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Community Pharmacy Interventions for Improving Adherence in Chronic Hypertension

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Abstract

Hypertension is the leading modifiable driver of global cardiovascular mortality, yet fewer than one in four affected adults worldwide have their blood pressure adequately controlled, a gap sustained in large part by poor long-term medication adherence rather than a shortage of effective drugs. Community pharmacies occupy an unusually well-placed position to close this gap: pharmacists see chronic hypertensive patients far more often than prescribing physicians do, hold relevant pharmacological and counseling expertise, and require no appointment to access. This article synthesizes the literature on community pharmacy interventions for hypertension adherence and control, tracing the evidence from foundational meta-analyses of pharmacist-delivered care, through specific behavioral, educational, and packaging interventions, to the newer wave of remote monitoring, telehealth, and digital adherence tools, and the collaborative-practice arrangements that determine whether a pharmacist's clinical judgment can translate into an actual prescribing change. We give particular weight to the consistency of effect across independent meta-analyses spanning a decade, to cost-effectiveness evidence supporting expanded pharmacist scope of practice, and to the geographic mismatch between where this evidence has been generated and where the burden of uncontrolled hypertension is now growing fastest. Read together, the evidence supports community pharmacy involvement as a coherent, well-evidenced, and underused component of chronic hypertension management, while leaving component isolation, long-term durability beyond typical trial follow-up, and translation to low- and middle-income settings as an open research and implementation agenda.

Keywords: community pharmacy; medication adherence; hypertension management; pharmacist intervention; blood pressure control

1. Introduction

Hypertension remains the single largest modifiable contributor to cardiovascular death worldwide, and it is also, stubbornly, one of the conditions medicine is worst at actually controlling once it has been diagnosed. A pooled analysis of more than a thousand population-representative surveys spanning three decades found that global age-standardized hypertension prevalence held essentially flat between 1990 and 2019 even as treatment coverage rose, and that fewer than one in four affected adults worldwide had their blood pressure adequately controlled by the end of that period, with wide variation by region and income level [1]. The problem, in other words, is not primarily a shortage of effective antihypertensive drugs. Modern pharmacotherapy can bring the overwhelming majority of patients to guideline-concordant blood pressure targets, a point the most recent multisociety United States guideline reaffirms in its detailed treatment algorithms [2]. The problem is that a large share of patients who are prescribed those drugs do not take them consistently enough, for long enough, to realize their benefit.

This is not a new observation. The World Health Organization's landmark 2003 report on adherence to long-term therapies argued, in terms that still read as current, that in developed countries average adherence to chronic disease treatment hovers around 50%, that adherence is lower still in the developing world, and that improving adherence might do more for population health than any single new medical technology [3]. Hypertension is arguably the paradigm case the report had in mind: it is asymptomatic for most of its natural history, its treatment offers no immediate subjective reward, its regimens often involve multiple daily pills, and the penalty for nonadherence — a stroke or a myocardial infarction years later — is temporally so distant from the missed doses that cause it that the causal link rarely registers with patients in the moment they decide whether to take their morning tablet.

Community pharmacies occupy a peculiar and, on reflection, obviously useful position in this problem. They are the point of the health system a hypertensive patient on chronic therapy visits most often — typically monthly, for a refill, far more frequently than they see their prescribing physician. Pharmacists are trained in exactly the pharmacological and behavioral content that

adherence support requires. And unlike a clinic visit, a pharmacy visit does not require an appointment, a referral, or, in many health systems, even much of a wait. It is this combination — high-frequency contact, relevant expertise, low access friction — that has made community pharmacy interventions one of the most heavily studied and, on the evidence assembled over the past two decades, one of the more consistently effective mechanisms for improving hypertension adherence and blood pressure control at scale.

This article synthesizes that evidence. We are not reporting a new trial or a new dataset; we are pulling together what a substantial and still-growing body of systematic reviews, meta-analyses, and pragmatic trials has found about what community pharmacists can actually do to move the needle on hypertension adherence and control, what mechanisms seem to matter most, what the cost and access implications look like, and where the evidence genuinely runs out. We organize the discussion around the burden and mechanics of the adherence problem itself; the foundational trial and meta-analytic evidence for pharmacist-delivered hypertension care; the specific behavioral, educational, and packaging interventions that have been tested at the patient level; the newer wave of telehealth, remote monitoring, and digital adherence tools that pharmacists now deploy; the collaborative-practice and health-system arrangements that determine whether pharmacist involvement translates into physician-level authority to act; the economic case for paying for this work; and, finally, the access gap between where this evidence has been generated and where the burden of uncontrolled hypertension is now heaviest.

