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Planned and emergent implementation strategies during national scale-up of hepatitis C point-of-care testing in Australia: a retrospective case study

Guillaume Fontaine

guil.fontaine@mcgill.ca

McGill University

William Nicholls

Kirby Institute, University of New South Wales

Thomas Rudge

Kirby Institute, University of New South Wales

Emma Day

Kirby Institute, University of New South Wales

Natalie Taylor

University of New South Wales

Andrea Torres Robles

University of New South Wales

Alison D. Marshall

Kirby Institute, University of New South Wales

Lise Lafferty

Kirby Institute, University of New South Wales

David Silk

Kirby Institute, University of New South Wales

Simon Comben

Kirby Institute, University of New South Wales

Samira Hosseini-Hooshyar

Kirby Institute, University of New South Wales

Jake Abbott

Kirby Institute, University of New South Wales

Keren Smart

Kirby Institute, University of New South Wales

Maria Martinez

Kirby Institute, University of New South Wales

Corey Markus

Kirby Institute, University of New South Wales

Susan Matthews

Flinders University International Centre for Point-of-Care Testing, Flinders University

Alisa Pedrana

Burnet Institute

Melanie Kingsland

The University of Newcastle

Marianne Martinello

Kirby Institute, University of New South Wales

Luke Wolfenden

The University of Newcastle

Jason Grebely

Kirby Institute, University of New South Wales

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Abstract

Background

Scaling up point-of-care testing requires implementation strategies across policy, program, service, and community levels, yet how these strategies are configured, adapted, and sustained over time is rarely examined. The Australian Hepatitis C Point-of-Care Testing Program is one of the first programs globally to scale up molecular hepatitis C point-of-care testing; by July 2026, it supported 113 services nationally and had delivered 75,878 antibody and RNA tests. We examined the configuration and evolution of planned, adapted, and emergent implementation strategies across the program.

Methods

We conducted a retrospective case study using 28 program documents, records from 124 implementation meetings, and interviews with 30 stakeholders across six states and territories. Strategy instances were coded using the Expert Recommendations for Implementing Change (ERIC) taxonomy, consolidated into distinct implementation strategies, and classified by implementation domain, trajectory, delivery level, timing, and evidence provenance. We examined how strategies operated together and derived implications for scale-up planning.

Results

The analysis identified 328 strategy instances, consolidated into 79 distinct strategies across nine implementation domains. Twenty-four (30%) were prospectively planned and implemented substantially as planned, 15 (19%) were planned and adapted, and 40 (51%) emerged in response to implementation experience. Governance and stakeholder partnerships formed the largest domain (n = 23), whereas client and community engagement (5/6 emergent), support for testing operators (4/5), and adaptation of the testing model to context (5/9) were predominantly emergent. Thirty-nine strategies were jointly delivered by the central program and services, 31 were primarily central, and nine were service-delivered; all service-delivered strategies were emergent. Seventeen strategies were first introduced during national scale-up and none during ongoing delivery, although 66 remained active. Planned strategies were documented mainly prospectively, whereas emergent strategies were identified primarily through stakeholder interviews. Interpretive synthesis generated a three-layer model comprising a nationally specified backbone, adaptive implementation infrastructure, and locally configured service delivery.

Conclusion

The national scale-up of hepatitis C point-of-care testing combined a central implementation backbone with ongoing adaptation and local configuration across settings. Future scale-up plans should

distinguish what must be specified in advance, what can be configured locally, and what capacity is needed for ongoing learning and adaptation.

Contributions to the literature

- Implementation strategies are commonly described as discrete actions, with limited empirical evidence on how configurations of strategies evolve across levels and phases during national scale-up of an innovation.
- This study shows how planned, adapted, and emergent strategies accumulated during national scale-up of hepatitis C point-of-care testing.
- Three interdependent implementation layers were identified: a nationally specified backbone, adaptive implementation infrastructure, and locally configured delivery, illustrating how standardization can coexist with adaptation.
- Prospective scale-up planning should distinguish what must be standardized, what can be locally configured, and what capacity is required to detect and respond to emerging implementation needs.

