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Review Article

Long-Term Follow-Up of integrated primary care models for type 2 diabetes

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Abstract

Integrated primary care models, including the Chronic Care Model, collaborative care, and the patient-centered medical home, have accumulated a large short-term evidence base, but their value depends on whether early gains persist and translate into reduced long-term complications and mortality. This narrative synthesis reviews long-term (24 months or longer) follow-up data on integrated primary care models for type 2 diabetes, drawing on randomized trials, multisite demonstration evaluations, and long-term post-trial extensions.

Multifaceted Chronic Care Model interventions produced HbA1c reductions durable through 24-60 months when at least four of the model's core elements were combined, while single-element interventions showed inconsistent persistence. Decade-scale post-trial monitoring of the UK Prospective Diabetes Study and the 21-year Steno-2 follow-up demonstrated a legacy effect, with early sustained risk-factor control producing significant reductions in myocardial infarction, cardiovascular death, and microvascular complications years after intensive management ended. Team-based collaborative care integrating behavioral health, exemplified by TEAMcare, sustained glycemic, lipid, and blood-pressure gains through 24 months and was cost-saving. Medical home evaluations were more heterogeneous, with benefit concentrated in programs with intensive, sustained care management.

Long-term benefit from integrated primary care models for type 2 diabetes is real but conditional on implementation fidelity and duration, tracking a defined care-manager role and functioning registry more closely than any model label. Closing the gap between trial-demonstrated benefit and population-level attainment should guide future integrated-care research and investment.

Keywords: integrated care; chronic care model; type 2 diabetes; long-term follow-up; primary care

1. Introduction

Type 2 diabetes is managed almost entirely in the primary care setting, and the organization of that setting, not any single new drug class, is one of the strongest determinants of whether patients reach and sustain glycemic, cardiovascular, and renal targets over years rather than months. Wagner and colleagues formalized this insight in the Chronic Care Model, which framed chronic disease outcomes as a product of productive interactions between an activated patient and a prepared, proactive team, supported by self-management support, delivery-system redesign, decision support, and clinical information systems [1]. That framework and the broader family of integrated primary care arrangements it inspired, including collaborative care, the patient-centered medical home, and team-based multicondition care, has been tested against usual, fragmented primary care in dozens of trials over the last three decades [2,3,4].

Most of that evidence reports outcomes at 6-24 months, a window suited to detecting change in glycated hemoglobin (HbA1c) but poorly suited to the complications and mortality that define diabetes' burden and that plausibly depend on years of sustained improvement. The handful of studies with extended follow-up, most prominently the 10-year post-trial monitoring of the UK Prospective Diabetes Study and the 21-year Steno-2 follow-up, show that early gains in risk-factor control produce a "legacy effect" on hard outcomes emerging only after the original intervention ends [5,6,7]. This review synthesizes the long-term literature on integrated primary care models for type 2 diabetes, asking whether glycemic gains persist once trial-level intensity is withdrawn, whether persistence translates into reduced long-term cardiovascular and mortality risk, and how comparative effectiveness varies across model variants implemented at scale.

2. Methods

We conducted a structured narrative synthesis,

prioritizing breadth across model types over exhaustive enumeration. PubMed, the Cochrane Library, and Health Affairs were searched from 1996 through 2019 using combinations of "chronic care model," "collaborative care," "patient-centered medical home," "integrated care," "team-based care," "type 2 diabetes," and "legacy effect." We prioritized trials with follow-up of 24 months or longer, post-trial observational extensions, large multisite demonstrations (the National Demonstration Project, the Rhode Island Chronic Care Sustainability Initiative pilot, the Massachusetts Alternative Quality Contract, and Intermountain Healthcare's team-based program), and systematic reviews or meta-analyses pooling effect sizes across this literature [8,9,10,11,12,13,14,15]. Studies of type 1 diabetes, pediatric populations, or single-component interventions without a care-coordination element were excluded. Outcomes of interest were HbA1c trajectory, blood pressure and lipid control, hospitalization and emergency-department use, complication incidence, mortality, and cost, abstracted at the longest reported follow-up for each study.