2. The Burden of Hypertension and the Mechanics of Nonadherence

Uncontrolled hypertension is not evenly distributed, and neither is the adherence problem that helps sustain it. The NCD-RisC pooled analysis found that while high-income countries have seen real gains in treatment and control rates since 1990, many low- and middle-income countries have seen prevalence rise even as control rates lag far behind, so that the absolute number of adults worldwide with uncontrolled hypertension has grown substantially even as the proportionate global rate has held roughly steady [1]. This matters for a discussion of pharmacy-based

interventions specifically, because community pharmacies are disproportionately accessible in exactly the settings — dense urban neighborhoods, medically underserved regions, health systems with thin primary-care capacity — where the adherence-and-control gap is now widest. We return to this geographic mismatch between evidence base and burden in a later section, but it is worth flagging at the outset: most of the trial evidence synthesized in the next several sections comes from North America, Western Europe, and a handful of well-resourced health systems elsewhere, even though the case for pharmacy-based intervention arguably applies with even more force outside those settings.

The mechanics of nonadherence itself are reasonably well characterized, and it is worth being specific about what "nonadherence" actually looks like in practice, because the interventions that follow are targeted at particular failure modes rather than at a single undifferentiated problem. Patients forget doses amid the ordinary friction of daily life; they discontinue therapy when they feel well and conclude, not unreasonably given the absence of symptoms, that the medication cannot be doing much; they struggle with complex multi-drug, multi-dose-timing regimens, particularly once a second or third antihypertensive class is added; they face genuine cost barriers, especially where copayments accumulate across several chronic medications; and they sometimes simply do not understand, because no one has taken the time to explain in plain language, why an asymptomatic condition requires lifelong daily treatment. Health literacy turns out to be a load-bearing variable across nearly all of these failure modes: a recent systematic review found a consistent positive association between health literacy and medication adherence across chronic diseases, with lower literacy predicting worse adherence in the substantial majority of the studies reviewed, and hypertension among the most heavily represented conditions in that literature [4]. A pharmacist who can diagnose which of these failure modes is operating for a given patient — forgetfulness, regimen complexity, low perceived necessity, cost, comprehension — is in a position to match the intervention to the problem rather than applying a one-size-fits-all reminder or lecture, and much of what distinguishes the more effective pharmacy interventions from the less effective ones, in the literature reviewed below, is precisely this kind of

tailoring.

3. Foundational Evidence for Pharmacist-Delivered Hypertension Care

The core empirical claim underlying this entire literature — that pharmacists, given the chance, measurably improve blood pressure outcomes — rests on a now-substantial base of randomized evidence synthesized across several independent meta-analyses conducted a decade apart, which is itself a reassuring sign of a field converging on a stable finding rather than chasing a single anomalous result. Santschi and colleagues' 2014 meta-analysis, drawing on dozens of randomized trials of pharmacist care for hypertension across ambulatory, community, and primary-care settings, found that pharmacist involvement was associated with meaningfully larger reductions in both systolic and diastolic blood pressure than usual care, establishing pharmacist-delivered care as an evidence-based rather than merely plausible intervention for blood pressure control [5]. Cheema, Sutcliffe, and Singer's meta-analysis published the same year, focused specifically on interventions delivered inside community pharmacies rather than pharmacist involvement embedded in clinics, reached a compatible conclusion: pharmacist interventions in the community pharmacy setting specifically were associated with significant improvements in blood pressure control and adherence outcomes relative to usual care, across a pool of randomized controlled trials conducted in multiple countries [6].

A decade later, an updated and expanded meta-analysis by Gastens and colleagues revisited the same underlying question with a larger and more recent trial base and reached essentially the same conclusion, while adding texture about which delivery formats and intensities of pharmacist involvement produced the largest effects [7]. That the core finding has replicated across three independent meta-analytic efforts spanning roughly a decade, using overlapping but not identical trial pools and somewhat different inclusion criteria, is a meaningfully stronger form of evidence than any single trial or single meta-analysis could offer on its own. A companion analysis by an overlapping author group examined the specific and clinically important subgroup of hypertensive patients who also have diabetes — a population in which blood pressure control carries outsized importance for preventing both cardiovascular