Background

Hepatitis C virus (HCV) elimination depends on identifying and treating people underserved by conventional testing and treatment pathways.[1,2] Although direct-acting antivirals can cure HCV infection, the global burden remains substantial and is concentrated in populations facing structural barriers to care.[2] In Australia, HCV disproportionately affects people who inject drugs, people with incarceration experience, Aboriginal and Torres Strait Islander peoples, and people from high-prevalence countries.[3,4] Conventional pathways may require venepuncture, off-site laboratory processing, return visits, and navigation between testing and prescribing, creating opportunities for loss to follow-up.[5,6]

Decentralized point-of-care HCV antibody and RNA testing can shorten diagnosis and treatment pathways by bringing testing closer to where people receive care.[6–11] Diagnostic studies, clinical trials and systematic reviews support its accuracy, feasibility and effectiveness across settings including prisons, needle and syringe programs, drug and alcohol services, and community-based health services.[6–10,12–17] The Australian Hepatitis C Point-of-Care Testing Program was established to scale-up point-of-care testing nationally across diverse settings, achieving scale-up across 113 sites and delivering 75,878 antibody and RNA tests by July 2026.[18]

The program built on Australian molecular point-of-care testing networks for sexually transmitted and respiratory infections, established connectivity systems, and experience delivering decentralized testing.[19–23] This informed prospective planning of governance, operator training and competency assessment, quality management, and technical support. Yet national scale-up requires more than deployment of testing platforms: it also requires coordinated financing, community engagement, workflow redesign, data systems, technical assistance, supply management, and pathways from

diagnosis to treatment.[18] Implementation strategies – purposive actions used to enhance the adoption, implementation, scale-up, or sustainment of an evidence-based practice[24] – are therefore often multicomponent and delivered across levels.[25,26] Although guidance has improved specification of implementation strategies,[24,27] descriptions commonly portray them as discrete and comparatively static actions, providing less insight into how strategies are configured across levels, adapted after introduction, or generated in response to implementation experience.

This gap is particularly important in large-scale implementation, where interventions and implementation strategies interact with heterogeneous organizations, workforces, communities, and policy environments.[28–31] Experience from infectious disease point-of-care testing programs suggests that stable central infrastructure and standards must coexist with flexible local workflows, continuing operator support, and mechanisms for learning and adaptation.[19,20,32–34] Overly prescriptive governance may constrain local fit, whereas poorly governed variation may undermine quality, interoperability, accountability, and equitable reach.[19–21] Understanding what should be specified nationally, configured locally, or supported through ongoing detection and response may therefore inform future scale-up.[29,31,35,36] We conducted a retrospective case study of the Australian Hepatitis C Point-of-Care Testing Program to:

1. Identify and characterize the implementation strategies used across the national program.

2. Examine how strategies changed over time, including whether they were prospectively planned, subsequently adapted, or introduced in response to implementation experience.

From this analysis, we also derived practical considerations for prospective scale-up planning.

Methods

Study design

We conducted a retrospective single-case study integrating documentary analysis and secondary qualitative analysis of stakeholder interviews.[37] The bounded case was the Australian Hepatitis C Point-of-Care Testing Program.[18] The unit of analysis was the distinct implementation strategy, defined as a purposive action undertaken to enhance adoption, implementation, scale-up, or sustainment of HCV point-of-care testing.[24] Program- and service-level enactment were treated as embedded analytic levels; jurisdictions and service settings provided contextual variation but were not treated as separate cases because comparable jurisdictional histories were unavailable. The study was descriptive and interpretive and was not designed to estimate comparative strategy effectiveness or causally attribute program outcomes. Reporting was informed by the Standards for Reporting Qualitative Research (SRQR) checklist, presented in *Supplementary material 1*.[38]

