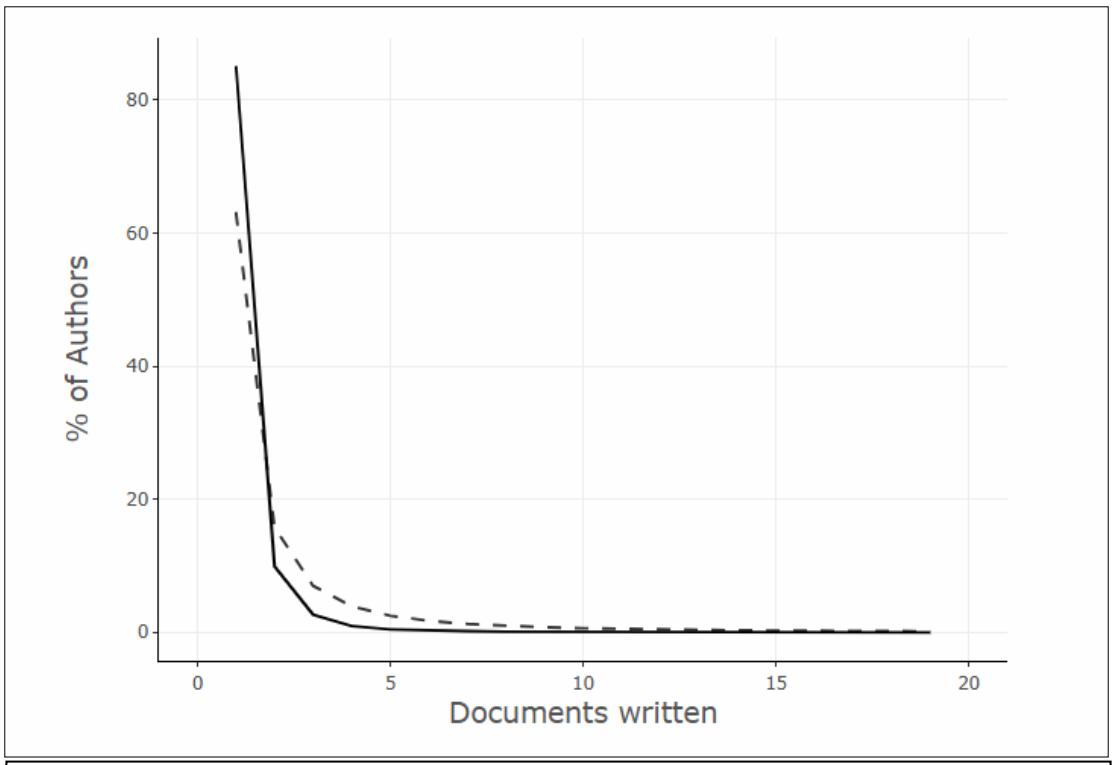

Figure 5: Production of Authors through Lotka's Law

The graph represents the distribution of authors based on the number of papers they have published, following Lotka's Law. This principle suggests that most researchers produce only a few papers, while a small group is responsible for a large number of publications. The steep decline in the curve indicates that as the number of publications rises, the number of contributing authors decreases. The solid and dashed lines likely compare real data with a predicted pattern, both confirming that a small percentage of authors contribute the majority of publications. Lotka's Law explains that in any research field, the majority of authors publish only one or two papers, whereas a small number are highly productive and publish frequently. It demonstrates an uneven distribution of scientific contributions, where a few researchers dominate in terms of output.

