

Why Continuing Professional Development Changes Pharmacy Practice in Some Settings but Not Others: A Realist Review of Motivation, Workplace Opportunity, and Sustained Behaviour Change

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Abstract

Continuing professional development (CPD) is expected to maintain pharmacists' competence, yet participation does not consistently become sustained practice change. To explain what CPD arrangements change pharmacy practice, for whom, through which mechanisms, and under what workplace conditions. A realist review used six PubMed-indexed search routes plus supplementary citation searching on 13 September 2026. Of 76 surfaced records, 15 duplicates were removed; 61 records were screened, 44 reports were sought, 40 were assessed in full, and 24 evidence units were included. Evidence was appraised for relevance, richness, and rigour and synthesised as context–mechanism–outcome (CMO) configurations. Four interacting CMO families explained variation: motivation; workplace opportunity; feedback and social reinforcement; and time, resources, and managerial support. Capability and confidence could rise without enactment when opportunity was restricted, while participation could coexist with weaker autonomous motivation. Repeated practice depended on actionable feedback, legitimate opportunities to act, and organisational capacity. CPD is most plausibly linked to sustained practice change when learning is meaningful, enactable in routine work, reinforced socially, and supported over time. Attendance, knowledge gain, or confidence alone should not be treated as sustained behaviour change.

Keywords: Continuing professional development, Pharmacy practice, Realist review, Programme theory, Context–mechanism–outcome, Behaviour change

Introduction

CPD is embedded in pharmacy regulation and professional development, but transfer into practice remains uneven. Evidence shows variation in how health professionals implement learning, how pharmacy systems organise CPD, and which systemic factors shape pharmacists' participation [1–3]. The key problem is

whether learning becomes usable in routine work and persists after the educational episode.

Regulatory expectations do not settle that question. Evidence supporting CPD standards is variable [4], while system-level reviews indicate that implementation and sustainability depend on organisational infrastructure and continued support [5]. Pharmacy CPD offerings also differ in format and alignment with the full CPD cycle [6]. Behaviour-change scholarship therefore emphasises links between learning and action, including goals, opportunity, reinforcement, and feedback [7]. Knowledge, confidence, satisfaction, and intention are valuable outcomes, but they do not by themselves demonstrate repeated practice.

This realist review asks: what CPD arrangements change pharmacy practice, for whom, through which

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mechanisms, and under what workplace contexts do motivation, opportunity, feedback, social reinforcement, time, resources, and managerial support produce sustained behaviour change? Its contribution is an evidence-bounded programme theory explaining why similar educational resources produce different practice trajectories.

Materials and Methods

Review question and realist logic

The review followed realist-synthesis logic informed by prior realist work on CPD, evidence appraisal, and collaborative workplace learning [8–10]. Context included role expectations, workflow, staffing, managerial support, autonomy, and access to practice opportunities. Resources included education, coaching, supervision, audit information, and peer interaction. Mechanisms were participant reasoning or responses activated by those resources, such as perceived relevance, reflective sense-making, accountability, or willingness to act. Outcomes included enacted behaviours, role or service uptake, repeated performance, and persistence where directly supported.

Three safeguards governed inference: determinants were not automatically labelled mechanisms; proximal educational outcomes were separated from practice outcomes; and sustained change required repeated enactment, temporal continuation, or a defensible cross-evidence inference.

Development of initial programme theory

The initial theory proposed that CPD resources increase relevance and capability, which strengthen motivation and confidence; workplace opportunity then permits enactment, feedback supports adjustment, and repetition supports persistence. Realist evidence on supervised workplace learning suggested that supervision, role expectations, and authentic practice opportunities could modify this sequence [11].

The theory was deliberately provisional. Motivation, opportunity, reinforcement, and organisational capacity were treated separately so that one could be present while another was absent. It also allowed useful education to fail when workload, authority, service design, or professional relationships prevented application.