Setting and case

The case was the Australian Hepatitis C Point-of-Care Testing Program, one of the first globally to support and evaluate scale-up of molecular point-of-care HCV testing.[18] It initially offered HCV RNA testing and later introduced antibody testing with reflex RNA testing for antibody-positive results. The program provides testing across diverse settings serving populations at increased risk of HCV.[18]

The program provides services with a largely centralised implementation infrastructure, including risk assessment/mitigation, standard operating procedures, operator training and competency assessment, quality control and quality assurance, logistics and deployment, technical support, testing instruments, assays, and other supplies, connectivity, and a research and evaluation framework.[18] Prospective implementation planning translated applicable Australian point-of-care testing standards and clinical policies into risk assessment, standard operating procedures, initial and ongoing operator training and competency assessment, internal quality control, external quality assurance, and result-reporting processes. These arrangements addressed risks before, during, and after testing, including specimen, analytical, and reporting errors.[39]

The program, initiated in 2022, has now been implemented across all states and territories in a range of service settings, including drug treatment clinics, prisons, homelessness services, needle and syringe programs, mobile outreach models, peer-led organizations, community health organizations, and Aboriginal Community Controlled Health Organisations. By July 31 2026, the program supported 113 services and had trained over 550 non-laboratory decentralised HCV testing operators. Participating services had performed 32,748 antibody and 43,130 RNA tests, diagnosed current HCV infection in 6,165 people, and initiated treatment in 3,906.

We distinguished four national program phases: pre-implementation (2021), covering design, governance, funding, protocol development, and preparation before service activation; early implementation (2022), covering initial deployment and testing at the first 37 sites; national scale-up (2023–2025), during which 46 additional sites opened in 2023, 27 in 2024, and 15 in 2025 alongside refinement of implementation arrangements; and ongoing delivery (2026 to the last ascertainment date), covering continued operation, support, and reconfiguration of the established network. Individual sites entered implementation at different times, and preparation, adaptation, and routine delivery overlapped across phases.

The analytic case covered program preparation in 2021 through 13 April 2026. Documents and meeting records covered periods ending in September and December 2023, respectively, and interviews were completed in February 2024. During validation in April 2026, program personnel additionally verified strategy introduction, modification, discontinuation, and continued activity through 13 April 2026, extending ascertainment beyond the original data-collection period.

Data sources

We used three complementary sources. First, we purposively selected 28 core program documents produced between May 2022 and September 2023, including protocols, standard operating procedures, governance materials, monitoring and communication plans, and materials on service selection, training, quality assurance, connectivity, and logistics.[40] Second, we reviewed records from 124 meetings across nine governance and implementation bodies held between February 2021 and December 2023. Third, using stratified purposive sampling, we interviewed 30 stakeholders from policy and funding, program partner, service, and community roles across six states and territories (Australian Capital Territory, New South Wales, Queensland, South Australia, Victoria, Western Australia) between January and February 2024. Data sources and the distribution of coded strategy instances by source are summarised in *Supplementary material 3*. During a 2-hour validation meeting on 13 April 2026, the lead investigator and program management and coordination staff reviewed all consolidated strategies, including their accuracy, consolidation or splitting, temporality, target, and actor.

The lead analyst (GF), a nurse and implementation scientist, is in the program's study team; JG leads the national program, and DS, SC, SHH, JA, KS and MM are program coordination staff. This insider knowledge was used to verify the accuracy, actors and timing of the consolidated strategies. To limit its influence on classification, initial coding (TR, WN) and origin classification (WN) were undertaken by analysts not involved in program delivery, with independent review by GF.

Identification, specification and consolidation of implementation strategies

We developed an extraction matrix aligned with the Expert Recommendations for Implementing Change (ERIC) taxonomy[41,42] and a corresponding NVivo coding structure, with an audit trail of inclusion decisions, codebook refinements, and consensus outcomes. Community of Practice recordings and semi-structured interviews were transcribed, deidentified, and checked for accuracy before coding.

