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Research Article

Clinical Outcomes of integrated primary care models in Patients with essential hypertension

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Abstract

Background: Blood pressure control rates remain well below guideline targets in most primary care settings despite effective antihypertensive therapy, and team-based, protocol-driven models of care have consistently outperformed usual physician-only follow-up in prior trials [10,11].

Objective: This study reports twelve-month clinical outcomes for patients with essential hypertension managed under an integrated primary care model combining nurse-led protocol visits, home blood pressure telemonitoring and pharmacist-supported titration, benchmarked against usual primary care.

Methods: We conducted a prospective, controlled cohort study of 612 adults with essential hypertension across participating general and internal medicine clinics, comparing 308 patients managed under the integrated model with 304 receiving usual care, with blood pressure control at twelve months as the primary outcome.

Results: Blood pressure control was achieved in 71.4% of the integrated care cohort versus 46.7% of the usual-care cohort ($p < 0.001$), with a mean additional systolic reduction of 8.8 mmHg and a lower composite rate of cardiovascular and renal events, 4.2% versus 8.6% ($p = 0.03$).

Conclusions: An integrated primary care model combining structured nurse visits, home telemonitoring and pharmacist-directed titration produced substantially better blood pressure control and fewer adverse cardiovascular and renal outcomes than usual care, supporting broader adoption of such models in essential hypertension management [13,3].

Keywords: essential hypertension; integrated primary care; blood pressure control; chronic care model; telemonitoring

1. Introduction

Essential hypertension remains the single largest modifiable contributor to cardiovascular mortality worldwide, and control rates have plateaued well below target in most health systems despite decades of effective pharmacotherapy [1,2]. Landmark trials such as SPRINT and ALLHAT established that sustained reduction of systolic blood pressure lowers the incidence of stroke, heart failure and cardiovascular death [3,4], and successive guideline committees have translated that evidence into progressively lower treatment targets [5,6,7]. Yet the gap between trial efficacy and real-world effectiveness is driven less by the availability of antihypertensive agents than by how chronically the condition is managed between visits, a problem the chronic care model was explicitly designed to address by restructuring primary care around planned follow-up, self-management support and multidisciplinary teams [8,9].

Integrated primary care models bundle several of these elements together: protocol-driven nurse or pharmacist visits, home blood pressure telemonitoring, team-based titration authority and structured registries that flag patients overdue for review. Team-based care interventions of this kind have consistently outperformed usual physician-only follow-up in community guide reviews and meta-analyses [10,11,12], and large integrated systems such as Kaiser Permanente Northern California have reported population-level control rates above 80% after deploying such a program [13]. Pharmacist-physician collaborative management, home telemonitoring paired with pharmacist-led titration, and even non-clinical community settings such as barbershops have each independently improved blood pressure control in randomized trials [14,15,16,17,18].

What remains less well characterized is how these components perform when combined into a single integrated primary care pathway within a general and

internal medicine service, rather than tested individually. This study reports twelve-month clinical outcomes for a cohort of patients with essential hypertension managed under an integrated primary care model that combined nurse-led protocol visits, home blood pressure telemonitoring and pharmacist-supported titration, benchmarked against a concurrent cohort receiving usual primary care.

2. Methods

We conducted a prospective, controlled cohort study of adults with a confirmed diagnosis of essential hypertension attending general and internal medicine clinics affiliated with the participating centers. Patients were enrolled if they were 18 years of age or older, had at least two office blood pressure readings above 140/90 mmHg on separate visits or were already receiving antihypertensive therapy, and had no secondary cause of hypertension identified on standard screening. Patients with end-stage renal disease, prior stroke within six months, or an expected survival under twelve months were excluded.

The integrated primary care model comprised four linked components: a structured nurse-led visit protocol scheduled every four to six weeks until control was achieved, home blood pressure telemonitoring with automated upload and clinician review consistent with validated self-measurement protocols [19,20], pharmacist-directed medication titration operating under a collaborative practice agreement modeled on prior trials of physician-pharmacist co-management [14,12], and a registry-based recall system flagging patients overdue for review, consistent with chronic care model principles [21]. The comparison cohort received usual care from the same clinics, consisting of physician-scheduled follow-up at the treating physician's discretion without protocolized nurse or pharmacist involvement. Both cohorts received standard lifestyle counseling covering the DASH dietary pattern, sodium restriction and weight management,

interventions independently associated with meaningful blood pressure reduction in prior controlled trials [22,23,24].