Search strategy

Searches were executed on 13 September 2026 through six PubMed-indexed routes covering: (P1) "continuing professional development" OR "continuing education" + pharmacist practice behaviour implementation; (P2) pharmacist CPD + transfer to practice; (P3) pharmacist professional development + workplace managerial support opportunity; (P4) pharmacist workplace learning + training intervention practice implementation; (P5) pharmacist motivation + continuing education/CPD; and (P6) pharmacist feedback/social reinforcement + mentoring/workplace learning/systematic review. All routes applied the 2017–2024 publication window. Supplementary citation chaining and targeted realist-method/workplace-learning searches identified four additional unique records.

The six primary routes surfaced 72 records; supplementary searching increased the corpus to 76 before deduplication. Because the available interface did not expose a trustworthy database-wide PubMed hit count, these values represent the auditable records actually surfaced and screened, not an exhaustive reconstruction of PubMed.

Selection

Deduplication by DOI and normalised title removed 15 records, leaving 61 for title/abstract screening. Seventeen were excluded: nine were outside the date window, four concerned the wrong training stage or population, and four had unrelated exposures or outcomes. Forty-four reports were sought; four lacked sufficient report-level retrieval, leaving 40 full reports.

Sixteen full reports were excluded: six had only participation, knowledge, attitude, or other proximal outcomes without usable transfer evidence; three were pre-entry/student-only; three addressed preferences, needs, or regulatory participation without usable transfer evidence; two were outside CPD/workplace professional learning; and two were commentary, protocol, or otherwise non-synthesizable. Twenty-four evidence units remained.

Relevance and rigour appraisal

Evidence was appraised separately for relevance, richness, and rigour. Relevance concerned contribution to programme-theory testing; richness concerned explanatory detail; rigour concerned credibility of the data supporting a specific inference. This followed realist appraisal guidance that distinguishes explanatory usefulness from conventional evidence hierarchy [9].

Appraisal informed interpretive weight but was not an automatic exclusion shortcut. Contradictory and null findings were retained because they helped identify boundary conditions.

Data extraction and coding

Extraction covered design, setting, participants, intervention or exposure, outcomes, follow-up, main findings, implementation dimensions, appraisal, contradictions, reported limitations, and applicability boundaries. The updated Consolidated Framework for Implementation Research sensitised coding to multilevel context [12], while the Theoretical Domains Framework supported identification of behavioural determinants without assuming that each domain constituted a mechanism [13].

Outcomes were separated into participation; knowledge or skill; confidence or intention; enacted behaviour; role/service implementation; and sustained or repeated practice. Work on CPD impact measurement supported this distinction [14]. Missing information was recorded as not reported or not applicable.

Context–mechanism–outcome configuration development

Candidate CMOs were built by identifying a resource or opportunity, examining the reasoning it activated, and linking that response to an outcome within a defined context. Similar educational conditions producing different outcomes were especially informative. Confidence without enactment, participation with weak autonomous motivation, and targeted improvement

accompanied by deterioration elsewhere were treated as theory-testing counterexamples.

Programme-theory refinement

Candidate configurations were compared across supporting, contradictory, and context-dependent evidence. Factors were repositioned when their causal role became clearer; for example, managerial support was treated primarily as a contextual resource enabling action rather than as an internal mechanism. Direct evidence was separated from review-level interpretation. Repeatedly observed links were treated as better supported, whereas cross-study inferences remained conditional. The refined theory allowed sustained, partial, transient, absent, and competing practice-change trajectories.

Results and Discussion

Study selection and characteristics

The review included 24 evidence units from 40 full reports assessed. Designs included direct CPD evaluations, workplace-learning and role-development studies, implementation analyses, realist evaluations and syntheses, and systematic or scoping reviews. Outcome horizons ranged from motivation, confidence, and self-reported behaviour to service implementation and longitudinal change; only a subset directly examined persistence.

Table 1 classifies the evidence by learning form, practice context, outcome horizon, and contribution to programme-theory refinement.