Two analysts (TR and WN) coded purposive actions intended to support adoption, implementation, scale-up, or sustainment of point-of-care testing using ERIC. Actions were reformulated as concise, verb-led strategy statements while preserving meaning and context; separable actions were coded independently. When no exact ERIC match existed, the closest functional label was selected. Program documents and meeting records were divided between two researchers and cross-checked with a third reviewer; interviews were independently double-coded and discrepancies reconciled through discussion.

Strategies were specified using the elements consistently supported by the data: actor, action, target, initiating level, delivery level, and temporal position.[24] Dose/intensity and intended mechanism were excluded because they were inconsistently documented and described. The 328 coded strategy instances were consolidated when they mapped to the same ERIC strategy, served equivalent implementation functions, involved similar actions and targets, and did not differ meaningfully in origin, level, or trajectory. Instances remained separate when consolidation would obscure meaningful

differences in actor, target, level, timing, trajectory, or implementation function. Links to source instances were retained for traceability. Consolidation rules are detailed in *Supplementary material 3*.

Classification of origin, trajectory, level, and evidence provenance

One author (WN) classified each strategy's origin as prospectively planned, emergent, or unclear; classifications were independently reviewed by GF and subsequently validated by the lead investigator (JG) and program staff (DS, SC, SHH, JA, KS, MM). Prospectively planned strategies were anticipated in the initial program design or an explicitly documented rollout plan. Emergent strategies were developed in response to needs or opportunities encountered during implementation, although they could still involve deliberate planning before delivery. Subsequent trajectory was coded separately as implemented substantially as planned, adapted after introduction, discontinued, not applicable because introduced emergently, or unclear.

GF coded the phase in which each strategy was first introduced and the phases in which it remained active; this was validated by ED, the lead investigator, and program staff. First introduction was distinguished from continued activity, and national program phases were interpreted separately from individual service implementation stages. GF also coded initiating level (national program, jurisdictional/regional, service, multiple levels, or unclear), delivery level (central, service, or joint), and evidence provenance (documentary, interview-based, both, program-team validation with a primary-source link pending, or unclear). Operational definitions and decision rules for all classification variables are provided in *Supplementary material 3*.

We summarized strategies by domain, trajectory, initiating and delivery level, timing, evidence provenance, and number of supporting instances; compared trajectory profiles across domains and delivery levels; and used qualitative excerpts to explain why strategies were introduced or adapted. Counts of supporting instances were interpreted as documentation frequency rather than strategy importance or effectiveness.

Interpretive synthesis and derivation of planning implications

After completing the strategy-level coding, we conducted an interpretive synthesis examining how strategies operated together across levels. GF developed an initial functional mapping based on each strategy's function, actor, target, delivery level, timing, trajectory, and supporting evidence. Through iterative comparison, strategies were organized into different layers based on their primary function. The resulting model was reviewed by all authors, and planning implications were then derived.

Use of large language models

Large language models, principally OpenAI's ChatGPT 5.6 and Anthropic's Claude Fable 5, were used during the drafting of this manuscript to improve the structure of paragraphs, revise sentences, and enhance clarity where needed.

Results

Data corpus and strategy inventory

The analysis included 28 core program documents produced between May 2022 and September 2023, records from 124 meetings of nine governance and implementation bodies held between February 2021 and December 2023, and interviews with 30 stakeholders across six Australian states and territories conducted between January and February 2024. The consolidated strategy inventory was reviewed with program management and coordination staff during a validation meeting in April 2026.

