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REVIEW

Community-Based Models for Type 2 Diabetes Care: A Review of Effectiveness, Implementation, and Health System Integration

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ABSTRACT

***Introduction*:** Type 2 diabetes mellitus (T2DM) presents a major challenge in low- and middle-income countries (LMICs) due to workforce shortages, limited primary-care capacity, and fragmented chronic-care delivery. Community-based diabetes care models have emerged as scalable approaches to strengthen self-management and extend service reach. With this background, we aimed to synthesize global evidence on community-based diabetes care models, classify major intervention typologies, examine their alignment with the diabetes care continuum, and assess their effectiveness and implementation characteristics.

***Methods*:** A narrative review was conducted using a structured search of PubMed, Scopus, Web of Science, and Embase for studies published between January 2010 and March 2025. Eligible studies focused on community-based T2DM interventions delivered by community health workers (CHWs), peer educators, or digital-community hybrids. Interventions were categorized and mapped across the diabetes care continuum, and evaluated using the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework, as well as complementary integration models.

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Results: Eleven studies were included, in which peer-led models were common in high-income countries, while CHW-led and hybrid models were predominant in LMICs. Interventions demonstrated clinically significant improvements in glycated hemoglobin (HbA1c), BMI, and self-efficacy. Successful models embedded within existing public health systems or culturally rooted community platforms showed higher adoption and long-term maintenance. Digital interventions enhanced reach, but faced challenges with sustained engagement and infrastructure support. The RE-AIM analysis revealed strong effectiveness and reach; however, long-term maintenance and adoption varied based on the level of contextual integration and supervision structures.

Conclusion: Community-based T2DM care models offer scalable, sustainable strategies to improve disease control. Integration into national health platforms, supportive supervision, and digital augmentation enhance implementation success. Challenges persist in follow-up, cost-effectiveness, and equity design; scale-up should prioritize integration, financing, and CHW capacity.

Keywords: Community-based care; Type 2 diabetes; Health system integration; Implementation science; Community health workers (CHWs)

Key Summary Points

Community-based diabetes care models improve glycemic control, self-management, and patient engagement in people with type 2 diabetes mellitus.
Programs led by community health workers, peers, or digital-community hybrids are feasible, scalable, and culturally adaptable.
Integration into existing health systems enhances sustainability and policy uptake.
Supportive supervision, fair incentives, and digital tools strengthen implementation and long-term maintenance.
These models offer an equity-driven, people-centered approach to expand diabetes care in resource-limited settings.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a leading contributor to the global burden of noncommunicable diseases (NCDs), affecting over 537 million adults worldwide [1]. Its prevalence is disproportionately high and growing rapidly in low- and middle-income countries (LMICs) [2]. Health systems in many LMICs face persistent structural constraints that undermine effective diabetes care. These include shortages of physicians and nurses, high patient-to-provider ratios, inadequate continuity of care, and limited access to diagnostics and medications at the primary care level. Service delivery is often facility-centric, requiring repeated visits that are difficult for rural and low-income populations due to travel costs and lost wages. Fragmented referral pathways, weak health information systems, and insufficient financing further impede long-term follow-up for chronic diseases. Also, traditional facility-based models of care struggle to address the lifelong, behaviorally rooted, and socially mediated nature of diabetes management [3]. As a result, large segments of the population remain undiagnosed, poorly controlled, or disengaged

from care, underscoring the need for decentralized models that can extend the reach of overstretched health systems and bridge gaps that facility-based care cannot address.

In response, community-based models have emerged as promising solutions to bridge the gap between health systems and people living with diabetes [4]. These models are particularly relevant for LMICs, where primary care systems remain chronically under-resourced and require task-shifting, decentralization, and culturally aligned approaches to reach dispersed and underserved populations. These models engage non-physician providers, including community health workers (CHWs), peer educators, and lay navigators, to deliver preventive, diagnostic, and management support directly within community settings. The CHWs are trusted front and mid-level health workers. They typically receive short, competency-based training to provide health education, screening, referral, follow-up, and support for self-management of chronic conditions. Unlike physicians or nurses, CHWs do not hold formal clinical degrees; instead, their effectiveness relies on cultural familiarity, local language fluency, and strong community relationships. In diabetes care, CHWs commonly conduct lifestyle counseling, home visits, glucose monitoring support, treatment adherence reinforcement, and linkage to primary care facilities. Therefore, CHWs represent a pragmatic and scalable workforce for chronic disease programs, especially where specialist or physician-led diabetes care is not feasible. Global interest in community-based diabetes care has grown in parallel with calls for more integrated, people-centered primary care models [5]. However, the design and delivery of these models vary substantially across countries, resulting in mixed implementation quality and inconsistent long-term outcomes.