Table 1. Evidence-source characteristics relevant to CPD-to-practice transfer

Unit	Learning form	Practice context	Outcome horizon	Programme-theory contribution
E01	Clinical CPD	Hospital pharmacy	Practice behaviour	Targeted gains with competing effects
E02	Behaviour-change training	Primary care	Implementation	Capability–opportunity separation
E03	Pharmaceutical-care CPD	Community pharmacy	Implementation	Reach versus application
E04	Online patient-care programme	Pharmacy practice	Confidence/practice	Transfer despite operational barriers
E05	In-house education	Hospital pharmacy	Service development	Organisational embedding
E06	Goal-based CPD	Health system	Engagement/goals	Motivational signal
E07	Post-foundation development	Hospital pharmacy	Development needs	Mentoring/managerial opportunity
E08	Leadership development	Pharmacy workforce	Participation	Workload/support constraints
E09	Role-development pathway	General practice	Longitudinal role use	Workplace support
E10	Educational supervision	Primary care	Workplace learning	Supervision resource
E11	Workplace programme	Community pharmacy	Reported practice	Mentoring/peer access
E12	Post-registration pathway	Community pharmacy	Application	Employer support/opportunity
E13	Coach-led programme	Community pharmacy	Transition	Social reinforcement

E14	Continuing education	Pharmacy CE system	Motivation	Value/access
E15	Existing CE system	Pharmacy CE system	21-month motivation	Participation–motivation divergence
E16	Lifelong-learning environment	Pharmacist development	Adaptability	Need-related reasoning
E17	CE/CPD formats	International pharmacy	Preferences	Format heterogeneity
E18	CPD transfer	Health professions	Implementation	Time/resource conditions
E19	Audit/feedback	General practice	Prescribing	Feedback-supported behaviour
E20	Statutory CE/CPD models	Global pharmacy	System design	Regulatory heterogeneity
E21	Expertise development	Prescribing	Expertise	Repeated practice/social context
E22	Pharmacy CPD participation	International pharmacy	Participation	Access/support/policy
E23	Workplace CPD	Healthcare	Realist synthesis	Organisational support/culture
E24	Collaborative learning	Primary care	Realist synthesis	Protected time/social learning

Initial-to-refined programme theory

The initial theory proved too linear. Capability and confidence sometimes increased without enactment because workflow space, role legitimacy, patient access, or organisational permission were missing. Participation could continue while autonomous motivation weakened. Feedback varied in usefulness according to actionability and relationships. Time, workload, staffing, and managerial priority determined whether new behaviour could recur.

Four refinements followed. First, capability was separated from opportunity. Second, motivation was treated as a reasoning response whose quality depends on relevance, autonomy, competence, and professional

value. Third, feedback and social reinforcement became iterative resources whose effects depend on trust and opportunities for repeated action. Fourth, time, resources, and managerial support were repositioned as contextual conditions governing recurrence and persistence.

The refined theory is configurational: sustained change becomes more plausible when meaningful learning activates motivation, legitimate workplace opportunity permits enactment, feedback supports adjustment, and organisational capacity supports repetition. Partial, transient, absent, or competing change becomes more plausible as those conditions weaken or conflict.

Table 2 traces the main theory revisions.

Table 2. Programme-theory refinement from educational exposure to sustained practice change

Initial assumption	Challenging evidence pattern	Refined proposition	Boundary
Capability leads to practice change	Capability/confidence rose while workplace barriers persisted	Capability requires practical opportunity for enactment	Opportunity and role legitimacy vary
Participation indicates motivation	Participation coexisted with weaker autonomous motivation	Motivation quality influences internalisation and use	Mostly observational evidence
Feedback reinforces behaviour	Effects varied with actionability and relationships	Feedback works through safe interpretation and opportunity to respond	Multi-component packages
Time/support are background facilitators	Workload, staffing, and employer engagement altered implementation	Organisational capacity governs recurrence	No universal threshold
Successful CPD yields stable change	Sustained, partial, transient, absent, and competing effects appeared	CPD transfer follows multiple configurations	Long-horizon evidence limited

The refinement is represented visually as a field in which CPD resources encounter contextual conditions and participant reasoning before practice outcomes emerge.

