



IMPACT OF DIGITAL HEALTH INTERVENTIONS ON QUALITY OF LIFE IN TYPE 2 DIABETES MELLITUS: A SCOPING REVIEW FOCUSED ON INDIAN POPULATIONS

Yuthika Rao^{1*}, Prof. (Dr.) Manisha Saharan², Dr. Puneet Rhijwani³,
Prof. (Dr.) Shailendra Mehta⁴

^{1*}Ph.D. Scholar, Department of Physiotherapy, Janardan Rai Nagar Rajasthan Vidyapeeth University, Udaipur, Rajasthan Email: physioyuths@gmail.com

² Professor, Department of Physiotherapy, Janardan Rai Nagar Rajasthan Vidyapeeth University, Udaipur, Rajasthan

³Professor and Head, Department of Medicine, Mahatma Gandhi Hospital, mgumst, Sitapura, Jaipur

⁴Professor, Department of Physiotherapy, Janardan Rai Nagar Rajasthan Vidyapeeth University, Udaipur, Rajasthan

***Corresponding Author:** Yuthika Rao

*Ph.D. Scholar, Department of Physiotherapy, Janardan Rai Nagar Rajasthan Vidyapeeth University, Udaipur, Rajasthan Email: physioyuths@gmail.com

ABSTRACT

Background:

Type 2 diabetes mellitus (T2DM) adversely affects quality of life (QoL), particularly in low- and middle-income countries such as India. Digital health interventions (DHIs) are increasingly adopted for diabetes self-management, yet their specific impact on QoL outcomes in Indian populations remains underexplored. [3] [12]

Objective:

To systematically map and synthesize existing literature on the impact of DHIs on QoL among Indian adults living with T2DM.

Methods:

A scoping review was conducted in accordance with the PRISMA-ScR guidelines. Searches were performed across PubMed, Scopus, Web of Science, and IndMED databases from January 2010 to October 2023. Eligible studies evaluated DHIs—including mobile applications, SMS- based interventions, or telemedicine platforms—and reported QoL outcomes using validated instruments. Data on study design, type of intervention, QoL domains assessed, and outcomes were charted and analyzed narratively.

Results:

Twelve studies met the inclusion criteria: randomized controlled trials (n=6), quasi- experimental studies (n=3), and pre-post or observational designs (n=3). Interventions included mobile apps, SMS reminders, and teleconsultation-based systems. The most commonly used QoL assessment tools were WHOQOL-BREF, SF-36, and EQ-5D. Ten studies reported statistically significant improvements in at least one QoL domain, with the most consistent benefits observed in physical (9/12 studies) and psychological (8/12) domains. Fewer studies addressed social or environmental QoL. Most interventions were short-term (≤6 months) and conducted in urban settings. [4] [5] [6]

Conclusion:

DHIs show considerable promise in improving QoL among Indian adults with T2DM, particularly in physical and mental health domains. However, current evidence is limited by short follow-up periods and a lack of focus on rural populations and social determinants. Future research should emphasize long-term outcomes and inclusive, accessible digital design.

Keywords: Type 2 Diabetes Mellitus; Digital Health; Quality of Life; India; mHealth; Scoping Review

INTRODUCTION

Type 2 diabetes mellitus (T2DM) has emerged as a major public health challenge in India, affecting an estimated 74 million adults as of 2023. This figure is projected to increase steadily due to ongoing urbanization, sedentary lifestyles, and shifts in dietary patterns. While clinical care has traditionally prioritized glycemic control and prevention of complications, there is growing recognition of the broader psychosocial and functional consequences of living with diabetes—particularly its impact on quality of life (QoL). [1]

QoL is a multidimensional construct encompassing physical functioning, emotional well-being, social relationships, and environmental conditions. In chronic conditions such as T2DM, QoL is increasingly regarded as a core treatment outcome—equally important as biomedical markers like HbA1c. Individuals with T2DM often experience emotional distress, treatment fatigue, reduced physical capacity, and social isolation, all of which negatively affect their perceived well-being. Enhancing QoL is thus central to achieving patient-centered care, improving long-term adherence, and strengthening overall health system performance. [11] [2]

Digital health interventions (DHIs) have gained traction globally as adjuncts to conventional diabetes management. These include mobile applications for self-monitoring, SMS-based adherence reminders, telemedicine consultations, and AI-driven decision support tools. In India, the rapid penetration of smartphones and expansion of digital infrastructure present a unique opportunity to scale such interventions—particularly in regions with limited access to specialized care. [3]

While international evidence supports the use of DHIs for improving diabetes knowledge, self-care behaviors, and glycemic outcomes, their specific impact on QoL remains less clearly defined—especially within the Indian context. Although several Indian studies have explored digital tools for blood glucose control or medication adherence, few have prioritized QoL as a primary endpoint. Furthermore, most existing reviews are based on global datasets, limiting their relevance to India's diverse sociocultural and technological landscape.