Across these sources, 328 coded strategy instances were consolidated into 79 distinct implementation strategies. The strategies spanned nine domains: developing stakeholder partnerships and governance (n = 23); training operators and assessing competency (n = 10); changing infrastructure, including testing platforms (n = 9); supporting evaluation and iterative learning, including monitoring, internal quality control, external quality assurance, and research evaluation (n = 9); adapting and tailoring the testing model to context (n = 9); engaging clients and communities(n = 6); providing technical assistance and troubleshooting (n = 5); supporting testing operators (n = 5); and using funding and financial arrangements (n = 3).

Figure 1 presents the introduction and continued activity of all 79 strategies across the program phases. Governance, financing, readiness, testing infrastructure, and quality systems were generally introduced before or during early implementation and remained active as the program expanded. Strategies concerned with workflow adaptation, community engagement, responsive operator support, peer learning, and strategic reassessment were more commonly introduced during early implementation or national scale-up. Strategies within the same domain nevertheless differed substantially in their origins, timing, and duration. The complete strategy-level matrix is provided in the *Supplementary material 2*.

Planned, adapted and emergent strategy trajectories

Of the 79 strategies, 24 (30%) were prospectively planned and implemented substantially as intended, 15 (19%) were prospectively planned and subsequently adapted, and 40 (51%) were introduced in response to implementation experience. The strategy configuration therefore comprised three complementary components: a stable planned foundation, planned functions that evolved after introduction, and new strategies generated during implementation.

These trajectories differed across implementation domains (*Supplementary material 4*). Governance and stakeholder partnerships included 11 planned strategies, one planned-then-adapted strategy, and 11 emergent strategies. Of the nine testing-platform and infrastructure strategies, four were planned, one

was planned then adapted, and four were emergent. Technical assistance and troubleshooting included two planned, one planned-then-adapted, and two emergent strategies. All three funding and financial strategies were prospectively initiated, although two were subsequently adapted.

By contrast, strategies closely connected to frontline delivery were predominantly emergent. Five of six client and community engagement strategies, four of five strategies supporting testing operators, and five of nine strategies adapting the testing model to context were introduced in response to implementation experience. Operator training and competency assessment also evolved considerably: only one of ten strategies remained substantially as initially planned, while four were adapted and five emerged. Monitoring, quality control, quality assurance, and evaluation included two planned, three planned-then-adapted, and four emergent strategies, reflecting an expansion from establishing assurance systems to using performance information as an active form of implementation support.

Twenty-two of the 24 planned strategies were supported by contemporaneous documentary evidence, either alone or together with interview accounts. In contrast, 36 of the 40 emergent strategies were identified primarily through retrospective interviews. Twelve strategies were supported by both documentary and interview evidence. Formal program records therefore captured the prospectively designed components of the program more consistently than the relational, adaptive, and problem-responsive work described by stakeholders.

Strategy introduction and continued activity across program phases

The timing analysis showed that planned strategies were concentrated before and during early implementation, whereas emergent strategy development continued through national scale-up (Fig. 2). Twenty-eight strategies were first introduced during pre-implementation and planning: 15 planned, six planned-then-adapted, and seven emergent. A further 34 strategies were first introduced during early implementation, including six planned, eight planned-then-adapted, and 20 emergent strategies. Seventeen were first introduced during national scale-up, comprising three planned, one planned-then-adapted, and 13 emergent strategies. No strategy was identified in the available data as having been first introduced during ongoing delivery.

The number of strategies documented as active increased as the program matured because most strategies continued after their introduction. The active configuration expanded from 28 strategies during pre-implementation to 57 during early implementation and 69 during national scale-up, before remaining high at 66 during ongoing delivery. These 66 included 17 planned, 15 planned-then-adapted, and 34 emergent strategies. Adaptation therefore did not displace the initial program infrastructure. Instead, modified and newly introduced strategies accumulated around functions that had been established prospectively.

Delivery level of implementation strategies

Implementation was most commonly shared between the central program and participating services. Thirty-nine strategies (49%) were jointly delivered, 31 (39%) were delivered primarily by the central program, and nine (11%) were delivered primarily at service level.