and renal complications, and in which polypharmacy and regimen complexity are, almost by definition, worse than in the general hypertensive population. That review, pooling twelve randomized trials and more than five thousand participants, found that pharmacist interventions produced a systolic blood pressure reduction of 7.2 mmHg and a diastolic reduction of 4.1 mmHg relative to control, alongside a relative risk of achieving blood pressure control of 1.76 favoring the pharmacist-intervention arm [8]. Effects of this magnitude are clinically consequential: a sustained systolic reduction in the range of 5-10 mmHg across a population is associated, in the broader hypertension outcomes literature that this synthesis does not attempt to review independently, with material reductions in stroke and cardiovascular event rates, which is precisely why blood pressure reduction of this size is treated as a clinically meaningful trial endpoint rather than a statistical curiosity.

Table 1: Representative quantitative findings from meta-analyses and economic evaluations of community pharmacy and pharmacist-delivered hypertension interventions cited in this review. [8,13,19,9].

Intervention Type	Source	Design	Reported Effect
Pharmacist hypertension care in patients with comorbid diabetes	Gastens et al. [8]	Meta-analysis, 12 RCTs, n=5,256	SBP -7.2 mmHg; DBP -4.1 mmHg; RR of BP control 1.76 (95% CI 1.39-2.24)
Remote pharmacist follow-up (all designs pooled)	Matsumoto et al. [13]	Meta-analysis, 13 RCTs, n=3,969	SBP -7.35 mmHg (95% CI -9.10 to -5.59)
Expanded pharmacist prescribing authority (US population model)	Dixon et al. [19]	30-year cost-effectiveness microsimulation	~2,100 fewer CVD cases per 10,000 patients; \$10,162 net savings per person
Multicomponent adherence interventions (habit-linking, feedback, self-monitoring, packaging, motivational interviewing)	Conn et al. [9]	Meta-analysis, 112 comparisons, n=34,272	Consistently positive effects on adherence; five components above identified as most promising

It is worth pausing on what these meta-analyses are actually pooling, because "pharmacist intervention" covers a fairly heterogeneous set of activities across the underlying trials: patient education sessions, structured medication reviews, adherence counseling, blood

pressure measurement and monitoring, dose-timing simplification, referral back to the prescriber when control is inadequate, and in some trial arms, pharmacist authority to adjust the regimen directly under a collaborative agreement. Disentangling which of these components is doing the work is one of the more active questions in the literature, and the sections that follow take up several of the individual components in more detail — first the behavioral and educational techniques used at the patient level, and later the collaborative-practice arrangements that determine how much authority the pharmacist actually has to act on what they find.

4. Behavioral, Educational, and Packaging Interventions

Conn and colleagues' meta-analysis of interventions to improve medication adherence specifically in hypertensive patients — not limited to pharmacy settings, but heavily populated by pharmacy-delivered interventions — pooled 112 treatment-versus-control comparisons across more than 34,000 subjects and identified the specific intervention components most consistently associated with improved adherence: linking the adherence behavior to an existing daily habit, giving patients ongoing feedback on their own adherence, self-monitoring of blood pressure, use of pill boxes and other adherence-focused packaging, and motivational interviewing [9]. Several of these components deserve individual attention, because each has its own dedicated evidence base beyond the aggregate finding.

Motivational interviewing, a patient-centered counseling style originally developed for addiction treatment that has been substantially adapted for chronic disease management, works by having the clinician draw out and reinforce the patient's own stated reasons for wanting to change a behavior, rather than delivering didactic instruction about why they should. A systematic review of pharmacy-care and motivational-interviewing interventions across cardiovascular disease populations, including a substantial subset of hypertension-specific trials, found that motivational-interviewing-based pharmacy interventions were associated with improved medication adherence relative to usual pharmacy care across the majority of the randomized trials reviewed [10]. The mechanism is worth stating plainly because it

explains why this technique shows up so consistently across the broader adherence literature: motivational interviewing addresses the "low perceived necessity" failure mode described earlier directly, by having patients articulate for themselves why controlling an asymptomatic condition matters to them, rather than relying on an external authority's instruction, which tends to produce more durable behavior change than instruction alone.