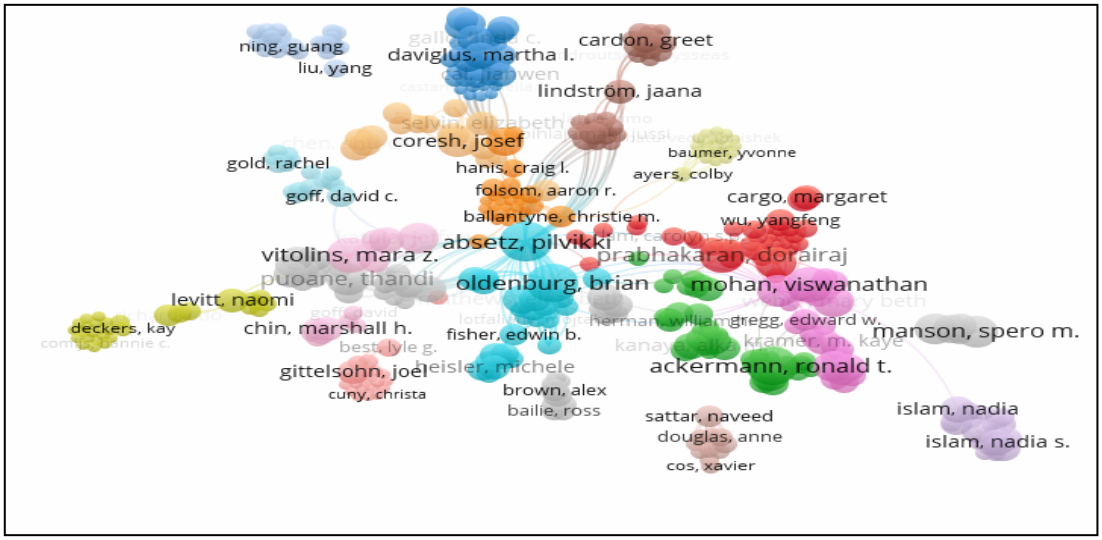

Figure 6: Co-authorship Network Analysis

Figure 6 shows how researchers in a particular field are connected based on their collaborative publications. Each node represents an author, and the size of the node likely indicates the number of publications or citations they have. The **color-coded clusters** represent different research groups or collaborations, with thicker lines indicating stronger or more frequent co-authorship ties. Prominent authors like **Prabhakaran D., Ackermann R.T., and Oldenburg B.** appear to be central figures with multiple connections, suggesting they have collaborated extensively across different groups. Smaller, isolated clusters indicate researchers who collaborate within smaller teams. This visualization helps in understanding key contributors and research networks within the field.

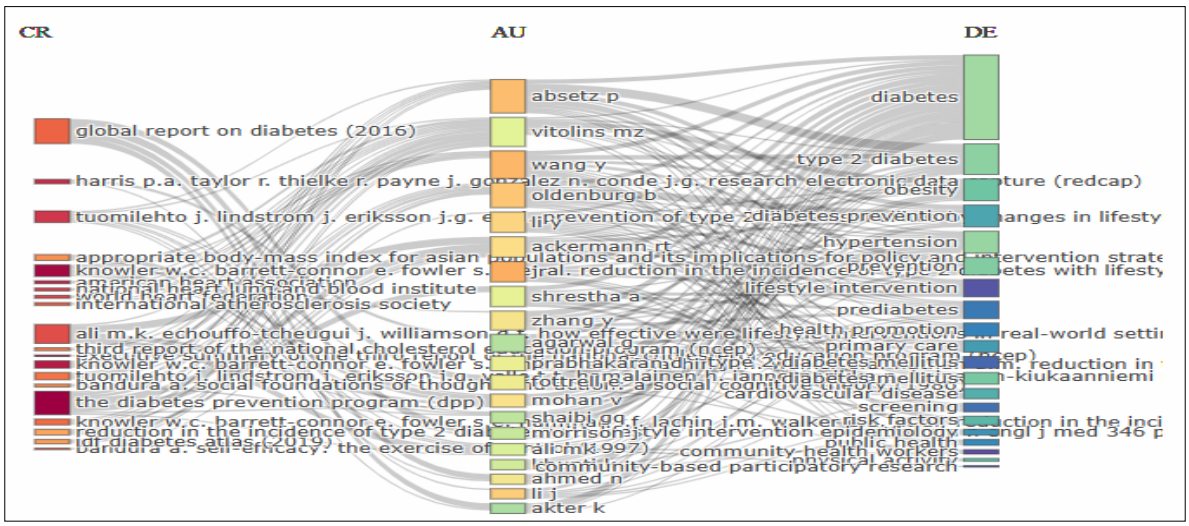

Figure 7: Relationships between cited references (CR), authors (AU), and research domains (DE)