Figure 3 shows that delivery level varied across domains. Governance and stakeholder partnership strategies were predominantly central (15/23), and all funding and financial strategies were centrally delivered. In contrast, operator training and competency assessment (8/10), monitoring, internal quality control, external quality assurance, and evaluation (5/9), adaptation of the testing model to context (5/9), and support for testing operators (3/5) were most commonly shared between central and service actors. Client and community engagement and technical assistance were distributed across central, shared, and service delivery.

Trajectory also differed by delivery level. All nine service-delivered strategies were emergent. Among the 39 jointly delivered strategies, 19 were emergent, 10 were planned, and 10 were planned then adapted. Centrally delivered strategies included 14 planned, five planned-then-adapted, and 12 emergent strategies. Emergence was therefore not synonymous with isolated local improvisation: 31 of the 40 emergent strategies were delivered centrally or jointly. Conversely, several prospectively planned strategies depended on substantial service-level enactment, particularly training and competency assessment, quality control and quality assurance, data infrastructure, and testing-platform deployment.

How strategies were modified, locally configured, and transferred across the program

Planned strategies evolved through implementation

Stakeholder accounts illustrated how established quality monitoring systems were used and refined to identify operator-level problems and target corrective support, including review of sample-collection practice. One program manager explained that monitoring provided “a chance to correct if things are wrong,” including by examining individual operator error rates and intervening when sample collection was not being performed optimally (P10, Program Management, New South Wales).

Training and competency assessment were similarly modified when implementation experience showed that standardized theoretical materials were insufficient for some operators. As one stakeholder observed, “The theory may appear overwhelming when you have a few PowerPoints. ‘What do I do? Which buttons do I press?’” Practical sessions using the testing instruments were therefore added to translate the initial training package into operator competence and confidence (P3, Laboratory/Quality Assurance, South Australia).

Technical assistance also became progressively responsive rather than operating as a fixed support package. Jurisdictional stakeholders described central support as helping to “iron out those little kinks that are stopping us from actually doing the testing,” while encountering “every week, a sort of slightly

different problem, a new problem for them to solve" (P28, Government and Policy, South Australia). Planned strategies therefore often retained their original function while their form, intensity, or mode of delivery evolved through implementation experience and unique service-specific needs.

Local configuration was negotiated within national and institutional boundaries

Local configuration was not equivalent to unrestricted service-level discretion. Changes to testing locations, workflows, and service models were negotiated within organizational permissions, governance arrangements, and host-facility requirements. A provider explained that services first needed to ensure that "all our processes [were] in place" and that they had permission to change delivery; staff could not simply "pick up the machine and the laptop" and begin testing in another service without appropriate verification (P4, Provider, South Australia).

These constraints were particularly visible in correctional settings, where routine point-of-care testing requirements could conflict with security procedures. One participant noted that facilities might prohibit ordinary chemicals (e.g., bleach) required by the preferred testing process and that, consequently, "It might not be the perfect workflow for us. We have to be working to the workflow of that facility" (P16, Industry, New South Wales). Adaptation therefore involved negotiating a workable form of delivery within local institutional rules rather than independently modifying the national model.

At the same time, stakeholders viewed national point-of-care regulatory standards as essential to the credibility and safety of decentralized testing. These complementary processes supported the detection and management of pre-analytical, analytical and post-analytical errors. One participant described concern that point-of-care testing could otherwise be perceived as "'cowboy science' that could be run by anyone," with uncertainty about whether results were valid. Standardized training, ongoing competency assessment, and internal quality control and external quality assurance management addressed this concern by demonstrating that operators achieved initial and ongoing competency and that these skills remained embedded, supporting the reliability of results (P16, Industry, New South Wales).