Packaging interventions occupy a more mundane but still evidence-supported niche. Zedler and colleagues' systematic review of medication packaging that incorporates a calendar feature — blister packs or organizers labeled by day and time rather than generic pill bottles — found that calendar-featured packaging was associated with improved adherence across the self-administered long-term medication trials reviewed, particularly for regimens involving multiple daily doses, which describes a meaningful share of multi-drug antihypertensive regimens [11]. This is precisely the kind of low-cost, low-complexity intervention that a community pharmacy is uniquely positioned to deliver at the point of dispensing, without requiring any additional clinical encounter, and it directly targets the "forgetfulness amid daily friction" failure mode rather than the motivational or comprehension failure modes that motivational interviewing and health-literacy-adapted counseling address.

Appointment-based medication synchronization is a related but structurally distinct intervention: rather than changing how an individual medication is packaged, it aligns the refill dates of all of a patient's chronic medications to a single monthly pharmacy visit, scheduled in advance, during which the pharmacist can also conduct a brief clinical check-in. A systematic review of the appointment-based model's effect on medication-taking behavior and health outcomes found consistent, if modest, improvements in adherence measures such as proportion of days covered across the studies reviewed, alongside operational benefits for the pharmacy in planning workload and stock [12]. For a hypertensive patient typically taking two or more chronic medications for blood pressure alone, medication synchronization removes one of the more prosaic but real barriers to adherence: the cognitive and logistical burden of tracking several different refill dates spread across a month, each one a separate opportunity

for a missed dose to turn into a missed refill.

5. Monitoring, Telehealth, and Digital Adherence Tools

The last decade has added an entire additional layer to the community pharmacy adherence toolkit: remote monitoring, telehealth follow-up, and digital communication channels that let a pharmacist maintain contact with a patient between physical pharmacy visits. This matters because blood pressure, unlike many chronic disease markers, can be measured by the patient at home cheaply and reliably, which opens the door to intervention models that would be impractical for conditions requiring laboratory testing.

Matsumoto and colleagues' 2024 meta-analysis of remote pharmacist follow-up for hypertension pooled thirteen randomized controlled trials covering nearly four thousand participants and found an overall systolic blood pressure reduction of 7.35 mmHg (95% CI, -9.10 to -5.59 mmHg) associated with remote pharmacist follow-up relative to usual care [13]. The subgroup analysis within that same meta-analysis is arguably more informative than the pooled headline figure, because it isolates which design choices within "remote follow-up" actually drive the effect. Trials using a regularly scheduled follow-up cadence produced substantially larger reductions (-8.89 mmHg) than trials that followed up only as needed or on patient request (-3.23 mmHg), a statistically significant difference; by contrast, whether the follow-up used telephone contact specifically (-8.04 mmHg) versus other communication tools (-5.49 mmHg) did not produce a statistically significant difference, nor did whether the pharmacist communicated directly with the patient's physician versus managing the follow-up independently. The clearest lesson from that subgroup breakdown is that the *regularity* of contact, not the specific channel used to deliver it, is what predicts effect size — a finding with practical implications for pharmacy operations, since it suggests that a scheduled cadence of check-ins is worth prioritizing over investment in any particular communication technology.

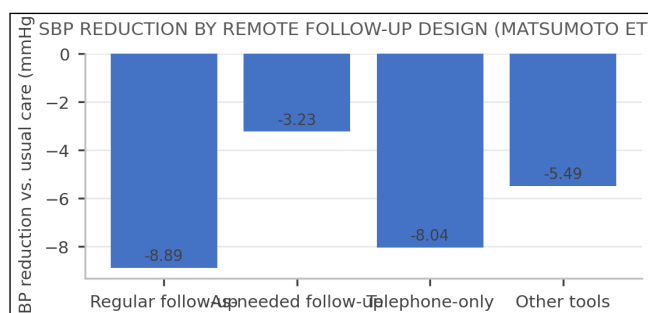


Figure 1: Systolic blood pressure reduction (mmHg) associated with remote pharmacist follow-up for hypertension, by follow-up design, from Matsumoto et al.'s meta-analysis of 13 randomized controlled trials (n=3,969) -- a regularly scheduled follow-up cadence produced a significantly larger effect than as-needed follow-up, while the communication channel used (telephone versus other tools) did not significantly affect the size of the reduction [13].