The image (Figure 6) provides a structured overview of the most impactful studies, key researchers, and prevalent research areas in diabetes-related literature. The left section (CR) lists influential studies, including the **Global Report on Diabetes (2016)** and key research papers by **Harris, Tuomilehto, and Knowler**, indicating highly cited works in the field. The middle section (AU) displays the contributing authors, such as **Absetz P., Vitolins MZ., and Ackermann RT**, who have significantly contributed to diabetes prevention and management research. The right section (DE) categorizes research topics, highlighting areas like **diabetes, type 2 diabetes, obesity, lifestyle interventions, hypertension, and prediabetes**. The **connecting lines** between these sections show how specific references influence authors and how their work aligns with particular research themes.

3.3 Country Analysis

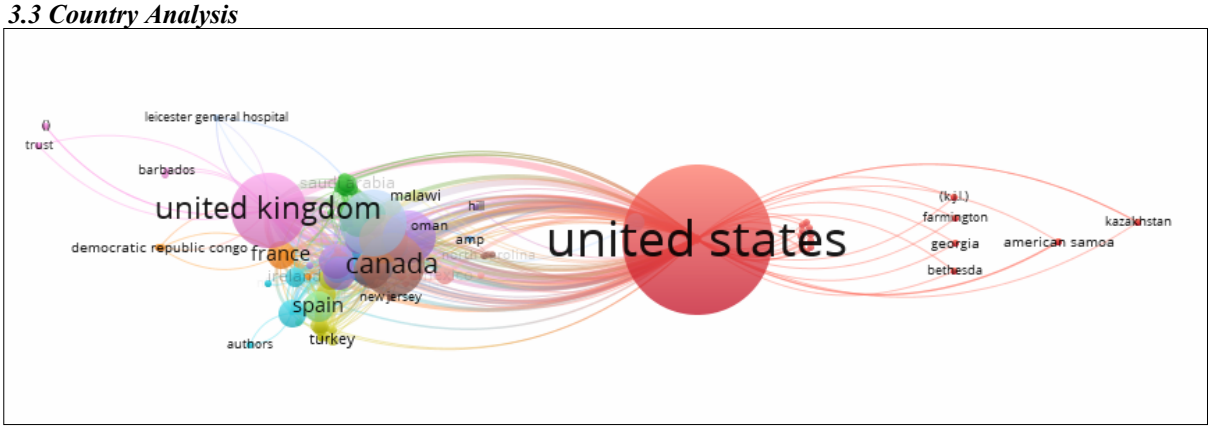

Figure 8: The Visualization of a Collaboration Network between Countries

The visualization (Figure 7) illustrates research collaborations between different countries, with the size of each country's name reflecting its prominence in the dataset and the connecting lines representing collaborative links. The United States stands out as the most influential country in research partnerships, while the United Kingdom, Canada, France, and Spain also play significant roles in global research networks. Smaller nodes, including Kazakhstan, American Samoa, and Georgia, indicate contributions from diverse regions, albeit with fewer collaborations. The density and thickness of the connecting lines highlight strong research ties, particularly among major countries like the United States, United Kingdom, Canada, and France. Additionally, the presence of institutions such as Leicester General Hospital and Bethesda suggests notable contributions from specific research centers.