While individual studies and pilot programs have demonstrated the feasibility and impact of community-based diabetes interventions, implementation remains variable [6–14]. A 2025 multi-site randomized controlled trial demonstrated that peer-support groups significantly improved glycemic control, self-efficacy, and treatment adherence among people with T2DM [6]. Similarly, in Pakistan, the integration of the chronic care model (CCM) into the existing lady health worker (LHW) network led to meaningful gains in diabetes control, continuity of care, and patient empowerment, underscoring the feasibility of embedding evidence-based frameworks into national community health platforms [10]. Despite these promising results, the adoption and scale-up of community-based diabetes interventions remain uneven [15]. Programs vary widely in delivery structure, intensity, supervision, digital integration, and alignment with national health systems [16]. Moreover, existing reviews of community-based diabetes interventions have largely focused on clinical outcomes and have not compared the performance of different models across diverse health system contexts. Critically, very few studies have examined implementation quality, scalability, or long-term sustainability factors that determine whether successful pilot programs can be institutionalized within routine care. Policymakers in many LMICs therefore lack clear guidance on which intervention types are most appropriate for their populations, workforce constraints, and digital readiness. Therefore, a nuanced understanding of which models work, in what settings, and under what conditions is crucial for guiding future policy and investment [17]. With this background, we reviewed the available global literature to synthesize evidence associated with community-based diabetes care models. Our specific objectives were to classify the major intervention typologies, examine their alignment with key stages of the diabetes care continuum, and assess their effectiveness and implementation strategies. We also evaluated the extent to which these models were integrated within existing health systems and their potential for scale-up. The emerging findings intend to inform policy, enhance program design, and guide future research toward more equitable and sustainable community-based diabetes care.

METHODS

We employed a narrative review approach to compile available evidence on the experiences

associated with community-based diabetes care models, as it facilitated the accommodation of heterogeneity in study designs, populations, delivery agents, and contextual determinants that precluded meta-analytic pooling. The focus was on interventions that engaged non-physician providers, such as CHWs, peer educators, or digital-community hybrids, to deliver preventive, diagnostic, or therapeutic diabetes services within community settings.

Search Strategy and Data Sources

A structured literature search was conducted to identify peer-reviewed articles published in English between January 2010 and March 2025. The following databases were searched: PubMed, Scopus, Web of Science, and Embase. Search terms included combinations of keywords and Medical Subject Headings such as "diabetes," "community-based care," "community health workers," "peer support," "digital health," "diabetes self-management," "implementation," and "integrated care." Additional studies were identified through backward citation tracking and expert consultation.

Selection and Inclusion Criteria

Given the narrative nature of this review, a purposive sampling approach was employed rather than the strict inclusion criteria typically used in systematic reviews. Studies were included if they described the design, implementation, outcomes, or integration of a community-based diabetes intervention. Randomized controlled trials (RCTs), quasi-experimental studies, implementation protocols, and feasibility evaluations from high and intensive care (HIC) as well as LMICs were included. This was done intentionally to mitigate and address the biases inherent in the narrative synthesis of literature. We believe that including a diverse range of studies enables us to represent variation in geographic settings, delivery agents, and health system structures. Inferences were triangulated using frameworks from implementation science. Articles focusing solely on facility-based or pharmacological interventions without a community component were excluded.

Data Extraction and Synthesis Approach

Key data were extracted using a standardized template that captured the following domains: geographic setting, intervention typology, delivery agent (e.g., CHW, peer, nurse), target population, primary outcomes (clinical or behavioral), and health system integration status. A thematic analysis approach was employed to analyze findings. Initial screening and data extraction were conducted independently by two reviewers, with discrepancies resolved through discussion or consultation with a third reviewer. Although formal PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagrams are not required for narrative reviews, a descriptive account of study identification, screening, and inclusion was maintained to enhance transparency.

Interventions were categorized into broad typologies based on the method of delivery. These were mapped against the key stages of the diabetes care continuum: risk identification, diagnosis, self-management support, clinical decision support, medication optimization, and long-term follow-up. Some narrative reviews strengthen contextual insights by also drawing from policy documents, program evaluations, and WHO/UN reports. Outcomes of interest included glycemic control (glycated hemoglobin, HbA1c), anthropometric measures [body mass index (BMI), and blood pressure (BP)], patient self-efficacy, implementation fidelity, adoption, and long-term sustainability.

To assess the effectiveness, implementation strategies, real-world relevance of each model, integration, and scalability of the community-based models tested in the included studies into healthcare systems, we applied the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework, as it enables a systematic evaluation of real-world performance beyond clinical outcomes. RE-AIM examines whether an intervention reaches its target population, produces meaningful effects,

is adopted by health systems, can be implemented with fidelity, and is maintained over time. This makes it particularly suitable for community-based and primary-care models implemented in heterogeneous settings, where contextual factors, workforce constraints, and health system readiness strongly influence outcomes. Given the diversity of delivery platforms, cadres, and integration levels in the included studies, RE-AIM provided a suitable framework for comparing models across implementation, external validity, and sustainability dimensions. Supplementary interpretation was informed by implementation science constructs (e.g., cultural adaptation, supervision, and financing mechanisms) and health system integration frameworks such as the WHO's Integrated People-Centred Health Services (IPCHS) and the CCM [18, 19]. Overall, the RE-AIM framework was selected for its suitability in evaluating the real-world impact of public health interventions, while CCM and IPCHS provided structured lenses for examining integration into primary care and system-level delivery [20]. The authors brought interdisciplinary expertise in public health, health systems research, and community engagement to the review. We acknowledge the need for culturally grounded interpretations and aim to represent diverse geographic and population perspectives.

This review adheres to the principles of quality reporting as outlined in the SANRA (Scale for the Assessment of Narrative Review Articles) guidelines [21]. A structured search was conducted, and findings were synthesized using conceptual and implementation frameworks. Data were organized using typologies and mapped across the diabetes care continuum, with results presented in summary tables to enhance interpretability and transparency.