Consistency in the intended function of testing nevertheless sometimes required variation in its technical or operational form. At a service with intermittent power supply, a provider explained, "We vary what testing modality we're using. We have to, if we want to continue to test in that site, and there's no way for us to have consistent power" (P1, Provider, New South Wales). The national program therefore established boundaries related to quality, safety, and accountability, while allowing services to configure how these requirements were achieved under different infrastructural and organizational conditions.

Relational support and shared learning connected local and national implementation

Stakeholders valued centralized resources and emphasized that in-person, practical assistance complemented remote support. A community-sector participant argued that sustainable national

delivery required “a human aspect,” describing the value of support staff visiting services, observing practice, and advising operators directly on how they could improve (P27, Community/Hepatitis, Australian Capital Territory).

Central program staff also recognized the limitations of offering solutions without direct experience of local delivery: “We’re not actually the people on the ground doing the point-of-care testing, speaking to the clients, getting people into treatment.” Experienced services willing to discuss their practices and challenges with other services were consequently described as “invaluable” (P5, Program Management, New South Wales). Facilitation, peer networks, and cross-service learning helped connect centralized technical expertise with situated implementation knowledge, for example, via the community of practice.

Community involvement also informed support for progression from diagnosis to treatment. Stakeholders observed that providing a diagnosis did not necessarily help people proceed to treatment: “While getting them a diagnosis is great, it doesn’t help them do the next thing, and that’s probably where we see the value of peers coming in. We see the value of incentives coming in” (P17, Research, Victoria). Peer involvement and incentives consequently became implementation strategies for supporting movement beyond diagnosis. Incentives, however, were part of the research element of the program.

External solutions were also embedded in the national program. In one instance, the National Reference Laboratory developed a whole-blood dried-tube sample method for quality assurance and control that was adapted for use with the GeneXpert platform, “rolled… out,” and subsequently “became enmeshed in the national program” (P11, Laboratory/Quality Assurance, national role). This represented the upward incorporation of an externally developed technical solution into the national configuration.

Document control at decentralised services was not always consistent: one participant described a local help sheet that had not been updated to reflect an authorised procedural change: “I haven’t sort of seen that [protocol change] been taken on… [the help sheet] still says the old version” (P30, Community/Hepatitis, New South Wales). Locally reported service-delivery innovations could also remain invisible unless structures existed to identify and circulate them. A provider described learning only through direct conversation about a service that had successfully tested people experiencing homelessness near a river, concluding that “unless you’re sharing this information,” innovations in the mobility of service delivery that could assist other services might not spread (P26, Provider, South Australia). Learning collaboratives, peer networks, and knowledge-capture strategies therefore served not only to support services, but also to identify local solutions, assess their transferability, and incorporate selected practices into the wider program.

A three-layer implementation model: national backbone, adaptive infrastructure, and locally configured delivery

The configuration of implementation strategies in the national program was interpreted as three interdependent layers rather than as a single standardized implementation package (Fig. 4).

The national backbone translated established point-of-care testing expertise, applicable regulatory requirements and clinical guidance into arrangements for consistent and safe HCV testing. It included governance and accountability, funding and formal agreements, testing platforms and cartridge supply, data capture and reporting systems, internal quality control and external quality assurance, and standardized operator training and competency assessment. Most of these functions were established before rollout, although training and data systems were refined as clinical delivery expanded and variations to testing protocols were introduced (e.g., introduction of antibody tests).

The adaptive implementation infrastructure supported services when problems arose during routine care. Central and local technical assistance for operators, performance monitoring and feedback with re-training where necessary, facilitation, cross-service learning, and stakeholder relationships helped identify problems such as invalid test results, connectivity failures, workflow bottlenecks, or delays in linkage to treatment. These supports allowed solutions developed in one service to be refined and shared across the program.