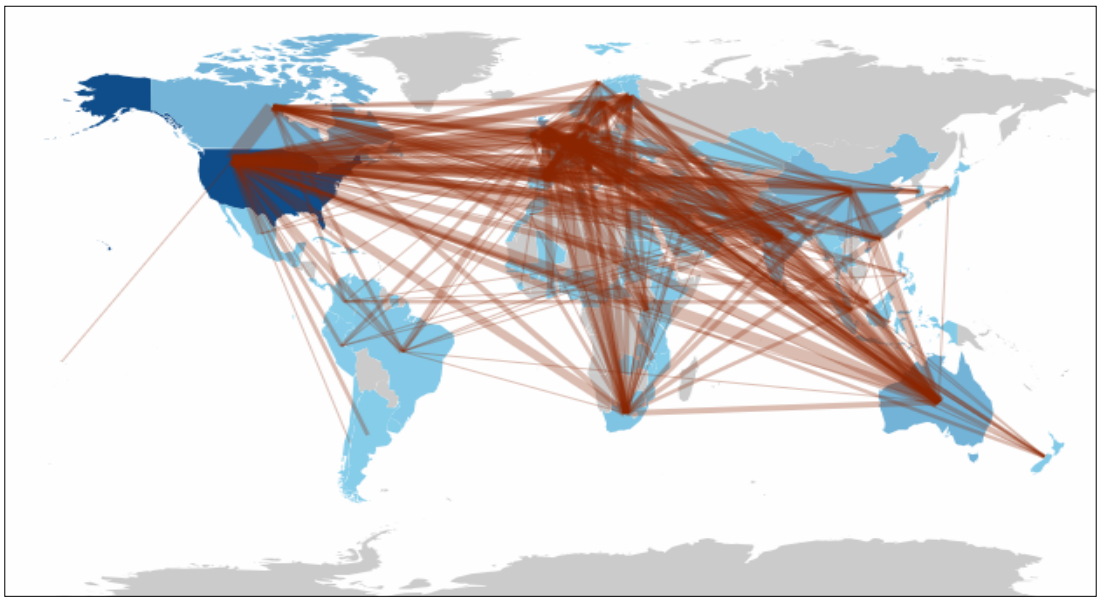

Figure 9: Global research collaboration network map

Figure 8 represents the interconnectedness of scientific research across countries, highlighting key contributors and emerging partnerships. Countries are color-coded, with darker shades, particularly in the United States, indicating higher research output and collaboration intensity. Red lines signify international partnerships, with their thickness and density reflecting the strength and frequency of collaborations. The United States emerges as the dominant hub, forming extensive connections with Europe, Asia, and Australia. Europe and France also plays a crucial role in facilitating cross-border research, while China and Australia exhibit strong international ties. Asia, especially China and India, is becoming increasingly influential in global

research, strengthening its collaborations with both Western and regional partners. Australia is also well-integrated into global research networks, reinforcing its active participation in international collaborations.