Counterexamples revise direct links, while supported and proposed relationships remain visually distinct.

Refining programme theory for CPD in pharmacy practice

From initial assumptions to a contextualised and empirically informed theory of change

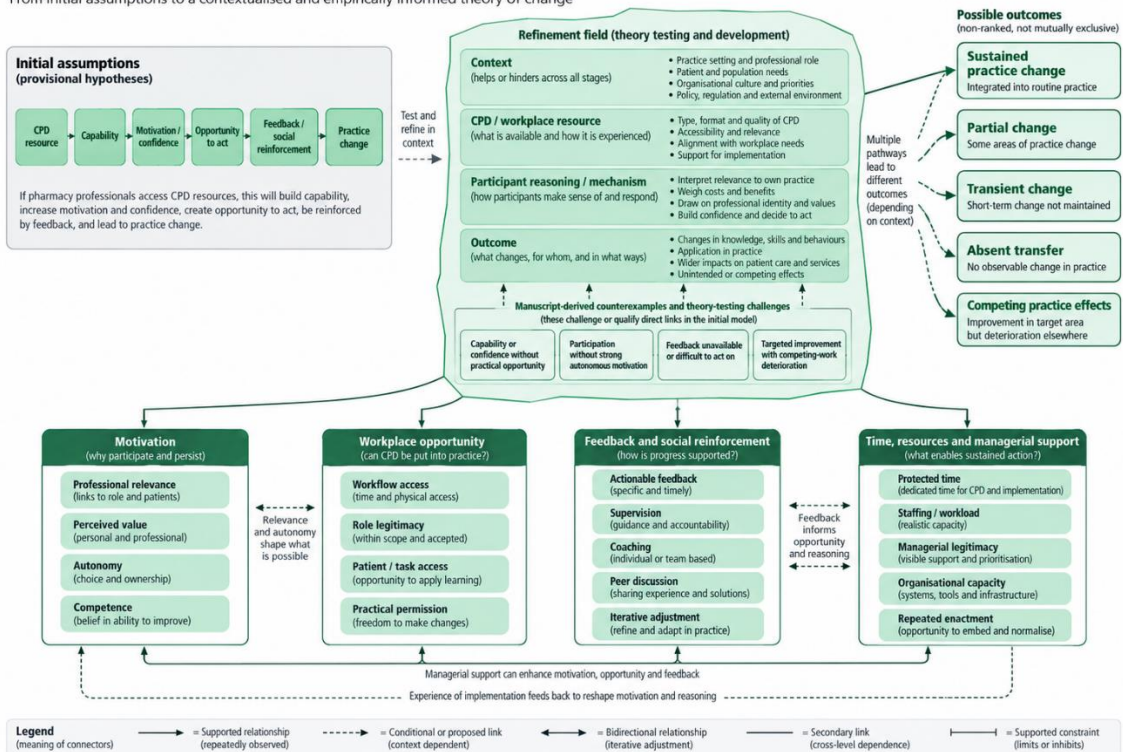


Figure 1. Refinement of CPD-to-practice programme theory through supporting, contradictory, and conditional evidence

CMO family 1: Motivation

Motivation influenced whether CPD was treated as a requirement to complete or as a resource worth integrating into practice. Longitudinal evidence from pharmacists is particularly important because participation and internal motivation did not move in parallel. Over 21 months, controlled motivation increased while relative autonomous motivation declined, showing that continued engagement with a formal education system cannot be assumed to indicate deeper professional internalisation [15]. Motivation therefore functions in the programme theory as a response to the meaning attached to learning, rather than as a simple property of attendance.