Ethical Approval

This article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

RESULTS

The current review included 11 core studies, representing diverse geographical and health system contexts (Table 1). The majority were conducted in North America (58.3%), primarily in the United States of America [8, 9, 12–14, 22] [23], while only a few originated from South Asia (16.7%)[10, 24], Southeast Asia (8.3%) [7], East Asia (8.3%) [6], and Sub-Saharan Africa (8.3%) [24]. Among the included studies, randomized controlled trials (RCTs) were the most frequently used design (n = 8), including individual RCTs [8, 11–14, 23] and cluster RCTs [24]. Study durations ranged from short 12-week pilots [9] to more extensive 24-month implementations [6, 13, 24] (Table 2). Sample sizes varied widely, ranging from small pilot cohorts (n = 15 in Li et al.) to large-scale trials (n = 1007 in Thankappan et al.). Intervention models were heterogeneous, including peer-support [23], CHW + digital hybrids [8, 12, 24], CHW-led interventions [10, 14], CHW + app-enabled programs [6], CHW + telehealth [13], a peer versus CHW comparative design [23], a multidisciplinary team approach [7], and a lifestyle-focused peer-led program [24]. The primary outcome focus was clinical (33.3%), with other studies evaluating combined clinical and behavioral outcomes (25.0%)[8, 14, 24], behavioral and psychosocial outcomes (16.7%)[6], satisfaction-linked outcomes (8.3%) [9], or behavioral outcomes only (8.3%) [23]. One study did not explicitly report its outcome domain [13]. Half of the studies (58.3%) explicitly employed the RE-AIM implementation framework [6–9, 14, 22, 24].

Table 2 outlines the key characteristics of the included studies. The study interventions showed improvements in various patient-reported outcomes. In LMICs, models such as Pakistan's CCM [10] and the Kerala lifestyle peer-support program in India have demonstrated significant reductions in HbA1c (– 0.83%) and improvements in diet and lifestyle behaviors [24]. Similarly, Debussche et al. reported clinically meaningful reductions in HbA1c (– 1.05%), BMI, and waist circumference during a peer-led diabetes self-management education and support (DSME) intervention conducted in Mali

Table 1 Key characteristics of the studies included in the review

Variable	Variable category	Number of studies	Percentage of studies (%)
Country/region	North America	7	58.3
	South Asia	2	16.7
	Sub-Saharan Africa	1	8.3
	East Asia	1	8.3
	Southeast Asia	1	8.3
Country classification	HIC	8	66.7
	LMIC	4	33.3
Study design	Implementation study	9	75.1
	RCT	3	24.9
Implementation framework	RE-AIM	7	58.3
	Not reported	5	41.7
Category of intervention	Peer-support	3	25.0
	CHW + digital	2	16.7
	CHW-led	2	16.7
	Peer vs. CHW	1	8.3
	CHW + app-enabled	1	8.3
	CHW + telehealth	1	8.3
	Multidisciplinary team	1	8.3
	Lifestyle peer-led	1	8.3
Duration	Mid-term (6–12 months)	6	50.0
	Short-term (< 6 months)	6	50.0
Outcome focus	Clinical	4	33.3
	Clinical + behavioral	3	25.0
	Behavioral + psychosocial	2	16.7
	Clinical + satisfaction	1	8.3
	Behavioral	1	8.3
	Not reported	1	8.3

Table 1 continued

Variable	Variable category	Number of studies	Percentage of studies (%)
Equity focus	Yes (low-income)	2	16.7
	Yes (Latino, underserved)	2	16.7
	Yes (rural LMIC)	2	16.7
	Yes (Medicaid-insured)	1	8.3
	Yes (national CHW)	1	8.3
	Yes (LMIC, high-risk)	1	8.3
	No	3	25.0

[11]. Digital tools [7] and structured self-management support were also utilized. Spencer et al. and Nelson et al. showed improved HbA1c and self-care behaviors through CHW-delivered DSME and mobile health (mHealth) reinforcement [12, 14]. Whitehouse et al. and Li et al. highlighted the effectiveness of culturally tailored digital interventions for underserved Latino populations, which increased engagement, satisfaction, and weight management despite minimal changes in HbA1c levels.[8, 9] Meanwhile, Sharp et al. evaluated a clinical pharmacist-CHW collaborative care model, which benefitted lipid management but did not produce significant changes in HbA1c [13]. The reviewed interventions demonstrated variation in delivery mechanisms classified into three core typologies: peer-support group models, CHW-led programs, and hybrid digital-community interventions (Fig. 1):

- *Peer-Support Models*: Of the included studies, such models were predominantly implemented in HIC and middle-income contexts and relied on trained peers to deliver structured education and psychosocial support. Such interventions demonstrated sustained improvements in HbA1c and diabetes distress through CHW-led DSMES, combined with peer leadership [14], and found significant reductions in HbA1c and BMI over a year [11].
- *CHW-led models* were common in LMICs and focused on task-shifting to extend the reach of diabetes care. The LHW-CCM in Pakistan depicted significant improvements in glycemic control and BMI [10]. Similarly, the multidisciplinary CHW-based program in Thailand, integrated diabetes and hypertension management, demonstrating clinical and service utilization gains.[7]
- *Hybrid Digital-Community Models* included CHW support interventions supported with digital technologies such as SMS reminders, mHealth apps, and telehealth. Whitehouse et al. used CHW-peer leader hybrids combined with mobile support, leading to HbA1c improvement and enhanced self-efficacy [8]. Likewise, the app-based model implemented by Li et al. among rural Latino adults achieved high retention, weight loss, and feasibility [9].