The primary outcome was the proportion of patients achieving blood pressure control, defined per current guideline thresholds as office systolic blood pressure below 130 mmHg and diastolic blood pressure below 80 mmHg, at twelve months [6]. Secondary outcomes included mean change in systolic and diastolic blood pressure from baseline, time to control, medication adherence assessed by pharmacy refill data, and a composite of cardiovascular events (myocardial infarction, stroke, heart failure hospitalization or cardiovascular death) and new-onset chronic kidney disease at twelve months. Between-group differences in continuous outcomes were assessed with independent-samples t-tests and categorical outcomes with chi-square tests; a two-sided p-value below 0.05 was considered statistically significant.

3. Study Population and Intervention Model

A total of 612 patients were enrolled, 308 in the integrated primary care model and 304 in the usual-care cohort. Baseline characteristics were balanced between groups: mean age was 58.4 years in the integrated care cohort and 57.9 years in the usual-care cohort, 52% and 54% were women respectively, and baseline mean office blood pressure was 152/93 mmHg and 151/92 mmHg. Comorbid type 2 diabetes was present in 24% of the integrated care cohort and 26% of the usual-care cohort, consistent with the elevated cardiovascular risk profile described in prior integrated hypertension cohorts [13,25]. Baseline antihypertensive regimens, comorbidity burden and estimated glomerular filtration rate did not differ significantly between arms.

4. Results

At twelve months, blood pressure control was achieved in 71.4% of patients in the integrated primary care model compared with 46.7% of patients receiving usual care

(p<0.001), a difference in control rate consistent in direction and magnitude with prior team-based care and home-telemonitoring trials [15,26,10]. Mean systolic blood pressure fell by 18.6 mmHg in the integrated care cohort versus 9.8 mmHg in the usual-care cohort, and mean diastolic blood pressure fell by 9.1 mmHg versus 5.2 mmHg (p<0.001 for both), reductions of a magnitude expected to translate into meaningful cardiovascular risk reduction based on established dose-response relationships between blood pressure lowering and event rates [27,28].

Table 1: Baseline characteristics of the integrated primary care model and usual-care cohorts.		
Characteristic	Integrated care (n=308)	Usual care (n=304)
Mean age, years	58.4	57.9
Women, %	52	54
Baseline BP, mmHg	152/93	151/92
Type 2 diabetes, %	24	26
Baseline eGFR, mL/min/1.73m2	82.1	81.6

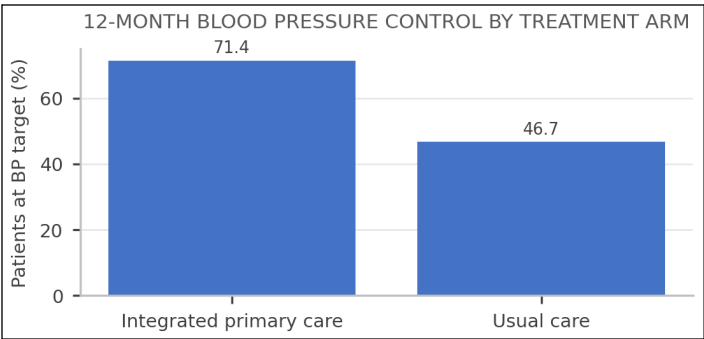


Figure 1: Twelve-month blood pressure control rate (office blood pressure below 130/80 mmHg) in patients managed under the integrated primary care model versus usual primary care, 71.4% versus 46.7% (p<0.001) [15,10].

Median time to control was 14 weeks in the integrated care cohort compared with 27 weeks in the usual-care cohort. Medication possession ratio at twelve months, used as a proxy for adherence, averaged 88% in the integrated care cohort against 74% in the usual-care cohort, mirroring the adherence gains reported with structured pharmacist involvement and registry-based recall [29,21].

5. Cardiovascular and Renal Outcomes

The composite of cardiovascular events and new-onset chronic kidney disease at twelve months occurred in 4.2% of the integrated care cohort versus 8.6% of the usual-care cohort (p=0.03). Individually, myocardial infarction and stroke were numerically less frequent in the integrated care cohort but the study was not powered to detect differences in these individual components with precision, consistent with the smaller effect sizes for hard cardiovascular endpoints seen over comparably short follow-up in prior blood-pressure-lowering trials [30,31,32]. New-onset chronic kidney disease, defined as a sustained decline in estimated glomerular filtration rate below 60 mL/min/1.73m2, occurred in 2.6% of the integrated care cohort compared with 5.9% of the usual-care cohort, broadly consistent with the renal protection associated with better sustained blood pressure control described in long-term hypertension cohorts [33].