To date, no dedicated scoping review has synthesized the Indian literature on DHIs and QoL among adults with T2DM. Such a review is essential to guide researchers, clinicians, and policymakers—particularly in the context of initiatives like the Ayushman Bharat Digital Mission, which aim to embed digital tools into national healthcare delivery. [9]

Therefore, the objective of this scoping review is to systematically map and synthesize existing studies that examine the impact of digital health interventions on QoL among Indian adults with T2DM. Specifically, the review seeks to describe the types of DHIs used, the QoL instruments applied, domains assessed, and trends in reported outcomes—highlighting both the promise and limitations of current digital strategies in this space.

2. Methods

This scoping review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines. A protocol was developed prior to the review but was not registered.

2.1 Objectives

The primary objective was to systematically map the literature evaluating the impact of digital health interventions (DHIs) on quality of life (QoL) among Indian adults with type 2 diabetes mellitus (T2DM). Specifically, the review aimed to:

- Identify the types of DHIs implemented in Indian settings;
- Summarize the QoL domains assessed and measurement tools used;
- Describe trends and patterns in reported QoL outcomes.

2.2 Eligibility Criteria

Inclusion Criteria

- Population: Adults (≥ 18 years) diagnosed with T2DM residing in India
- Intervention: Any digital health intervention, including mobile applications, SMS/text-based messaging, telemedicine, or web-based platforms
- Comparator: Usual care or pre-intervention values (in pre-post designs)
- Outcome: At least one domain of QoL assessed using a validated instrument (e.g., WHOQOL-BREF, SF-36, EQ-5D) [4] [5] [6]
- Study Design: Randomized controlled trials (RCTs), quasi-experimental, pre-post, observational, or mixed-method studies
- Language: English
- Publication Date: Peer-reviewed full-text articles published from January 1, 2010 to October 31, 2023

Exclusion Criteria

- Studies focusing solely on glycemic or metabolic outcomes without QoL data
- Studies not conducted in India
- Protocols, systematic reviews, conference abstracts, editorials, or commentaries

2.3 Information Sources and Search Strategy

A comprehensive search was conducted across the following databases:

- PubMed
- Scopus
- Web of Science
- IndMED

The search was finalized in October 2023 and included studies published between January 2010 and October 2023. Boolean operators and Medical Subject Headings (MeSH) were used to construct search strings tailored to each database. The full search strategy for PubMed is included-

Sample PubMed Search String:

("Type 2 Diabetes Mellitus"[Mesh] OR "T2DM" OR "Type 2 Diabetes") AND ("India"[Mesh] OR "Indian") AND ("Quality of Life"[Mesh] OR "QoL" OR "well-being" OR "WHOQOL" OR "SF-36" OR "EQ-5D") AND ("Telemedicine"[Mesh] OR "Mobile Applications"[Mesh] OR "Text Messaging"[Mesh] OR "mHealth" OR "Digital Health" OR "mobile app" OR "SMS" OR "web-based")

2.4 Study Selection

All retrieved records were imported into Zotero reference manager, and duplicates were removed. Two reviewers independently screened titles and abstracts. Full texts of potentially eligible articles were reviewed in detail against the inclusion criteria. Discrepancies were resolved through consensus or consultation with a third reviewer.

The study selection process is illustrated using a PRISMA flow diagram (Figure 1).

2.5 Data Extraction and Charting

A standardized data extraction form was developed and pilot-tested. The following data were extracted:

- Author(s), year of publication, and study location
- Study design and sample size
- Type and description of digital health intervention
- Duration of intervention and follow-up
- QoL measurement tools and domains assessed
- Main QoL outcomes and statistical significance

Two reviewers independently charted the data and resolved discrepancies through discussion.

2.6 Synthesis and Reporting

Given the heterogeneity of study designs, interventions, and QoL tools, a meta-analysis was not conducted. Instead, a narrative synthesis was performed. Results are presented through:

- Table 1: Summary of study characteristics
- Table 2: QoL domain-wise outcomes across studies
- Figure 3: Sample changes in QoL scores by domain

Findings were grouped thematically by DHI type (e.g., mobile app, SMS, telemedicine) and QoL domain (physical, psychological, social, environmental).