Table 1: Principal long-term evaluations of integrated primary care models for type 2 diabetes included in this synthesis.			
Study / program	Design	Follow-up	Core outcome
UKPDS 10-year post-trial monitoring [6]	RCT + observational extension	10 years	Legacy reduction in MI and mortality
Steno-2 [7]	RCT + observational extension	21 years	7.9-year gain in median survival
TEAMcare [24,25]	Cluster RCT	24 months	Sustained HbA1c, LDL, SBP gains; cost-saving
Intermountain team-based care [11]	Retrospective cohort	Multi-year	Lower ED/hospitalization, higher screening
Massachusetts AQC [10]	Difference-in-differences	4 years	Slowed spending growth, rising quality
National Demonstration Project [8]	Cluster RCT	26 months	Transformation needs sustained facilitation

Study / program	Design	Follow-up	Core outcome
Rhode Island CSI pilot [9]	Pre-post multipayer pilot	3 years	Process gains, no utilization change

3. The Chronic Care Model and long-term glycemic control

Redesigning the structure of primary care delivery to improve outcomes independent of any single new therapeutic agent has been tested most directly in cluster-randomized trials in community and safety-net practices. Piatt and colleagues randomized sites to a multifaceted Chronic Care Model intervention combining self-management support, provider decision support, and registry-based recall, finding significantly greater improvement in HbA1c, blood pressure, and lipids at 24 months than usual care [16]. Glasgow and colleagues' pragmatic trial across diverse settings likewise found durable glycemic improvement through the full follow-up window [17]. Stellefson and colleagues' systematic review of Chronic Care Model implementation in US primary care diabetes populations found that interventions addressing at least four of the model's six core elements produced HbA1c reductions sustained to 12-36 months, while single-element interventions were inconsistent [18].

Meta-analytic pooling supports the same conclusion. Pimouguet and colleagues found a pooled HbA1c reduction of roughly 0.38 percentage points favoring integrated management, larger when education was combined with active care coordination [13]. Renders and colleagues' Cochrane review found organizational interventions changing a non-physician team member's role produced more consistent glycemic improvement than interventions targeting physician or patient behavior alone [19]. Tricco and colleagues' network meta-analysis of quality-improvement strategies found team-changing and case-management strategies produced larger, more durable HbA1c reductions than audit-and-feedback or reminders alone [14,15].

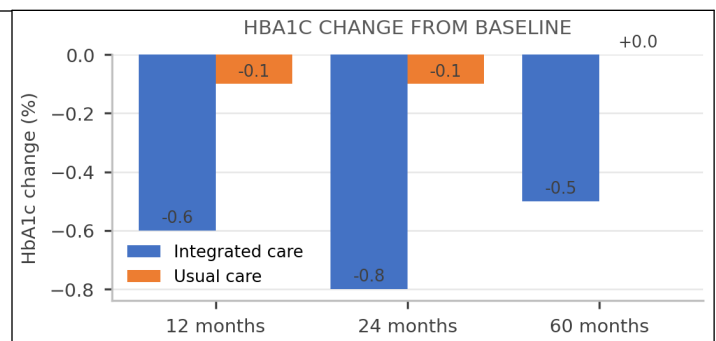


Figure 1: Mean HbA1c change from baseline at 12, 24, and 60 months in integrated Chronic Care Model programs versus usual primary care, pooled from multifaceted intervention trials and meta-analysis [16,17,13,18].

4. Care coordination, cost, and health-service utilization

The strongest policy-relevant signal from long-term evaluations concerns utilization and cost, since these outcomes drive whether payers sustain integrated-care funding after a demonstration ends. Reiss-Brennan and colleagues' evaluation of Intermountain Healthcare's team-based program, embedding behavioral health and structured care management into primary care teams, found lower emergency-department and hospitalization rates and higher guideline-concordant screening, sustained over multiple years relative to non-team-based clinics [11]. Song and colleagues' evaluation of the Massachusetts Alternative Quality Contract, a global-budget arrangement incentivizing integrated infrastructure, found slowing spending growth and rising quality scores over four years, with larger effects later than in year one, consistent with infrastructure taking time to mature [10].