3.4 Keywords Analysis

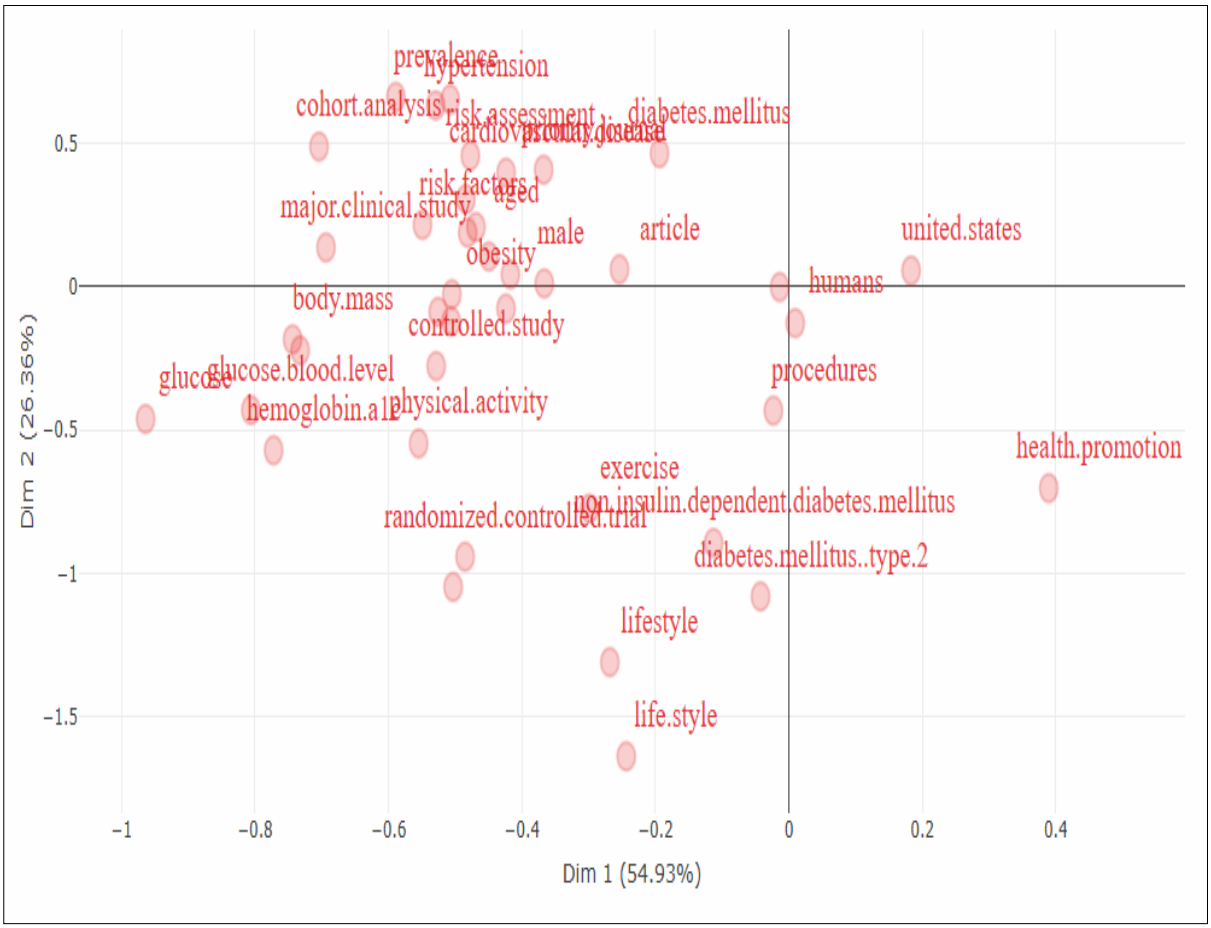

Figure 10: Principle Component Analysis

The scatter plot (Figure 9) represents a factorial analysis or correspondence analysis or principal component analysis of key terms related to research on diabetes, obesity, and associated health topics. This visualization provides insight into how different terms are grouped based on their relevance and co-occurrence in scientific literature. The x-axis (Dim 1: 54.93%) and y-axis (Dim 2: 26.36%) depict the two primary dimensions explaining the variation in the dataset. Each point corresponds to a term, with its position indicating its relationship with other terms. Clusters of terms like "diabetes mellitus," "obesity," "risk factors," and "cardiovascular disease" suggest their frequent co-occurrence in research studies, while "exercise," "lifestyle," and "health promotion" are closely positioned, highlighting their connection to diabetes prevention and management. The term "United States" appears separately on the right, possibly signifying its prominence in diabetes-related research. Additionally, the presence of "randomized controlled trial" and "cohort analysis" indicates the use of rigorous research methodologies.