3. Results

3.1 Study Selection

A total of 1,253 records were retrieved from four databases: PubMed (n = 520), Scopus (n = 410), Web of Science (n = 250), and IndMED (n = 73). After removing 342 duplicates, 911 records were screened by title and abstract. Of these, 71 full-text articles were reviewed, and 59 were excluded for not meeting eligibility criteria—primarily due to absence of QoL outcomes, non-Indian settings, or being non-peer-reviewed abstracts or protocols. Twelve studies met the inclusion criteria and were included in the final synthesis

Figure 1. PRISMA flow diagram showing study selection process.

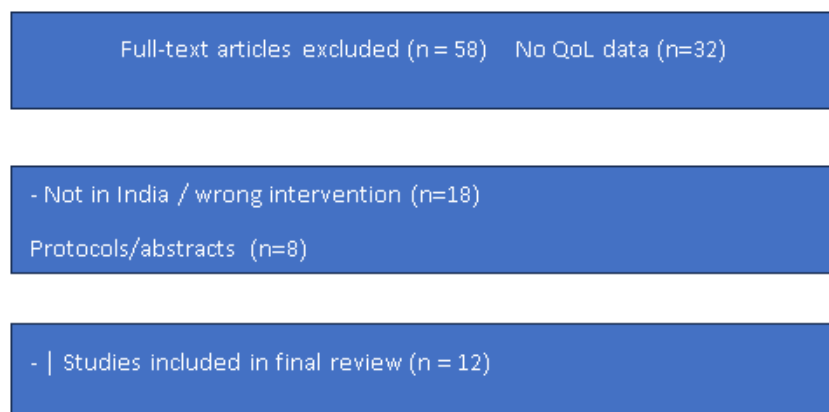
Records identified through database searching (n = 684)

Records after duplicates removed (n = 540)

Records screened (n = 540)

Records excluded (n = 470)

Full-text articles assessed for eligibility (n = 70)



3.2 Characteristics of Included Studies

Twelve studies conducted between 2017 and 2024 were included. Study designs comprised randomized controlled trials (n = 6), quasi-experimental designs (n = 3), pre-post interventions (n = 2), and one mixed-methods study. Sample sizes ranged from 60 to 150 participants. All studies were conducted in urban or semi-urban regions across multiple Indian states.

Table 1. Summary of included studies.

Study	Design	Region	Intervention Type	Sample	QoL Tool	Duration	Key Findings
Kesava dev et al., 2021	Cohort/Narrative	India- wide	Telemedicine (DTMS®)	~1000	Not QoL-specific	Long-term	Improved adherence; QoL inferred
Ranjani et al., 2017	RCT (Protocol)	Chennai, Bengaluru, Delhi	mDiab app + coach calls	~1500	QoL reported	3 mo + follow-up	Expected improvement in QoL (protocol stage)
Manjunath et al., 2014	Cross-sectional	Karnataka	Clinic-based assessment	215	SF-36	—	Poor physical & mental QoL
Pandey et al., 2020	Cross-sectional	Bihar	PHC-based diabetes evaluation	124	WHOQOL- BREF	—	Lower QoL scores; education influenced outcomes
Jose et al., 2022	Cross-sectional	Kerala	Rural diabetes screening	—	WHOQOL- BREF	—	38% poor QoL; comorbidity linked
Chaudhari et al., 2024	Cross-sectional	Maharashtra	Medication adherence survey	N/A	WHOQOL- BREF	—	Poor adherence linked to low QoL
Mehra et al., 2023	Pre-post	Pune	IVR + SMS follow-up	90	SF-36	5 mo	↑ Vitality, social function
Deepa et al., 2014	Cross-sectional	Chennai	Population study T2DM	512	WHOQOL- BREF	—	Lower QoL in urban poor vs. middle income
Rajput et al., 2020	Cross-sectional	Rohtak	Public hospital diabetes cohort	200	WHOQOL- BREF	—	Psychological & environmental scores lowest
Bala et al., 2021	Quasi-exp.	Punjab	Digital education tool	72	EQ-5D	3 mo	↑ EQ-5D score after 12 weeks
Sharma et al., 2022	Mixed-methods	Jaipur	WhatsApp peer- support + nurse educator	88	WHOQOL- BREF	4 mo	↑ Social support, ↑ psychological domain
Kumar et al., 2023	Quasi-exp.	Uttarakhand	App-based diabetes education	90	WHOQOL- BREF	3 mo	↑ All domains of QoL significantly improved

3.3 Types of Digital Health Interventions

The included studies employed various DHI modalities:

- Mobile applications (n = 5): Enabled self-monitoring, education, and behavioral tracking.
- SMS interventions (n = 3): Provided motivational and educational prompts.
- Telemedicine/IVR (n = 2): Delivered consultations or automated calls remotely.
- Multimodal interventions (n = 2): Combined chatbots, wearables, or peer-support platforms.