Psychological need satisfaction offers one explanation for this variation. Pharmacists reporting stronger fulfilment of autonomy, competence, and relatedness also showed more favourable motivational and lifelong-learning characteristics [16]. The evidence is associational and does not establish a causal pathway, but it supports distinguishing an educational resource from the reasoning it may activate. Learning perceived as relevant to professional problems can be interpreted as

useful and competence-enhancing; learning experienced principally as an external obligation can generate compliance without the same commitment to enactment. Variation in perceived value is also visible across continuing-education settings. Pharmacists differed in their motivation toward educational activities, with perceived usefulness and accessibility contributing to the pattern [17]. Within a health-system CPD process, pharmacists similarly regarded goal development as potentially useful while the quality and practical specificity of goals varied [18]. A formally documented learning goal should therefore be understood as a possible motivational resource, not evidence that behaviour subsequently changed.

The resulting CMO interpretation separates three stages that are easily conflated: exposure to a CPD resource, the reasoning it evokes, and the professional behaviour that follows. When learning connects with an immediate practice problem, supports competence, and retains meaningful professional choice, it can activate perceived relevance and willingness to apply learning. When participation is predominantly externally controlled, poorly connected to practice, or experienced as

administratively remote, the same educational exposure may lead only to completion.

Table 3 makes this distinction explicit by separating context, resource, participant reasoning, practice outcome, and plausible rival explanation.

Table 3. Context–mechanism–outcome configurations linking motivation and opportunity to pharmacy-practice enactment

Configuration	Practice context	CPD/workplace resource	Participant reasoning or response	Practice outcome	Rival or limiting explanation
Professionally meaningful learning	Learning addresses an identifiable practice problem	Relevant CPD content with scope for application	“This can improve work I already need to do”	Greater willingness to test learning in practice	Motivated participants may already be more development-oriented
Controlled participation	CPD is primarily experienced as a regulatory or organisational requirement	Mandatory or externally monitored participation	“This must be completed”	Attendance or completion without assured enactment	Compliance may still produce useful learning for some pharmacists
Competence-supported engagement	Pharmacist perceives developing mastery and professional growth	Structured learning, goals, feedback or developmental support	Increased competence and ownership	Stronger readiness to apply learning	Confidence can rise without opportunity to act
Opportunity-constrained motivation	Pharmacist values learning but workflow or role access is restricted	Relevant CPD without protected implementation opportunity	Willingness to act but recognition that enactment is impractical	Delayed, partial or absent transfer	Lack of behaviour may reflect context rather than weak motivation
Practice-enabled motivation	Learning is relevant and the workplace permits repeated use	CPD plus legitimate clinical/workflow opportunity	Learning is interpreted as usable and consequential	Repeated enactment becomes more plausible	Persistence still depends on reinforcement and resources

CMO family 2: Workplace opportunity

Motivation and capability did not resolve whether pharmacists could use what they had learned. Analysis of behaviour-change training in primary-care pharmacy showed that implementation depended on opportunity as well as capability and motivation [19]. Opportunity included access to appropriate patients or tasks, time within workflow, authority to perform the behaviour, and a work environment in which the behaviour was recognised as legitimate.

Educational supervision can expand that opportunity by linking professional development with actual role demands [20]. Supervision is not merely another educational session; it can create occasions to interpret cases, test judgement, and adapt practice under conditions where support remains accessible. Similar distinctions appeared in a nationwide pharmaceutical-care initiative: large numbers of community pharmacists could be trained, yet training reach and sustained implementation remained conceptually different outcomes [21].

The same separation was evident in online development. Pharmacists completing the ADAPT programme reported improved confidence and changes in aspects of practice, while operational barriers remained relevant to what they could implement [22]. Confidence therefore became consequential only where there was somewhere for the new behaviour to occur. Coaching for newly registered community pharmacists likewise provided structured social and workplace support during transition, but feasibility and perceived usefulness should not be interpreted as proof of universal or durable effectiveness [23].

Post-foundation pharmacists identified access to development opportunities, mentoring, qualifications, and managerial support as relevant to progression [24]. Community pharmacists participating in a workplace-based programme described mentoring, peers, and access to other healthcare professionals as important to confidence and reported changes in practice [25]. Opportunity was therefore both material and relational: pharmacists required tasks, time, and permission, but

also access to people who could help interpret unfamiliar situations.