Furthermore, we segregated the interventions across the entire diabetes care continuum to visualize the scope of these interventions across six major domains, spanning from early identification and risk stratification to long-term follow-up and maintenance.

1. *Community-Based Risk Identification*: LMIC-based interventions emphasized early identification using community screening, risk scores, and glucometers. These upstream approaches often included awareness generation. [7, 10, 24]
2. *Structured DSME*: Studies from Thailand and Pakistan delivered structured education on lifestyle, medication, and diet through

Table 2 Clinical characteristics of the included studies that evaluated community-led diabetes interventions

Author, year	Country	Study duration	Study design	Sample size	Model type	Objective/ outcome assessed	Key outcomes	Key learning from the model
Liu et al. 2025 [6]	China	24 months	Quasi-experimental	967	Community-based peer support model	To evaluate the effectiveness of a 24-month peer-support intervention for diabetes management in community settings	Significant improvements in HbA1c, BMI, fasting glucose, depressive symptoms	Culturally tailored peer support is effective in improving clinical and psychosocial outcomes and is robust across age and gender groups
Boocha et al. 2023[7]	Thailand	6 months	Mixed-method	41	Community-based primary care model with multidisciplinary team	To evaluate the impact of diabetes and hypertension care integration within primary care services through community-based teams	Improved metabolic parameters, increased service utilization, community trust, provider engagement	Decentralized, community-involved approaches are feasible, acceptable, and can improve access and clinical outcomes in NCD care
Whitehouse et al. 2022[8]	USA	6 months	RCT	150	CHW and peer-led digital hybrid	To assess the implementation of a culturally tailored digital diabetes self-management intervention led by CHWs and peer leaders in underserved populations	HbA1c decreased from 9.89% to 8.96% ($p < 0.001$); increased diabetes self-efficacy, diabetes distress improved, enhanced self-care behaviors	Combining CHW and peer delivery with mobile-based support improves glycemic control and engagement among underserved urban patients, especially when digital access barriers are addressed

Table 2 continued

Author, year	Country	Study duration	Study design	Sample size	Model type	Objective/ outcome assessed	Key outcomes	Key learning from the model
Li et al. 2022 [9]	USA	12 weeks	Quasi-experimental	15	CHW-led mHealth diabetes self-management education and support (DSMES)	Assess feasibility of mHealth-based DSMES to reduce health disparities in rural Latino adults with T2DM	93% retention; high satisfaction; modest weight loss (3.5 kg, $p = 0.001$); no significant change in HbA1c	mHealth-based DSMES, facilitated by CHW, is feasible and acceptable for rural Latino populations, with weight loss as a key outcome
Ansari et al., 2022[10]	Pakistan	6 months	Quasi-experimental	30	Chronic care model (CCM)	Assess effect of self-management support and delivery system design on T2DM outcomes in rural Pakistan	Significant improvement in HbA1c (− 0.83%), BMI, self-care; gender-specific variations noted	Implementing core CCM elements improves diabetes control in rural low-resourcesettings
Debussche et al. 2018 [11]	Mali	12 months	RCT	151	Structured peer-led diabetes self-management education (DSME)	Evaluate the effectiveness of peer-led structured SME in improving glycemic control among patients with T2DM in a low-income setting	Significant reduction in HbA1c (-1.05%), BMI (-1.65 kg/m^2), and waist circumference (− 3.34 cm) over 12 months; improved diabetes knowledge scores	Culturally tailored, structured peer-led education can improve diabetes outcomes in resource-limited settings with high fidelity and community engagement

Table 2 continued

Author, year	Country	Study duration	Study design	Sample size	Model type	Objective/ outcome assessed	Key outcomes	Key learning from the model
Spencer et al. 2018[14]	USA	18 months	RCT	222	CHW-led DSME + peer leader support	Evaluate CHW-led DSME program followed by peer-led support for sustaining diabetes outcomes in Latino adults	Improved HbA1c (− 0.45% at 6 months, − 0.76% at 18 months), reduced diabetes distress and depressive symptoms, improved diabetes understanding and support	Combination of CHW and peer support maintained diabetes improvements long-term in underserved populations
Sharp et al. 2018 [13]	USA	24 months	RCT	244	Collaborative care: clinical pharmacist + CHW	Evaluate effectiveness of adding CHW support to clinical pharmacist management for glycemic control in underserved populations	No significant difference in HbA1c between groups; greater lipid-lowering medication intensification with CHW; modest improvements in DBP	Multidisciplinary models may have differential benefits; CHW role in contextual support, but not directly improving HbA1c in this setting
Nelson et al. 2017 [12]	USA	12 months	RCT	287	Peer-support CHW model with mHealth	To evaluate community-based DSMES with text message reinforcement	Improved HbA1c (-0.8%), increased knowledge, improved self-efficacy and adherence	Combining CHW support with mHealth reinforcement is feasible and culturally acceptable

Table 2 continued

Author, year	Country	Study duration	Study design	Sample size	Model type	Objective/ outcome assessed	Key outcomes	Key learning from the model
Tang et al. 2014 [23]	USA	18 months	RCT	116	Peer-led support vs. CHW support after DSME	Compare effectiveness of peer leader vs. CHW support models in sustaining HbA1c improvements post-DSME in Latino adults with T2DM	Both groups maintained HbA1c improvements at 12 months; only PL group sustained at 18 months. BP improvement only in PL group	Peer-led DSMS can be a sustainable, low-cost alternative for ongoing diabetes support, especially effective in sustaining clinical outcomes
Thankappan et al. 2013 [24]	India	24 months	Cluster RCT	1007	Peer-support lifestyle intervention model	Evaluate the effectiveness of a peer-led lifestyle intervention in reducing risk factors for diabetes and CVD in Kerala, India	Significant improvements in physical activity, fruit and vegetable intake, and reduction in tobacco and alcohol use in the intervention group	Trained peer leaders can effectively deliver community-based lifestyle interventions to reduce diabetes and CVD risk

CHW Community Health Worker

CHWs or CCM platforms and led to measurable behavioral and clinical outcomes.