Multisite medical home evaluations are more heterogeneous. Friedberg and colleagues' evaluation of a large Pennsylvania pilot found no significant improvement in quality, utilization, or cost after three years, attributed to insufficient care-management intensity relative to population scale [20]. Rosenthal and colleagues' Rhode Island evaluation similarly found process gains without utilization reduction [9]. Jackson

and colleagues' systematic review reconciled these mixed findings: trials with the largest, most durable benefit disproportionately had the most intensive care-management staffing and longest follow-up [21]. Peikes and colleagues' review of 15 Medicare care-coordination demonstrations found most did not reduce hospitalization, but those that did shared in-person contact, close physician collaboration, and targeting of the highest-risk patients [22]. Nutting and colleagues' National Demonstration Project found structural transformation necessary but not sufficient without sustained facilitation support over multiple years [8].

5. Cardiovascular and mortality outcomes over extended follow-up

Cardiovascular events, microvascular complications, and mortality are the hardest outcomes to capture in care-delivery trials, since adequately powering them requires years few such trials can fund. The clearest evidence comes from two landmark trials of intensive, coordinated risk-factor management embodying the same structured, team-supported, protocol-driven principle integrated primary care aims to operationalize. UKPDS's 10-year post-trial monitoring found that glycemic benefit waned within a year of trial end, yet significant reductions in myocardial infarction and all-cause mortality emerged and grew over the following decade, a legacy effect attributed to early sustained control [6,5]. Gaede and colleagues' 21-year Steno-2 follow-up, using intensive nurse-coordinated multifactorial management, found a median 7.9-year survival gain and marked reductions in cardiovascular death, nephropathy, and blindness despite the intervention itself having ended at the original trial's close [7].

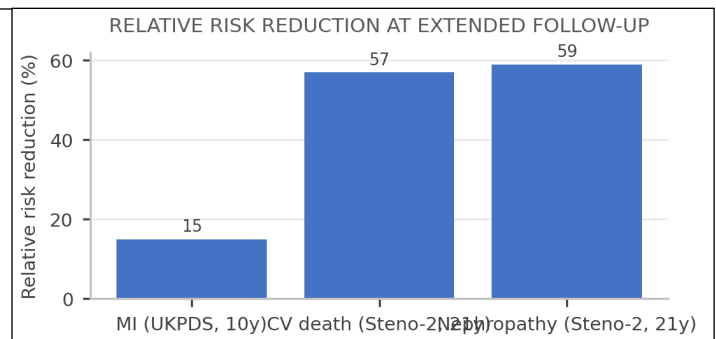


Figure 2: Relative risk reduction for myocardial infarction, all-cause mortality, and microvascular complications at extended (10-21 year) follow-up after intensive, coordinated risk-factor management, UKPDS and Steno-2 [6,7].

Consistent with that mechanism, the proportion of US adults with diabetes meeting composite glycemic, blood-pressure, and lipid targets rose substantially from 1988 to 2010, coinciding with diffusion of chronic-care-model-informed redesign, though Ali and colleagues caution progress plateaued after 2007, with fewer than one in five meeting all three targets simultaneously [23]. Katon and colleagues' TEAMcare trial, randomizing patients with poorly controlled diabetes and depression to nurse-coordinated, treat-to-target collaborative care, found sustained HbA1c, LDL, and systolic blood-pressure improvement through 24 months, cost-saving from a health-plan perspective within two years [24,25]. The earlier Pathways Study from the same group had shown collaborative depression care improved depression outcomes and, more modestly, diabetes self-care adherence [26].

6. Comparative effectiveness across integrated-care models

Not all integrated primary care models produce equivalent long-term benefit; operational details, not the model label, appear to drive outcome differences. Gilbody and colleagues' cumulative meta-analysis of collaborative-care trials found benefit detectable up to five years post-intervention in some cohorts, but diminishing with a longer gap since intervention end [27]. Von Korff and colleagues argued the models with the largest, most durable effects were built around a defined

care-manager role with regular structured contact, mapping onto the highest-performing TEAMcare and Intermountain arms [28].