The organisational environment could strengthen or narrow these opportunities. Leadership-development evidence identified managerial and peer support as drivers while workload and restricted opportunity operated as constraints [26]. Work on adoption of pharmacists' full scope of practice similarly showed that environmental and behavioural determinants influence whether professionals enact capabilities already within their potential scope [27].

Opportunity also has a temporal dimension. Evidence on recency of practice indicates that maintenance of professional performance varies with time away from practice, prior experience, and task characteristics [28]. This cautions against treating a capability acquired at one point as indefinitely available. Repeated exposure and use may matter because workplace opportunity is also the environment in which capability is maintained.

Implementation research in pharmacy reinforces this interpretation. Establishing new community-pharmacy services required adaptation to workflow, staffing, coordination, and other practice conditions [29]. Reviews of implementation strategies similarly show that professional-service implementation cannot be reduced to education alone [30], while qualitative evidence from clinical pharmacy services illustrates how organisational culture, resources, roles, and local expectations shape implementation [31]. Workplace opportunity in the refined programme theory therefore represents the practical possibility of performing the learned behaviour repeatedly within real service constraints.

CMO family 3: Feedback and social reinforcement

Enactment does not guarantee persistence. Feedback and social reinforcement determine whether early attempts are interpreted, adjusted, abandoned, or incorporated into routine practice. Pharmacist-involved audit-and-feedback interventions provide direct evidence that feedback can contribute to changed professional behaviour; pooled eligible studies in one review reported improvement in prescribing outcomes [32]. Because these interventions frequently combine several components, the effect cannot be attributed to information provision alone.

For feedback to function mechanistically, it must be received in a way that permits sense-making and action. Workplace-learning research shows that feedback

conversations can be shaped by role expectations, vulnerability, interpersonal relationships, and power [33]. Information that threatens professional identity or arrives without an actionable route may fail to activate reflection even when technically accurate.

A broader review of workplace-based feedback describes feedback as a process involving observation, interpretation, dialogue, and subsequent action rather than a one-way transfer of information [34]. This fits the realist synthesis: feedback is a resource, whereas reflection, accountability, reassurance, or revised judgement are possible reasoning responses. Whether those responses occur depends on relationships and context.

Pharmacy-specific communication training provides a further example. Structured preparation can improve professionals' readiness for challenging medication-related conversations [35], but short-term preparedness cannot establish sustained implementation. Reinforcement becomes more plausible when pharmacists repeatedly encounter the relevant situation, can discuss difficulties with peers or supervisors, receive information about consequences, and retain permission to adjust their approach.

Social reinforcement thus spans formal supervision, coaching, peer discussion, audit information, and interprofessional interaction. These resources can normalise new behaviours, provide corrective interpretation, and reduce uncertainty. Their absence does not necessarily erase capability; it can leave new behaviour fragile, inconsistently performed, or dependent on unusually motivated individuals.

CMO family 4: Time, resources and managerial support

Time and organisational resources shaped whether pharmacists could repeat behaviours often enough for them to become embedded. Workload was repeatedly reported alongside restricted developmental opportunity, whereas managerial and peer support could create space for learning and role expansion [26]. These factors were not treated as generic "barriers" because their realist function depended on what they enabled. Protected time could permit deliberate practice; staffing could preserve service capacity while a new activity was learned; managerial endorsement could legitimise priority for the behaviour.

The temporal problem is particularly important. Skills and professional performance are influenced by recency and repeated use [28]. A behaviour performed shortly

after training may therefore represent early enactment rather than sustained change. Persistence requires opportunities to encounter the relevant task again, adapt it to variation, and recover after interruptions.

Organisational resources can also redistribute attention rather than simply increase it. Implementation of new pharmacy services occurs within existing workloads and competing service demands [29]. A programme may therefore improve one targeted behaviour while indirectly reducing attention elsewhere. This possibility prevents the review from assuming that successful implementation within one domain is equivalent to net improvement across practice.