A parallel and larger literature has assessed digital health interventions for hypertension more broadly, not limited to pharmacist-delivered contact specifically. A systematic review and meta-analysis of randomized controlled trials of digital health interventions for hypertension — spanning text messaging, mobile apps, and remote monitoring platforms, with varying degrees of clinician involvement including pharmacist-staffed programs — found generally positive but heterogeneous effects on blood pressure control and adherence across the trials reviewed, with effectiveness apparently depending heavily on program design features such as the degree of two-way interaction with a clinician rather than passive, one-directional messaging alone [14]. This is a useful complement to the pharmacist-specific telehealth literature because it situates pharmacist-led remote follow-up within the broader digital-health evidence base: digital tools appear to work best not as a stand-alone replacement for clinical contact but as a channel through which an ongoing clinical relationship — in this case, with a pharmacist — can be maintained more frequently and cheaply than in-person visits alone would allow.

Text messaging specifically, as a narrower and cheaper communication channel than a full telehealth platform, has its own dedicated evidence base. A meta-analysis of mobile telephone text messaging interventions across chronic diseases, including a substantial hypertension-specific trial pool, found that text-message-based adherence support was associated with improved medication adherence relative to usual care, though the authors noted that most included trials were relatively short in duration and that the durability of text-messaging effects beyond several months

remained less well established than the durability of more intensive, ongoing pharmacist-delivered contact [15]. Taken together with the Matsumoto subgroup findings above, this suggests a coherent picture: cheap, low-intensity digital channels like text messaging can move adherence in the right direction, but the largest and most durable effects in this literature are consistently associated with a sustained, regularly scheduled relationship with a pharmacist, whatever channel that relationship happens to use.

The clearest single demonstration of pharmacist-led telehealth at scale is the Hyperlink 3 trial, a pragmatic cluster-randomized trial comparing pharmacist-led telehealth care against usual clinic-based care for patients with persistently uncontrolled high blood pressure across a large multi-site health system [16]. Trials of this design — pragmatic, cluster-randomized, embedded directly in routine clinical operations rather than run as a separate research protocol — are particularly valuable for this literature because they test whether effects observed under the more controlled conditions of a typical efficacy trial survive contact with the messiness of real clinical workflow, competing staff priorities, and heterogeneous patient populations, which is exactly the environment any pharmacy-based intervention will actually need to operate in if it is to be adopted at scale.

6. Collaborative Practice and Health-System Integration

None of the interventions described so far require a pharmacist to have independent prescribing authority; education, motivational interviewing, packaging, synchronization, and remote monitoring can all be delivered by a pharmacist operating strictly within their traditional dispensing and counseling role. But a distinct and generally more powerful category of intervention grants the pharmacist explicit authority, under a collaborative practice agreement with a supervising physician, to independently initiate, adjust, or titrate antihypertensive therapy in response to home or in-pharmacy blood pressure readings, without waiting for a separate physician visit and prescription change.

Hunt and colleagues' randomized controlled trial of team-based care, comparing physician-pharmacist collaborative management against usual physician-only care for patients with uncontrolled hypertension, found that patients in the collaborative arm achieved

significantly better blood pressure control over the trial period, with the pharmacist empowered to adjust medications directly according to a pre-specified treatment protocol rather than merely flagging concerns back to the physician [17]. This design feature — authority to act, not just authority to observe and report — appears repeatedly across the literature as a plausible mechanism for why collaborative-practice models tend to outperform pure counseling-and-education models on hard blood pressure endpoints specifically, even when both models perform similarly on adherence measures. A patient who is adherent to an inadequately titrated regimen will still have uncontrolled blood pressure; closing that gap requires someone with the authority to change the regimen, not only someone able to encourage adherence to it.

Anker and colleagues' comparative analysis of pharmacist scope-of-practice concordance with hypertension management guidelines across North American and European jurisdictions is a useful complement to the trial evidence, because it documents just how unevenly this authority is actually distributed across health systems that otherwise have broadly similar hypertension guidelines [18]. Some jurisdictions grant pharmacists explicit prescribing or dose-adjustment authority for hypertension under collaborative agreements; many others restrict pharmacists to counseling, monitoring, and referral, leaving the prescribing decision itself entirely with the physician regardless of how clearly the pharmacist's own monitoring data indicates a need for a dose change. This variation matters enormously for interpreting the trial literature, because it means the upper bound on what community pharmacy interventions can achieve for blood pressure control specifically — as opposed to adherence more narrowly — is set as much by regulatory scope-of-practice rules in a given jurisdiction as by anything intrinsic to the intervention itself. A well-designed remote-monitoring program of the kind Matsumoto and colleagues studied will underperform its full potential in a jurisdiction where the pharmacist who detects an inadequately controlled reading has no authority to act on it directly and must instead route the finding back through a physician referral process that reintroduces exactly the access friction and delay that pharmacy-based care is meant to avoid.