3. *Initial Diagnosis and Linkage to Care*: Studies from China [6], the USA [12, 14], and Mali [11] exemplify CHW-facilitated referral and digital registration systems that support timely linkage to care.
4. *Ongoing Monitoring and Clinical Decision Support*: Real-time symptom monitoring, glucose tracking, and feedback loops were central to the models by Liu et al., Boocha et al., and Nelson et al. [6, 7, 12].
5. *Treatment Optimization (including medications)*: Only a few studies engaged CHWs in medication adherence and titration support [10, 13].
6. *Long-Term Follow-Up and Maintenance*: Sustained behavioral changes were achieved through longitudinal engagement in interventions that emphasized cultural tailoring and community trust [6, 11, 14, 23, 24].

The RE-AIM framework offers a structured lens to assess the real-world scalability and sustainability of community-based diabetes care models. The 12 interventions reviewed (Table 3) highlight several cross-cutting themes and contextual nuances.

- *Reach*: Most interventions demonstrated high reach within their target populations. For instance, Liu et al. enrolled over 900 participants in a multi-level peer-support program across China [6]. Similarly, Boocha et al. implemented their model across multiple rural districts in Thailand, leveraging decentralized community engagement [7]. In the USA, CHW-led digital and hybrid interventions effectively reached underserved Latino and African American communities, with high retention rates [8, 12].
- *Effectiveness*: CHW-based interventions demonstrated meaningful improvements in clinical and behavioral outcomes. The Pakistan CCM model demonstrated significant reductions in HbA1c (– 0.83%) and BMI over a 6-month period [10]. The ST2EP trial also documented improvements in HbA1c, BMI, and diabetes knowledge [11]. Few studies depicted improvements in diabetes distress, medication adherence, and self-efficacy [12, 14].
- *Adoption*: Adoption was highest where programs aligned with existing health systems. Boocha et al. embedded their model within a public primary care network with multisectoral coordination [7]. Spencer et al. and Nelson et al. leveraged Federally Qualified Health Centers (FQHCs) in the U.S., while Ansari et al. utilized Pakistan's LHW platform [10, 12, 14]. Peer-led interventions were community-driven, with local volunteers trained as leaders boosting acceptability [24].
- *Implementation*: Structured protocols, culturally tailored materials, and a trained workforce underpinned strong implementation fidelity. Studies such as Whitehouse et al. and Debussche et al. adapted content using RE-AIM or similar frameworks and incorporated local feedback [8]. Models like those of Liu et al. utilized tiered or remote delivery mechanisms (such as Zoom and hybrid formats) to ensure flexibility [6]. However, some interventions, especially digital ones, faced challenges in sustaining engagement across delivery cycles [9].
- *Maintenance:* Sustainability varied across models. Spencer et al. and Tang et al. demonstrated long-term improvements over 12–18 months [14, 23]. Pakistan's CCM model and the Kerala Diabetes Prevention Program (DPP) showed sustainability through integration into national platforms [24]. In contrast, short-term interventions, such as those studied by Li et al. or those implemented during the COVID-19 period, demonstrated feasibility but lacked follow-up data.[6] The ST2EP trial maintained gains over one year despite political instability, underscoring the resilience of community-embedded strategies [11].

Overall, the most scalable and sustainable models were those embedded in existing public systems and driven by community participation. Pakistan's LHW program, Thailand's integrated CHW-primary care model, and U.S. programs aligned with FQHCs demonstrated high potential for institutionalization. Peer-led models in