Managerial support was interpreted as a contextual resource because it can change access to time, cases, staffing, feedback, or decision latitude. Where organisational culture and role expectations support the service, learning has a recurrent setting in which it can be used; where the work remains marginal to recognised priorities, enactment may become episodic [31]. Sustainability is therefore partly an organisational property, not merely the persistence of individual motivation.

Configurations supporting sustained behaviour change

The four CMO families did not operate as independent ingredients with additive effects. Sustained change was most plausible when they converged. Professionally meaningful learning could activate motivation; workplace access allowed the pharmacist to try the behaviour; feedback and social interaction supported

adjustment; and time, staffing, and managerial legitimacy permitted repetition. Removal of one element altered the trajectory.

A first configuration involved supported enactment: relevant learning was accompanied by legitimate opportunities to apply it, access to feedback, and sufficient organisational capacity for repeated use. This configuration offered the strongest basis for sustained change. A second involved motivated but constrained transfer, in which pharmacists valued the learning but lacked time, authority, patient access, or workflow opportunity. Practice change was delayed or partial.

A third involved enabled but weakly internalised enactment. Organisations created opportunities or requirements, but learning remained externally controlled or weakly connected to professional goals. Behaviour might occur while monitoring or support remained strong and then become vulnerable to erosion. A fourth involved initial change without reinforcement, where early implementation was possible but feedback, mentoring, or repeated opportunities were insufficient to stabilise it.

A fifth configuration involved competing implementation demands. A targeted practice could improve while limited cognitive or organisational capacity displaced attention from other activities. Such patterns are especially important because they prevent the review from equating increased performance in the trained domain with globally improved practice.

Table 4 summarises these cross-CMO configurations.

Table 4. Cross-CMO configurations associated with sustained, partial, transient, absent, or competing pharmacy-practice change

Configuration	Motivation state	Workplace opportunity	Feedback/social reinforcement	Time/resources/managerial support	Most plausible practice trajectory
Supported enactment	Learning is meaningful and internally valued	Repeated legitimate opportunities	Actionable feedback and trusted reinforcement	Sufficient capacity and managerial legitimacy	Sustained change
Motivated but constrained transfer	High relevance and willingness	Restricted task, workflow, role, or patient access	Available variably	Insufficient or poorly aligned	Partial or delayed change
Enabled but weakly internalised enactment	Predominantly controlled motivation	Behaviour is required or made available	Monitoring may be strong	Support tied to programme activity	Transient or compliance-dependent change

Initial change without reinforcement	Motivation initially adequate	Early opportunity exists	Feedback or peer reinforcement diminishes	Repetition becomes inconsistent	Erosion after initial enactment
Capability without enactment	Knowledge/skill/confidence present	Practical opportunity absent	Limited relevance if behaviour cannot occur	Context does not prioritise use	Absent transfer
Competing implementation demands	Motivation directed toward target behaviour	Opportunity concentrated in one domain	Reinforcement favours target behaviour	Finite workload/cognitive resources	Targeted gain with competing effects

The refined programme theory is represented as a branching field rather than a single pathway. Motivation, opportunity, reinforcement, and organisational capacity can align, diverge, recover, or erode over time.

What works, for whom, how and under what conditions

The synthesis indicates that CPD is linked to practice change through configurations rather than educational exposure alone. The most consistent explanatory pattern is that learning must become both meaningful and usable. Motivation affects whether pharmacists interpret learning as professionally relevant; opportunity determines whether they can enact it; feedback influences how early attempts are interpreted and adjusted; and organisational capacity determines whether the behaviour can recur long enough to persist. For whom CPD works therefore depends partly on the relationship between the learner and the practice setting. Pharmacists entering new or expanded roles may require more supervision and legitimate opportunities to practise than colleagues already embedded in those tasks. Professionals with high initial motivation can still fail to implement learning when workflow, authority, staffing, or patient access is restricted. Conversely, organisational requirements may produce participation or temporary enactment without equivalent autonomous commitment. This interpretation is consistent with pharmacy evidence showing that delivery of behaviour-change recommendations varies with capability, opportunity, and motivation [36]. The value of this result lies less in assigning pharmacists to fixed behavioural categories than in demonstrating that individual and workplace determinants coexist. CPD design should therefore avoid treating learner motivation as an explanation for outcomes that may actually arise from organisational opportunity.