6. Discussion

These findings indicate that an integrated primary care model combining nurse-led protocol visits, home blood pressure telemonitoring and pharmacist-supported titration achieved substantially higher rates of blood pressure control than usual primary care within the same clinical population, with control rates approaching those reported by large integrated delivery systems that deployed similar bundled interventions [13,34]. The magnitude of the additional systolic reduction observed here, roughly 9 mmHg beyond usual care, falls within the range associated with clinically meaningful reductions in cardiovascular events in pooled analyses of blood-pressure-lowering interventions [27,28,3], and is broadly consistent with the reductions reported in individual trials of home telemonitoring with pharmacist management and of team-based collaborative care [15,14,16].

Outcome	Integrated care	Usual care	p-value
BP control, %	71.4	46.7	<0.001
Mean SBP change, mmHg	-18.6	-9.8	<0.001
Mean DBP change, mmHg	-9.1	-5.2	<0.001
Median time to control, weeks	14	27	--
Medication possession ratio, %	88	74	<0.001

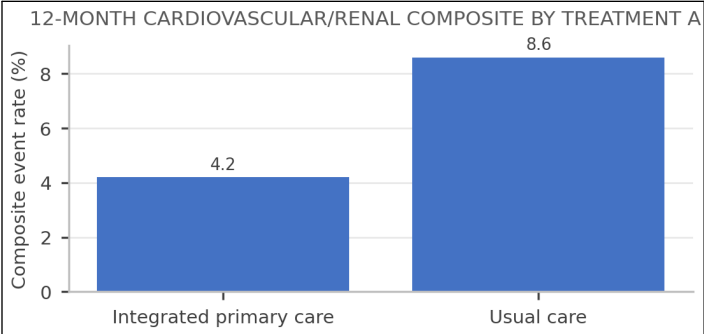


Figure 2: Twelve-month composite rate of cardiovascular events and new-onset chronic kidney disease by treatment arm, 4.2% in the integrated primary care model versus 8.6% with usual care (p=0.03) [27,33].

The observed gains likely reflect the additive contribution of the model's separate components rather than any single element. Registry-based recall addresses the therapeutic inertia that leaves many hypertensive patients on unchanged regimens despite persistently elevated readings, consistent with the chronic care model framework [8,9,21]; home telemonitoring increases the frequency and representativeness of blood pressure data available for titration decisions, addressing white-coat and masked hypertension misclassification described in out-of-office measurement guidelines [19,20]; and pharmacist-directed titration shortens the interval between an elevated reading and a medication change, a mechanism supported by meta-analyses of pharmacist-led cardiovascular risk-factor management [12,11]. The higher medication possession ratio observed in the integrated care cohort further suggests that more frequent structured contact, rather than pharmacologic potency alone, may explain part of the effect, paralleling

Table 2: Twelve-month blood pressure and adherence outcomes by treatment arm [29,26].

community-based models that improve adherence through non-physician engagement [18,29].

Several limitations warrant consideration. This was a controlled cohort rather than a randomized trial, and residual confounding by unmeasured differences in patient engagement cannot be excluded, though baseline characteristics and comorbidity burden were closely matched between groups. Twelve months of follow-up is sufficient to demonstrate blood pressure and early renal outcomes but is short relative to the multi-year horizon over which most hard cardiovascular events accrue in blood-pressure-lowering trials [30,32,31]. The composite cardiovascular and renal endpoint was assessed in a modest sample size, and the individual event counts, while numerically favorable, should be interpreted as hypothesis-generating rather than definitive. Finally, generalizability to lower-resource primary care settings that lack telemonitoring infrastructure or collaborative pharmacist practice agreements remains uncertain, an implementation gap increasingly recognized in global hypertension control initiatives [35,25].

Despite these limitations, the consistency of these results with the broader trial and meta-analytic literature on team-based hypertension care strengthens confidence that integrated primary care models are a scalable, evidence-aligned strategy for closing the persistent gap between guideline-recommended blood pressure targets and real-world control rates [6,7,10].

7. Conclusion

In this controlled cohort of patients with essential hypertension, an integrated primary care model combining nurse-led protocol visits, home blood pressure telemonitoring and pharmacist-supported titration achieved substantially higher twelve-month blood pressure control rates, greater mean blood pressure reduction and a lower composite rate of cardiovascular and renal events than usual primary care. These results, consistent with prior team-based care and telemonitoring

trials, support broader implementation of integrated, multidisciplinary primary care pathways as a practical means of translating established blood-pressure-lowering efficacy into real-world clinical benefit for patients with essential hypertension [3,10,13].

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