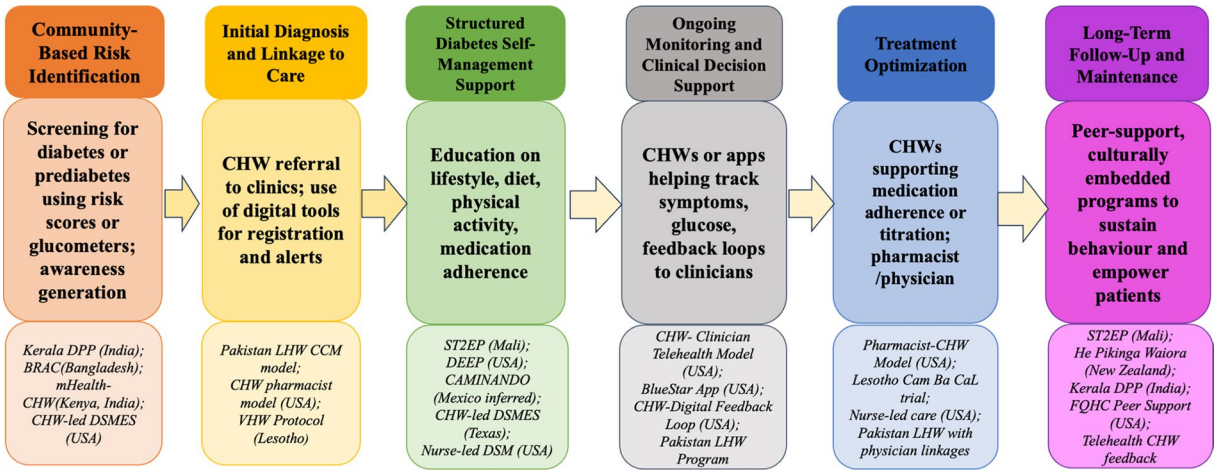

Fig. 1 Mapping community-based diabetes care models across the care continuum. *BRAC* Bangladesh Rural Advancement Committee, *CAMINANDO* Community-based Diabetes Intervention (Mexico), *CCM* chronic care model, *CHW* community health worker, *DEEP* diabetes education and empowerment program, *DPP* Diabetes Prevention Program, *DSM* diabetes self-management, *DSMES* diabetes self-management education and support, *FQHC* Federally Qualified Health Center, *LHW* lady health worker, *mHealth* mobile health, *VHW* village health worker, *ST2EP* Steps to Prevent Diabetes Program (Mali)

Kerala (India) and the USA. were particularly effective in low-resource or marginalized populations. Meanwhile, digital innovations have shown promise in terms of reach and flexibility, but they require better infrastructure, sustained engagement strategies, and policy integration to ensure long-term viability.

DISCUSSION

This review highlights four key findings with implications for the delivery of diabetes care. First, models integrated into existing health systems depicted the greatest potential for scale-up and sustainability. Second, culturally tailored peer-support models in underserved settings showed consistent improvements in HbA1c, behavior, and satisfaction. Third, digital-community hybrids expanded their reach and self-efficacy but struggled with engagement and long-term follow-up due to a lack of strong infrastructure. Lastly, while most interventions had good reach and effectiveness, long-term adoption and maintenance were strongest when community ownership and flexible delivery were prioritized.

Community-based diabetes programs across different settings faced several recurring barriers. A major challenge was related to human resources, including high attrition rates among CHWs, low financial incentives, and inconsistent supervision, which adversely affected program fidelity and sustainability [25]. Additionally, many initiatives suffered from data-related limitations, as only a few had established robust monitoring and evaluation systems capable of providing real-time feedback or outcome tracking. This constrained adaptive learning and limited evidence generation [26]. Another commonly reported barrier was policy fragmentation, particularly in LMICs, where parallel nongovernmental organizations and government structures operated without unified mandates, thereby hampering integration, coordination, and scale-up [27]. Despite these challenges, several enablers contributed to the successful implementation of community-based diabetes interventions. Programs that ensured supportive supervision and established feedback loops often reported improved CHW morale, consistency

Table 3 Evaluation of community-based diabetes interventions using the RE-AIM framework

Author, year	Model type	Key outcomes	Reach	Effectiveness	Adoption	Implementation	Maintenance	Overall inference (RE-AIM)
Liu et al. 2025 [6]	Peer-support model with tiered delivery (community/group/individual)	HbA1c, BMI, FPG, depressive symptoms	967 participants from 12 intervention communities; 71% retention at 24 months	Significant reductions in HbA1c, BMI, FPG, and depressive symptoms	Implemented in 12 communities with involvement of local health authorities and organizations	Standardized modules delivered with local adaptations across 3 levels (community-wide, group, individual)	Sustained benefits through COVID-19 disruptions; incorporated into local public health strategy	Demonstrates strong scalability and long-term sustainability of community-based peer support
Boocha et al. 2023 [7]	Multidisciplinary community-based care model (PHC-integrated)	HbA1c, BP control, service utilization, provider trust	Patients in multiple rural and semi-urban communities; high service uptake	Improved glycemic and hypertension control	Adopted by multiple subdistricts; integrated with government primary care network	Delivered via trained health workers, nurses, and community members	Maintained beyond study period; supported by local policy and health system alignment	A scalable model for rural health system strengthening in LMICs
Whitehouse et al. 2022 [8]	CHW-Peer-digital Hybrid	HbA1c ,Üì 0.93%, ,Üë self-efficacy, ,Üì distress, ,Üë self-care	High: Urban underserved communities; 88% retention at follow-up	Strong: Clinically and statistically significant HbA1c reduction and psychosocial improvements	Moderate: Requires digital infrastructure and trained CHWs	High fidelity; guided by RE-AIM; culturally adapted content and structured protocols used	Potential: Promising if embedded in FQHCs or supported via Medicaid/community programs	Highly promising hybrid model for scalable diabetes self-management support