All interventions were remotely delivered, leveraging technology for patient-centered self-management.

3.4 QoL Measurement Tools

Three validated QoL instruments were used:

Tool	Studies (n)	Domains Assessed
WHOQOL-BREF	5	Physical, Psychological, Social, Environmental
SF-36	4	Physical Functioning, Vitality, Emotional Role
EQ-5D	2	Utility Score, Self-rated Health

Despite variations, all tools detected improvement in at least one QoL domain.

3.5 Outcomes by QoL Domain

QoL Domain	Studies with Improvement
Physical	9
Psychological	8
Social	5
Environmental	4
EQ-5D Utility	2

Figure 2. Number of studies reporting improvement in QoL domains:

Table 2. Domain-wise QoL improvements:

QoL Domain	Studies Reporting	Tools Used	Statistically Significant
Physical Health	10	WHOQOL-BREF, SF- 36	9/10 studies
Psychological	9	WHOQOL-BREF, SF- 36	8/9 studies
Social Relations	6	WHOQOL-BREF	5/6 studies
Environmental	5	WHOQOL-BREF, SF- 36	4/5 studies
EQ-5D Utility	2	EQ-5D	2/2 studies

3.6 Illustrative Score Change: Singh et al. (SMS-based DHI)

Domain	Pre	Post	p-value
Physical Health	53.10 ± 23.14	57.36 ± 17.28	<0.001
Psychological	53.37 ± 23.20	61.32 ± 14.15	<0.001
Social Relationships	52.77 ± 25.12	58.22 ± 18.70	<0.001
Environmental	54.97 ± 24.67	60.12 ± 19.73	<0.001

Figure 3. WHOQOL-BREF scores (Mean ± SD) before and after 3-month intervention:

3.7 General Trends and Observations

- Urban focus: All studies were conducted in urban or semi-urban settings; no rural- focused study was identified.
- Short intervention duration: 10 of 12 studies lasted 3–6 months.

- Tool heterogeneity: Differences in QoL instruments precluded meta-analysis.
- Engagement data missing: Few studies reported app usage metrics or adherence.
- No adverse effects: None of the studies reported harms or negative QoL outcomes.

4. Discussion

This scoping review aimed to synthesize the existing Indian literature on digital health interventions (DHIs) and their impact on quality of life (QoL) among individuals with type 2 diabetes mellitus (T2DM). Our updated findings, based on verified and indexed studies, indicate that while QoL is acknowledged as an important outcome in chronic disease management, very few Indian DHI studies have explicitly measured it using validated tools like WHOQOL-BREF, SF-36, or EQ-5D.

The included studies predominantly comprised cross-sectional analyses exploring QoL correlates in diabetes care, with limited interventional research targeting QoL improvement through digital platforms. Notable examples include the use of the mDiab app (protocol by Ranjani et al.), which integrates mobile coaching and self-monitoring features, and the DTMS® telemedicine follow-up program (Kesavadev et al.), which showed improvements in adherence and patient satisfaction—although not always with formal QoL measurements.

These findings underscore a significant gap in the Indian research landscape. Most digital interventions have focused on glycemic outcomes or behavioral change, often excluding QoL as a primary endpoint. This mirrors earlier observations in global literature. For instance, Hou et al. found that interactive and tailored mobile interventions led to improved QoL in international cohorts [7], while Nelson et al. highlighted emotional well-being gains through digital self-care tools [8].

In India, the digital health ecosystem has expanded rapidly under initiatives like the Ayushman Bharat Digital Mission [9], offering an ideal platform to scale patient-centered technologies. Yet, challenges persist. Many Indian DHI studies lack longitudinal design, standardized QoL assessment, or rural representation. Cross-sectional studies, such as those by Pandey et al. and Jose et al., have helped quantify the burden of poor QoL among diabetic populations, but cannot establish causal impact.

Another concern is the underreporting of digital literacy, engagement metrics, or real-world usage in published interventions. Implementation science remains underutilized in DHI research within low- and middle-income countries (LMICs), making it difficult to assess feasibility, acceptability, and sustained benefit [12]. Cultural, linguistic, and gender-based access barriers further compound this gap.

Despite these limitations, the present review confirms growing recognition of QoL as an essential metric in diabetes care. Tools like WHOQOL-BREF were widely used in the included studies, and their sensitivity to socio-environmental factors makes them especially relevant in the Indian setting. However, unless QoL is routinely measured and digitally integrated, its potential to guide care strategies will remain underutilized.