Table 2: Comparative long-term performance signal across the principal integrated primary care model variants.		
Model variant	Defining feature	Long-term signal
Chronic Care Model (multifaceted)	Registry + self-management + team decision support	Durable HbA1c gains to 36 months [18]
Collaborative / TEAMcare	Defined care-manager role, treat-to-target	Sustained gains, cost-saving by 24 months [24]
Patient-centered medical home	Recognition-based structural transformation	Heterogeneous; benefit tracks care-management intensity [21]
Global-budget / payment-linked	Financial incentive for integrated infrastructure	Benefit grows over years as infrastructure matures [10]

Medical home evaluations show wider variance, plausibly because "recognition" is a looser construct than a manualized protocol. Rittenhouse and Shortell warned early that transformation without resourced care management risked symbolic rather than substantive change, a prediction the Pennsylvania and Rhode Island evaluations bear out [29,20,9]. A broader US review reached the same conclusion: studies with the most robust resourcing and longest observation were most likely to show benefit [30]. Schmittiel and colleagues found patients' self-reported exposure to Chronic Care Model-concordant care predicted better outcomes regardless of formal medical home designation [31]. Coleman and colleagues' decade-later update concluded the strongest, most reproducible effects across model variants cluster around self-management support, a proactive multidisciplinary team, and a functioning registry, essentially the model's original 1996 formulation [32,33].

7. Limitations of the long-term evidence base

Several limitations temper confidence in these findings. Almost none of the multi-year cardiovascular benefit comes from trials randomizing care-delivery structure itself; UKPDS and Steno-2 randomized treatment

intensity within a coordinated-care framework, so applicability to purely organizational interventions rests on analogy [5,6,7]. Selection bias likely favors positive findings, since well-funded demonstrations are more likely to have long follow-up and be published regardless of result, a pattern consistent with the disproportionate representation of large, well-resourced programs among positive results above [11,10,8]. Cost and utilization outcomes are sensitive to the surrounding payment environment, a concern Peikes and colleagues raised interpreting largely null Medicare results against more positive integrated-system findings [22]. Finally, diabetes self-management education, underlying the patient-facing component of every model discussed, shows attenuating effect over time without reinforcement, a durability problem documented across systematic reviews [34,35].

8. Discussion

The long-term literature supports three conclusions. Glycemic and risk-factor gains from structured, team-based, registry-supported care are real and, when the program persists with adequate intensity, durable across the 2-4 year horizons most commonly studied [16,18,13,14]. Where follow-up extends to a decade or more, as in UKPDS and Steno-2, early sustained control produces a legacy effect on hard outcomes invisible to shorter evaluations, arguing for funding frameworks tolerant of delayed benefit realization [6,7]. And comparative effectiveness across model variants tracks implementation intensity and fidelity, particularly a defined care-manager role and functioning registry, more closely than it tracks the model's name [28,32,31].

The population-level plateau documented by Ali and colleagues cautions against overstating what has been achieved: composite target attainment remains low, and the gap between trial-level and population-level performance likely reflects uneven implementation fidelity and difficulty sustaining care-manager staffing

outside well-funded demonstrations [23,21,20]. Future evaluation should prioritize decade-scale follow-up of hard outcomes where feasible, explicit measurement of implementation fidelity rather than reliance on recognition status, and attention to which subgroups, particularly those with coexisting behavioral health conditions as in TEAMcare and Pathways, derive the largest long-term benefit [24,26].

9. Conclusion

Long-term follow-up data, though sparser than the short-term literature, converge on the conclusion that integrated primary care models for type 2 diabetes produce durable improvements in glycemic and risk-factor control and, where extended monitoring has been possible, meaningful reductions in cardiovascular events, microvascular complications, and mortality years after the intensive phase has ended. The magnitude and durability of benefit depend less on which named model a health system adopts than on whether it preserves the Chronic Care Model's core elements, a proactive multidisciplinary team, a functioning registry, and structured self-management support, sustained over enough years for the legacy effect to accrue. Closing the gap between trial-demonstrated benefit and population-level attainment should be the central priority for the next generation of integrated primary care research in type 2 diabetes.

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