Table 3 continued

Author, year	Model type	Key outcomes	Reach	Effectiveness	Adoption	Implementation	Maintenance	Overall inference (RE-AIM)
Li t al., 2022 [9]	mHealth-enabled DSMES via community health workers	Weight loss, HbA1c, self-monitoring, digital education completion	15 Latino adults with T2DM in rural South Texas	Significant weight loss observed, but no significant change in HbA1c. High participation in self-monitoring and digital education	Delivered by community health workers using cloud-based platforms for tracking and support	12-week intervention; digital education, self-monitoring, and weekly community health worker support via mobile tools	Program feasible with high adherence, but long-term efficacy on glycemic control needs further testing	Feasible and acceptable for underserved populations; potential for scalability if integrated into local health systems
Ansari et al. 2022 [10]	Chronic care model (CCM)	HbA1c, BMI, gender-differentiated outcomes	30 patients with T2DM, 20 healthcare workers in Abbottabad	HbA1c and BMI improved significantly over 6 months	Training of nurses and doctors to deliver CCM components	6-month intervention via primary care clinics using education and structured follow-up	Feasible for integration in local EMRs with both qualitative and quantitative outcome tracking	CCM adoption at primary care level yields measurable benefits in diabetes control
Debussche et al. 2018 [11]	Peer-led structured SME using 'Learning Nests' model	HbA1c, BMI, waist circumference, BP, diabetes knowledge score	151 adults with T2DM recruited from 2 secondary health centers in Bamako; 76 in intervention group	HbA1c reduction significantly greater in intervention group ($p = 0.006$); also improvements in BMI, WC, and knowledge score	Educators recruited from patient associations, fluent in local language, well integrated in community	3 structured courses, each with 4 sessions delivered over 12 months; peer educators trained and evaluated rigorously	Behavioral and biometric improvements sustained at 12 months despite contextual challenges (e.g., political unrest)	High feasibility and effectiveness of peer-led SME in low-income, low-resource urban settings

Table 3 continued

Author, year	Model type	Key outcomes	Reach	Effectiveness	Adoption	Implementation	Maintenance	Overall inference (RE-AIM)
Spencer et al. 2018 [14]	CHW-led DSME + peer leader	HbA1c, diabetes distress, depressive symptoms, knowledge	222 Latino adults with poorly controlled T2DM, randomized from FQHC	Sustained HbA1c reduction and psychosocial improvements in CHW + PL arm	Implemented in community health center via CHWs and peer volunteers	Structured DSME, home visits, motivational interviewing, followed by peer-led weekly sessions	Follow-up to 18 months showed sustained outcome improvements	Integrated CHW-peer models are feasible, effective, and sustainable for T2DM care in low-income communities
Sharp et al. 2018 [13]	Collaborative team-based care (pharmacist + CHW)	HbA1c, blood pressure, lipid profile, medication intensification	244 African-American and Hispanic/Latino adults with T2DM in academic medical centers in Chicago	HbA1c reduction in both groups (~ 0.4,Äì0.5%) with no significant difference; DBP higher in CHW arm ($p = 0.0078$)	Integrated within academic health centers; culturally tailored CHWs recruited	2-year crossover RCT; training protocols for CHWs and pharmacists; home visits, co-visits, follow-up	Effectiveness not superior to pharmacist-only; scalability depends on local engagement and care coordination capacity	CHW addition did not significantly improve HbA1c over pharmacist care; CHWs contributed contextual and psychosocial support
Nelson et al. 2017[12]	Peer-support CHW + mHealth	HbA1c (-0.8%), improved DSM knowledge, self-efficacy	Targeted underserved Latino population in rural US ($n = 72$)	Clinically meaningful reduction in HbA1c and improved behavioral outcomes	Adopted via FQHC partnership, implemented in real-world setting	Structured training for CHWs and text message protocol	Follow-up extended to 12 months, maintained glycemic control	Moderate-to-high potential for scale-up with CHW + digital synergy

Table 3 continued

Author, year	Model type	Key outcomes	Reach	Effectiveness	Adoption	Implementation	Maintenance	Overall inference (RE-AIM)
Tang et al., 2014 [23]	Peer-led vs. CHW telephone-based DSMS	HbA1c, BP, LDL cholesterol, diabetes distress, social support	116 Latino adults with T2DM in Detroit; 60 in PL group, 56 in CHW group	Statistically significant HbA1c and BP improvements maintained at 18 months in PL group	Used existing CHW infrastructure and peer graduates from DSME program	Weekly group sessions + phone follow-ups by PLs; monthly calls by CHWs	PL model better sustained outcomes over 18 months; CHW gains attenuated	PL model more effective for long-term diabetes self-management support in low-resource settings
Thankappan et al. 2013 [24]	Peer-support lifestyle intervention (community-based)	Physical activity, diet, tobacco use, alcohol use, weight, blood pressure	Participants from 60 clusters in Kerala; large community-based randomized trial	Significant improvement in behavior change indicators in intervention group vs control	Local community volunteers trained as peer leaders; accepted by community	Structured training; 15 group sessions over 12 months; regular monitoring	Behavioral improvements sustained over 12-month intervention period	Peer-led models feasible and effective for NCD prevention in low-resource settings

in service delivery, and better patient outcomes [28]. Community ownership also emerged as a strong enabler; models embedded within trusted local structures, such as faith-based organizations, women's groups, or Indigenous councils, showed higher levels of acceptance and long-term engagement [29]. Early community-based diabetes awareness initiatives, such as the Southeastern Anatolia Diabetes Project (GAPDIAB Project) in Turkey, also highlighted the importance of public and provider education for improving diabetes detection and engagement, reinforcing the long-recognized value of education-oriented community strategies [30]. Similarly, screening-based research from the STAR (Screening Those At Risk) program in the United Kingdom showed that a substantial proportion of individuals with screen-detected T2DM or impaired glucose tolerance also met the criteria for metabolic syndrome, underscoring the value of community-linked screening initiatives for the early identification of high-risk individuals [31]. Moreover, the use of established implementation research frameworks, such as the RE-AIM, allowed programs to systematically evaluate the implementation for informing policy translation and wider scalability [20].