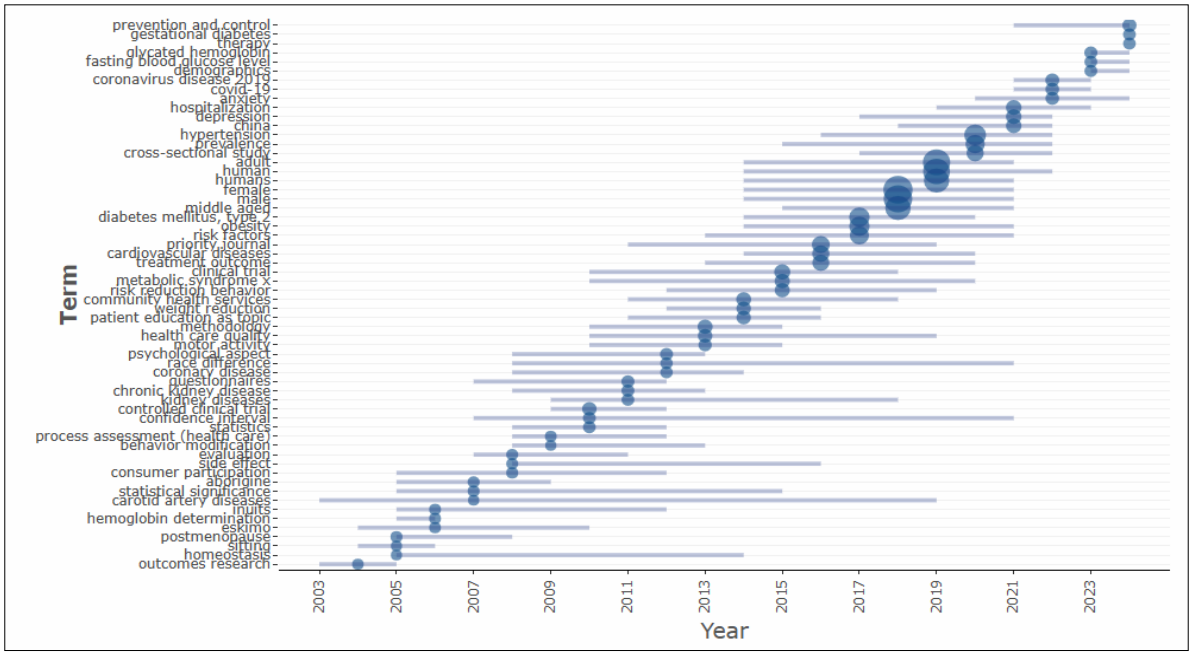

Figure 11: Trend analysis of research topics

Figure 11 explains how scientific focus shifts over time, reflecting emerging health concerns and evolving research priorities. The **vertical axis** lists key research terms related to diabetes, cardiovascular diseases, obesity, and public health, while the **horizontal axis** represents the years. The **bubble sizes** indicate the prominence or frequency of these terms in research publications, with larger bubbles signifying higher relevance in a given year. The progression of bubbles suggests that earlier research focused on **basic health metrics** like haemoglobin determination and homeostasis, while recent years have seen growing interest in topics like **COVID-19, prevention strategies, behavioral modifications, and patient education**.