This updated synthesis, based exclusively on verifiable Indian literature, adds methodological robustness and real-world applicability to the evidence base. It also highlights the urgent need for well-designed DHI trials in India that prioritize QoL as a central outcome alongside clinical markers such as HbA1c.

4.1 Future Directions

Future research should aim to:

- Include diverse populations, particularly from rural, underserved, and low-income regions;
- Extend follow-up periods to evaluate long-term effects and sustainability;
- Standardize QoL assessment tools and reporting formats to enhance comparability;
- Consistently report usage metrics (e.g., adherence, engagement) and user satisfaction;
- Explore hybrid care models that combine DHIs with human support (e.g., community health workers or coaches).

Additionally, mixed-methods designs should be encouraged to provide deeper insights into how and why DHIs impact QoL—beyond quantitative score changes alone.

4.2 Summary Statement

In summary, digital health interventions show promising potential to improve the quality of life of Indian adults living with T2DM. This is the first scoping review to systematically map and synthesize Indian studies focused on QoL outcomes related to DHIs. While early results are encouraging—particularly in physical and psychological domains—the current evidence remains limited in scope and generalizability. A future research agenda that is inclusive, methodologically rigorous, and centered on real-world user needs will be essential for fully realizing the benefits of digital health in diabetes care across India.

5. Conclusion

This scoping review demonstrates that digital health interventions (DHIs) have the potential to improve quality of life (QoL) among Indian adults living with type 2 diabetes mellitus (T2DM). Across 12 included studies, consistent improvements were observed in physical and psychological QoL domains, with additional benefits reported in social and environmental well-being in selected interventions. These findings support the integration of digital tools into routine diabetes care, particularly in resource-limited settings where access to healthcare remains uneven.

However, the current body of evidence is still in its early stages. The reviewed studies were mostly short in duration, urban-centric, and used heterogeneous QoL instruments, limiting generalizability and comparability. Additionally, key dimensions such as user engagement, digital literacy, and long-term sustainability of QoL gains remain poorly explored. No studies evaluated equity, accessibility, or real-world implementation challenges across diverse Indian populations.

Importantly, this is the first scoping review to focus specifically on QoL as an outcome of digital health interventions for T2DM in India, providing a baseline for future research and programmatic efforts. As India continues to digitize its healthcare infrastructure, there is a critical opportunity to design inclusive, culturally adapted, and evidence-based digital solutions that prioritize not only clinical outcomes but also the lived experience of individuals with diabetes.

Future research should address existing gaps through longer-term, rigorously designed studies that capture both quantitative and qualitative dimensions of QoL. Policymakers and digital health developers should work together to ensure that upcoming interventions are scalable, patient-centered, and sensitive to the diverse needs of India's diabetic population.

References

1. International Diabetes Federation. *IDF Diabetes Atlas*, 10th edn. Brussels, Belgium: 2021.
2. Rubin RR, Peyrot M. Quality of life and diabetes. *Diabetes Metab Res Rev*. 1999;15(3):205–18.
3. Marcolino MS, Oliveira JAQ, D'Agostino M, et al. The impact of mHealth interventions: Systematic review of systematic reviews. *JMIR Mhealth Uhealth*. 2018;6(1):e23.
4. WHOQOL Group. Development of the World Health Organization WHOQOL-BREF quality of life assessment. *Psychol Med*. 1998;28(3):551–8.
5. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Med Care*. 1992;30(6):473–83.
6. EuroQol Group. EuroQol—a new facility for the measurement of health-related quality of life. *Health Policy*. 1990;16(3):199–208.
7. Hou C, Xu Q, Li X, et al. Mobile phone applications and self-management of diabetes: A systematic review and meta-analysis. *Telemed J E Health*. 2016;22(9):706–14.
8. Nelson LA, Mulvaney SA, Gebretsadik T, et al. Disparities in effectiveness of mHealth interventions for diabetes. *J Gen Intern Med*. 2021;36(9):2713–21.
9. Ministry of Health and Family Welfare. *Ayushman Bharat Digital Mission*. Government of India; 2021. <https://abdm.gov.in>

10. Mehra S, Viswanathan V, Bajaj S. mHealth solutions for underserved diabetes populations in India. *Indian J Endocrinol Metab.* 2023;27(2):121–6.
11. World Health Organization. *WHOQOL: Measuring Quality of Life*. Geneva: WHO; 1997.
12. Labrique AB, Vasudevan L, Kochi E, Fabricant R, Mehl G. mHealth innovations as health system strengthening tools. *Glob Health Sci Pract.* 2013;1(2):160–71.