Our synthesis also suggests that different community-based models are better suited to specific country contexts and health system configurations. CHW-led models are most effective in rural or resource-limited LMIC settings where physician shortages and weak primary-care infrastructure necessitate task-shifting. Peer-support models work particularly well in semi-urban or socially cohesive communities, such as Indigenous groups or migrant populations, where shared lived experiences strengthen engagement and collective problem-solving. Hybrid digital-community interventions are most appropriate in settings with adequate digital connectivity and literacy, enabling CHWs or peers to extend follow-up and reinforce self-management remotely. Therefore, model selection should be guided by local workforce capacity, digital readiness, community organization, and the strength of the primary care system, rather than a uniform adoption strategy.

The review highlights that community-based diabetes care models can improve glycemic control, self-management, and patient empowerment, particularly in settings where traditional facility-based care remains limited or inaccessible. Moving forward, it is essential to prioritize the institutionalization and system-level integration of these models [32]. Interventions that are embedded within primary healthcare platforms, linked to health financing mechanisms, and aligned with national NCD strategies are more likely to achieve sustainability and scale [33]. Additionally, strengthening supervisory structures, incentivization mechanisms, and digital support systems will be crucial to enhancing the effectiveness and fidelity of community interventions [28]. Governments and policymakers should also establish dedicated frameworks to support CHW workforce development, data reporting systems, and decentralized diabetes management protocols [25]. Efforts to scale community-based models must also consider context-specific barriers such as digital literacy, infrastructural constraints, and socio-cultural acceptability [34]. For digital-health enhanced programs, the future lies in equity-sensitive design that ensures interventions are accessible to populations with limited technological access or literacy. Community ownership and trust remain foundational enablers of sustainability. Thus, engagement with local leaders, Indigenous governance bodies, and civil society organizations should be considered not only at the implementation stage but from the point of program conception. Cross-sectoral partnerships, linking ministries of health, digital innovation hubs, academic institutions, and non-governmental organizations, will be critical in building the institutional, technical, and financial capacities required for the long-term scale-up of community-based diabetes care [35].

Despite the breadth of interventions reviewed, this narrative synthesis has limitations. The study selection did not involve systematic review procedures or formal meta-analytic pooling; hence, comparisons across interventions should be interpreted with caution. The review included studies with varied designs ranging from RCTs to feasibility studies, which differ in methodological rigor, duration, and outcome assessment. Moreover, some interventions lacked quantitative outcome data, particularly

in newer digital or hybrid models, which limited our ability to consistently compare effect sizes across settings. While the RE-AIM framework provided a structured lens for evaluation, not all studies explicitly reported on all five domains, resulting in an interpretive synthesis based on available information and inferred judgment. Geographical distribution also poses a limitation. Although the review sought global representation, most studies originated from a limited set of countries, including India, Pakistan, the USA, and select African contexts. Underrepresentation from other regions, such as Latin America, may have omitted promising community-based diabetes models that are unpublished or published in regional languages. Furthermore, issues such as gender dynamics, disability inclusion, and social determinants of health were underreported across studies, pointing to critical gaps in understanding the equity dimensions of implementation.

This review underscores the urgent need for policymakers to formally recognize and embed community-based diabetes care into national health strategies. As T2DM continues to rise, especially in LMIC, community-led models present a scalable solution to expand access, improve outcomes, and ease the burden on overstretched health systems. To ensure sustainability, governments should prioritize the formal integration of CHWs and peer educators into primary care, supported by clear roles, standardized training, and fair compensation. Dedicated financing mechanisms, such as performance-based incentives, CHW reimbursements, and allocated NCD budgets, are critical for long-term viability. In parallel, policy frameworks must promote interoperable digital platforms to enable seamless data sharing, remote monitoring, and patient confidentiality. Crucially, policies should embed equity principles by supporting cultural tailoring, community participation, and inclusive governance, particularly among Indigenous and underserved populations. Strategic investment in these areas can strengthen health system resilience and accelerate progress toward universal health coverage.

Future research should aim to fill these evidence gaps by prioritizing longitudinal evaluations, cost-effectiveness analyses, and equity-focused impact assessments of community-based diabetes models. Specifically, studies should explore how these models perform in fragile or resource-limited health systems, during health crises (e.g., pandemics), and among hard-to-reach or high-risk populations such as Indigenous groups, migrants, or individuals with multimorbidity. The use of implementation science frameworks should be standardized to allow for better cross-site comparisons. Moreover, future trials should adopt mixed-methods approaches, including patient and provider perspectives, to understand the nuances of intervention adoption and fidelity. There is also a pressing need to evaluate the digital equity implications of mHealth interventions and develop ethical, inclusive design principles for AI-supported diabetes care.

CONCLUSION

Community-based diabetes care models provide a practical approach to enhancing chronic disease management by expanding the reach and responsiveness of the healthcare system. These models improve access, support self-management, and show impact on glycemic control, patient engagement, and service use, especially when CHWs are integrated into primary care with digital and team-based support. As countries pursue universal health coverage, scaling up such community-led interventions is essential. This review highlights the importance of adaptive, context-sensitive models (including peer-led, nurse-led, or digital hybrids) that are tailored to local systems and sociocultural contexts. Key gaps remain in long-term follow-up, cost-effectiveness data, and standardized outcome metrics. Moving from innovation to institutionalization requires co-investment in implementation science, clear integration pathways, and stronger CHW training with digital and decision-support tools. Global stakeholders should also support South-to-South learning and evaluate scale-up strategies through real-world demonstration projects. Selecting the most

appropriate model requires aligning intervention design with local workforce capacity, digital infrastructure, and community structures to ensure feasibility and sustainability.

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Declarations

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