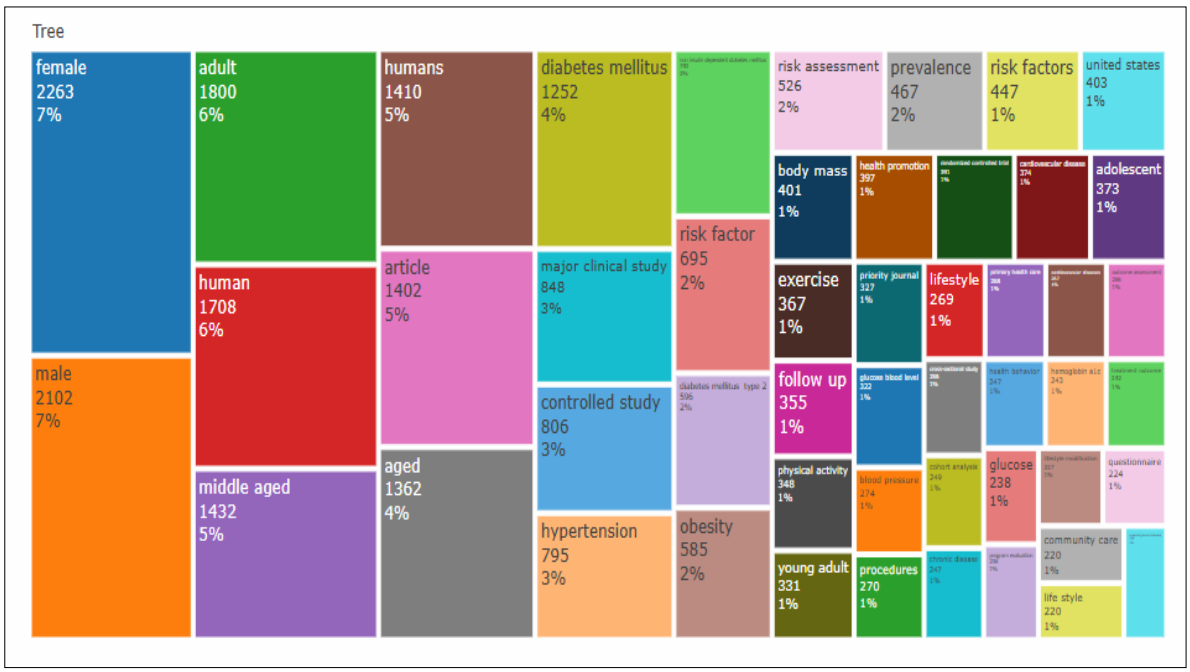

Figure 12: Tree Map

The visualization (Figure 12) provides a clear structure of key themes in diabetes research, covering demographic factors, disease conditions, study methodologies, and intervention strategies The most frequently mentioned terms include **"female" (2263 occurrences, 7%)** and **"male" (2102 occurrences, 7%)**, highlighting gender as a critical factor in diabetes-related studies. Other commonly appearing terms such as **"adult" (1800, 6%)**, **"human" (1708, 6%)**, and **"middle-aged" (1432, 5%)** indicate a demographic focus. Additionally, terms like **"diabetes mellitus" (1252, 4%)**, **"risk factor" (695, 2%)**, and **"hypertension" (795, 3%)** emphasize the importance of disease conditions and associated risk factors. The presence of **"controlled study" (806, 3%)** and **"major clinical study" (848, 3%)** suggests a substantial number of research efforts aimed at assessing treatment outcomes and risk elements.

Topics such as **"obesity" (585, 2%)**, **"exercise" (367, 1%)**, and **"lifestyle" (269, 1%)** highlight the significance of physical activity and behavioral changes in diabetes management. The inclusion of **"risk assessment" (526, 2%)** and **"prevalence" (467, 2%)** reflects a strong research focus on identifying and quantifying diabetes risks. Additionally, terms like **"body mass" (401, 1%)**, **"follow-up" (355, 1%)**, and **"community care" (220, 1%)** emphasize the importance of patient monitoring and public health interventions. The mention of **"United States" (403, 1%)** indicates a significant volume of research originating from this region.

IV. DISCUSSION

The findings of this study highlight the effectiveness of community-based interventions in diabetes prevention and management. Our results align with global research emphasizing the role of community-driven programs in reducing diabetes incidence and improving lifestyle behaviors. A systematic review by Barry et al. (2021) found that lifestyle interventions focusing on diet and physical activity significantly lowered the progression from prediabetes to diabetes in various populations.(9) Similarly, our study indicates that structured lifestyle programs have a measurable impact on diabetes prevention in urban settings.