7. Cost-Effectiveness and the Access Gap

A body of work distinct from the clinical-effectiveness literature reviewed above has asked a related but separate question: even where pharmacist-delivered hypertension care measurably improves outcomes, is it worth paying for, and is it reaching the populations that need it most? Dixon and colleagues' cost-effectiveness microsimulation of expanded pharmacist prescribing authority for hypertension management in the United States estimated that scaling pharmacist prescribing nationally would be associated with approximately 2,100 fewer cardiovascular disease cases per 10,000 patients over a thirty-year horizon, alongside net cost savings of roughly \$10,162 per person over the same period, driven by prevented cardiovascular events outweighing the direct cost of additional pharmacist visits [19]. Findings of this kind matter for policy adoption specifically because health-system and payer decisions about whether to fund and authorize expanded pharmacist scope of practice are made on exactly this kind of cost-effectiveness evidence, not on clinical-effectiveness evidence alone; a demonstrably effective intervention that appears to cost more than it saves faces a much harder path to reimbursement and regulatory authorization than one that pays for itself.

The geographic and economic distribution of the underlying evidence base, however, does not match the geographic and economic distribution of the underlying burden, and this mismatch is, in our reading, the single most important open issue this synthesis surfaces. The great majority of the randomized trials underlying the meta-analyses discussed above were conducted in the United States, Canada, Western Europe, and a handful of other high-income health systems with well-established community pharmacy infrastructure, pharmacist training standards, and in some cases the collaborative-practice legal frameworks discussed in the previous section. Yet the NCD-RisC data summarized at the outset of this article show that the fastest-growing share of the global uncontrolled-hypertension burden is now concentrated in low- and middle-income countries, where community pharmacies are often the most accessible point of contact with any part of the formal health system, and sometimes the only point of contact a patient has for years at a stretch [1].

A smaller but growing literature has begun to test whether the community pharmacy adherence model translates to these settings. Gentilini, Kasonde, and

Babar's systematic review of community retail pharmacies' role in expanding access to noncommunicable disease services across low- and middle-income countries found that pharmacies were already functioning as a de facto first point of contact for hypertension and other chronic disease care in many of the settings reviewed, but that formal integration of pharmacists into NCD care pathways — with defined protocols, training, and, critically, the kind of collaborative prescribing authority discussed above — remained inconsistent and, in most reviewed countries, considerably less developed than in the high-income settings where the core trial evidence originates [20]. The COPE-BP programme, a multi-phase research initiative developing and testing a community-pharmacy-based hypertension intervention specifically for urban Bangladesh and Pakistan, is one of the more deliberate recent efforts to close this gap: rather than assuming that an intervention validated in a high-income health system will transfer unchanged, the programme explicitly builds and tests a locally adapted community pharmacy hypertension care model, reframing pharmacies — often overlooked in national health planning in the region — as a realistic frontline resource for populations poorly served by an overburdened public primary care system [21]. Programmes of this kind are still at an earlier stage of the evidence pipeline than the well-established meta-analyses reviewed in earlier sections, but they represent exactly the kind of deliberate, context-specific translation work that the access-gap problem requires, rather than an assumption that findings from one health system generalize automatically to another.

8. Open Challenges

Several gaps recur across the literature synthesized here and are worth stating plainly rather than leaving implicit. First, the geographic mismatch described in the previous section is, in our view, the most consequential open problem: the trial evidence base is concentrated in high-income health systems with mature community pharmacy infrastructure and, in some cases, established collaborative-practice legal frameworks, while the fastest-growing share of the global uncontrolled-hypertension burden sits in settings where that infrastructure and those legal frameworks are still being built. Extrapolating effect sizes from the former to the latter is a reasonable working assumption but not something the evidence base can yet confirm directly,

and the small emerging literature on locally adapted programmes such as COPE-BP has not yet matured into the kind of large, multi-trial meta-analytic base that underlies the confidence we can place in, for example, the Matsumoto or Gastens findings [21,20].