The implementation literature also discourages single-component explanations. Workflow redesign, local service conditions, organisational culture, and implementation strategy interact in shaping whether new

pharmacy services become routine [29–31]. This is the third and final grouped citation in the manuscript. The realist contribution is to specify how those conditions matter: they provide or restrict resources that pharmacists interpret and act upon.

Sustained change remains less securely evidenced than immediate or intermediate outcomes. Several included studies assessed confidence, motivation, reported practice, or early implementation, while fewer followed behaviour over sufficiently long intervals to determine persistence. The review therefore supports a conditional explanation of sustained behaviour rather than a quantitative estimate of its probability.

Strengths and limitations

A major strength is the explicit separation of CPD participation, proximal educational outcomes, enacted behaviour, and sustained practice. The review also preserved contradictory evidence and treated it as informative for programme-theory refinement. Realist appraisal allowed qualitative, implementation, and mixed-method evidence to contribute according to explanatory relevance and rigour rather than a single methodological hierarchy.

The review has important limitations. Searches were executed through auditable PubMed-indexed routes and supplementary searching rather than a database interface exposing complete platform-wide hit counts. The reported 76-record corpus therefore represents the executed and screened retrieval set, not an exhaustive reconstruction of every potentially relevant PubMed record. Four sought reports could not be retrieved with sufficient report-level detail.

The evidence base was heterogeneous and frequently relied on self-report. Studies of confidence, motivation, perceived competence, and implementation experience could inform mechanisms but could not prove sustained behaviour. Several explanatory sources came from broader healthcare workplace-learning contexts; these strengthened programme-theory development but

require caution when transferred to pharmacy. Long-horizon evidence was comparatively sparse, and no universal threshold for protected time, supervision, feedback frequency, or managerial support could be inferred.

Implications

CPD should be designed around enactment as well as learning. Educational activities can be linked prospectively to opportunities for pharmacists to use new skills, access supervision or feedback, and revisit behaviours in routine practice. Managers can influence transfer by protecting relevant opportunities, legitimising role expansion, and ensuring that implementation does not depend solely on discretionary effort.

Evaluation should distinguish attendance, learning, confidence, initial enactment, repeated enactment, and persistence. Measuring these stages separately would make it possible to identify where transfer fails and whether failure reflects motivation, capability, opportunity, reinforcement, or organisational capacity.

The synthesis also suggests that high motivation should not be interpreted as evidence that an implementation environment is adequate. Pharmacy research using COM-B has shown that professionals can be motivated while behavioural participation remains constrained by capability or opportunity conditions [37]. Future evaluations should therefore measure contextual access alongside individual readiness.

Longitudinal studies are particularly needed. They should observe behaviour after formal educational support diminishes, assess whether feedback and supervision become embedded, and examine competing effects on other pharmacy work. Realist evaluations can strengthen this agenda by testing specified CMO configurations across different pharmacy sectors rather than asking only whether a CPD programme produced an average improvement.

Conclusion

Continuing professional development changes pharmacy practice most plausibly when learning is professionally meaningful, pharmacists have genuine opportunities to use it, feedback and social relationships help them interpret and adjust performance, and organisational conditions permit repeated enactment. These conditions interact rather than operate as independent ingredients.

Their alignment can support sustained change; their absence or erosion can produce partial, transient, absent, or competing effects. Participation, knowledge, confidence, or motivation alone should therefore not be treated as evidence that practice has changed or that change will persist. A realist view of CPD shifts evaluation from whether education was delivered to how learning becomes usable, reinforced, and sustainable within the settings where pharmacists actually work.

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