Several international studies have demonstrated the long-term benefits of community-based interventions. For example, the Diabetes Prevention Program (DPP) in the United States showed a 58% reduction in diabetes risk through lifestyle changes.(10) Likewise, a study conducted in Finland by Lindström et al. (2020) confirmed the effectiveness of dietary modifications and increased physical activity in reducing diabetes incidence. (11) Additionally, the Norfolk Diabetes Prevention Study in the UK reported that group-based interventions were more effective than individual counselling in sustaining long-term behavioral changes. (12) Our study findings resonate with these results, reinforcing the need for culturally tailored community interventions to achieve sustainable health outcomes.

In the Indian context, studies have shown that community-based programs are crucial in addressing the diabetes epidemic. The Chennai Urban Rural Epidemiology Study (CURES) highlighted the rising burden of diabetes in urban India and emphasized lifestyle interventions as a key preventive strategy. (13) Furthermore, the Indian Diabetes Prevention Programme (IDPP) showed that lifestyle changes significantly lowered the incidence of diabetes, especially in high-risk individuals. A recent study by Misra et al. (2021) emphasized the effectiveness of school and workplace-based interventions in promoting healthy behaviors to prevent diabetes in India. Our findings further support these conclusions, showcasing the potential of structured community interventions in mitigating diabetes risk among urban populations. (14)

Despite the effectiveness of these programs, challenges remain in implementing large-scale community-based interventions. Ramachandran et al. (2018) highlighted that socioeconomic challenges and limited awareness frequently obstruct adherence to lifestyle modifications. (15) Similarly, our research indicates that while community engagement is beneficial, sustained efforts are needed to ensure long-term adherence to lifestyle modifications. A comparative study conducted in China found that while urban interventions were effective, rural populations faced additional barriers such as limited healthcare access and cultural resistance to lifestyle changes, which mirrors challenges observed in Indian settings. Addressing these barriers through policy support and public health initiatives is essential for maximizing the impact of such interventions. (16)

Moreover, advancements in digital health interventions have shown promising results in diabetes prevention. A study in Australia by Davis et al. (2022) found that mobile health (m-Health) interventions led to improved adherence to lifestyle changes and better glycaemic control among high-risk populations. (17) Similar studies in India have highlighted the growing role of telemedicine and mobile-based health coaching in enhancing diabetes prevention efforts, particularly in rural areas with limited access to healthcare facilities. These findings suggest that integrating digital tools into community-based interventions can further enhance their effectiveness and scalability. (18)

V. CONCLUSION

In conclusion, our study reinforces the importance of community-based diabetes prevention strategies, aligning with both international and Indian research. While lifestyle modifications have proven to be effective, challenges such as socio-economic constraints and adherence issues must be addressed to maximize impact. Future research should focus on developing cost-effective, scalable models tailored to diverse populations. Integrating technology, such as mobile health interventions and digital coaching, could further enhance the reach and effectiveness of community-driven programs in diabetes prevention. Strengthening collaborations between public health agencies, healthcare providers, and community stakeholders will be essential in ensuring the long-term success of diabetes prevention efforts.

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I am truly grateful to the researchers and experts whose work has helped expand the understanding of community-based efforts to prevent diabetes. Tools like **VOSviewer** and **Biblioshiny** played a key role in this analysis, and I appreciate the developers for making them available. I also value the existing research that provided important insights and guided this study.

AUTHOR CONTRIBUTIONS:

Conceptualization: A.H. Irfaunul Azees, Methodology: A.H. Irfaunul Azees, Software: Merlin G, Validation: Hetal Tejas Mer, Formal Analysis: Merlin G, Investigation: Hetal Tejas Mer, Resources: A.H. Irfaunul Azees, Writing: A.H. Irfaunul Azees, Visualization: Hetal Tejas Mer, Supervision: Hetal Tejas Mer, Project administration: A.H. Irfaunul Azees

CONFLICTS OF INTEREST:

The authors declare that they have no conflicts of interest.

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