Second, the scope-of-practice variation documented by Anker and colleagues means that a large share of the clinical-effectiveness literature was generated under conditions — pharmacist authority to independently adjust therapy — that do not hold in many of the jurisdictions where this evidence might otherwise be used to justify expanding pharmacist involvement [18]. Advocates citing the collaborative-practice trial evidence to argue for expanded pharmacist scope of practice in a jurisdiction that currently restricts pharmacists to counseling and referral are, in effect, arguing that the regulatory change itself is a precondition for realizing the benefits the trials demonstrate, not simply an administrative detail; that is a coherent argument, but it is a different and harder argument to win than "pharmacist counseling improves adherence," and the two should not be conflated.

Third, component isolation remains incomplete. Conn and colleagues' meta-analysis identifies habit-linking, feedback, self-monitoring, packaging, and motivational interviewing as the components most consistently associated with improved adherence, but most real-world pharmacy programs bundle several of these components together rather than testing them in isolation, which makes it difficult to say with confidence how much of the observed effect any single component contributes on its own, or whether the components are additive, redundant, or synergistic when combined [9]. This matters practically because pharmacy staff time is a finite resource, and a program that could achieve most of the benefit through, say, packaging plus one structured feedback conversation per quarter would be far more scalable than one that assumes all five components must be delivered together to see an effect.

Fourth, durability beyond the typical six-to-twelve-month trial follow-up window is thinner than the volume of short-term trial evidence might suggest. The text-messaging literature in particular flags this explicitly, with effects well established over the duration of individual trials but considerably less evidence available on whether adherence gains persist once an active intervention — a synchronized

appointment schedule, a scheduled telehealth check-in cadence, a structured feedback program — is discontinued or scaled back [15]. Hypertension is a lifelong condition, and an adherence intervention that produces a real but temporary improvement is a materially different, and less valuable, finding than one that produces a durable behavior change, even though most trial designs in this literature are simply not long enough to distinguish the two.

Fifth, and more practically: reimbursement and workforce capacity constraints are real even where the clinical and cost-effectiveness case is strong. Dixon and colleagues' favorable cost-effectiveness finding for expanded pharmacist prescribing describes a population-level economic case, not a guarantee that any individual pharmacy or health system has the staffing, training pipeline, or payment model in place to actually deliver the intervention at the intensity the trials tested [19]. A regularly scheduled follow-up cadence, which the Matsumoto subgroup analysis identifies as the single most important design feature driving remote-monitoring effect sizes, requires dedicated pharmacist time that a chronically understaffed pharmacy, in any country, may simply not have to give [13].

9. Conclusion

The evidence reviewed here supports a fairly specific and, we think, well-earned claim: community pharmacy interventions — spanning patient education and motivational interviewing, adherence-focused packaging and appointment synchronization, remote monitoring and telehealth follow-up, and, where scope of practice allows, direct collaborative authority to adjust therapy — measurably improve both medication adherence and blood pressure control in patients with chronic hypertension, and they do so consistently across independent meta-analyses conducted a decade apart using different, overlapping trial pools [5,6,7]. The largest and most durable effects in this literature are not associated with any single novel technology or technique but with the regularity and continuity of pharmacist contact with the patient, whether that contact happens face to face at the counter, by scheduled telephone check-in, or through a structured telehealth platform [13,16]. And where pharmacists are given the regulatory authority to act on what they observe — adjusting a dose, initiating a medication, not

merely flagging a concern for someone else to act on later — the evidence for improved blood pressure control specifically, as distinct from adherence alone, is strongest [17,18].

Making this pattern actually work at the scale the global hypertension burden demands depends on treating several threads as inseparable rather than optional extras: the behavioral-science evidence on which specific intervention components actually move adherence [9,11,10], the scope-of-practice and collaborative-agreement frameworks that determine whether a pharmacist's clinical judgment can translate into an actual prescription change [18], the economic case that justifies paying for pharmacist time at the intensity the evidence says matters [19], and a deliberate, ongoing effort to test and adapt these models in the low- and middle-income settings where the burden of uncontrolled hypertension is now growing fastest and where community pharmacies are often the most realistic point of sustained clinical contact a patient has [20,21]. None of these are reasons to doubt the core finding; they are, read together, closer to an implementation roadmap. The consistency with which independent research groups, across multiple countries and using different trial pools, keep arriving at the same basic conclusion — that a pharmacist who sees a hypertensive patient regularly, and who has the tools and the authority to act on what they see, materially improves that patient's blood pressure — is, in our view, the strongest evidence available that community pharmacy is not a peripheral add-on to hypertension care but one of its more underused core components.

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The authors declare that they have no competing interests relevant to the content of this article.

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