The third layer was locally configured service delivery, which determined how testing was best incorporated into the patient pathway in each service. This included adapting when and where testing occurred, who performed it, and how tasks were shared among trained and competent clinicians, nurses, peers, and other operators. It also included adapting how clients moved from screening (using HCV antibody testing) to HCV RNA confirmation, clinical assessment, prescribing, and treatment initiation. Outreach models, communication approaches, and community engagement were also adapted to the needs of different populations and service settings. Experience from local delivery could then inform continuous quality improvement through changes in technical support needs, training, testing-performance monitoring, or national procedures.

Table 1 presents the principal implementation functions within each layer, together with representative strategies, trajectories, and delivery levels.

Table 1
Implementation strategies by function, with representative strategies, trajectory, and level.

Implementation function	Illustrative strategies	ERIC strategy name (strategy ID)	Trajectory	Principal level
NATIONAL BACKBONE				
Governance and accountability	Establish a National Reference Committee, Implementation Committee, Clinical Advisory Group, Protocol Steering Committee, and Aboriginal and Torres Strait Islander reference group	Use advisory boards and workgroups (S36–S40)	Planned	National
Funding and agreements	Secure government and industry funding and formal commitments covering equipment, quality materials and cartridges, and establish service agreements covering nursing support and case reporting	Obtain formal commitments (S32–S33); Access new funding (S85)	Planned	National / program
Testing infrastructure	Secure, install, and supply GeneXpert instruments, hepatitis C fingerstick cartridges, connectivity tools, internal quality control and external quality assurance materials, and consumables to services	Change physical structure and equipment (S12–S13)	Planned	National to service
Data infrastructure	Establish interoperable systems to capture point-of-care results and transfer them into medical records and public health reporting	Change record systems (S16–S17, S83); Use data warehousing techniques (S8)	Planned then adapted	Both
Quality management	Establish operator training and competency assessment, internal quality control, and external quality assurance schedules with reporting pathways	Develop and organize quality monitoring systems (S72–S73)	Planned	Both

Implementation function	Illustrative strategies	ERIC strategy name (strategy ID)	Trajectory	Principal level
NATIONAL BACKBONE				
Training infrastructure	Develop standardised, blended initial and ongoing operator training and competency assessment, with training resources (online modules, videos, guides) covering eligibility, testing, and result delivery	Conduct ongoing training (S60); Develop and distribute educational materials (S62–S64)	Planned then adapted	Both
ADAPTIVE IMPLEMENTATION INFRASTRUCTURE				
Technical assistance	Provide a centralised telephone and online help desk and responsive, multi-channel troubleshooting for connectivity, device, and testing problems	Centralize technical assistance (S47–S48); Provide local technical assistance (S51)	Planned then adapted	Both
Performance feedback	Monitor service-level error rates and provide comparative analytical performance data, local targets, corrective feedback (e.g., adjusting operator technique) and retraining as required	Audit and provide feedback (S70–S71)	Planned then adapted	Both
Cross-service learning	Establish cross-service implementation forums and peer-learning structures for sharing practical solutions	Create a learning collaborative (S61); Capture and share local knowledge (S22–S23)	Emergent	Both
Facilitation	Conduct targeted service visits and build supportive service relationships that encourage operators to seek help	Facilitation (S49–S50)	Emergent	Service
Stakeholder relationships	Build and use relationships with the Department of Health, state and territory departments, services, clinicians, and community organisations	Build a coalition (S19, S84); Promote network weaving (S34–S35)	Planned then adapted	Multiple levels
LOCALLY CONFIGURED DELIVERY				
Workflow integration	Adapt testing pathways and clinic workflows to local operations and integrate testing into	Promote adaptability (S2–S3, S6)	Emergent	Service

Implementation function	Illustrative strategies	ERIC strategy name (strategy ID)	Trajectory	Principal level
NATIONAL BACKBONE				
	existing services (e.g. needle and syringe programs, alcohol and other drug services) and mobile services			
Workforce configuration	Revise operator roles and task-sharing, including peer-led and community-led testing models, to expand the testing workforce	Revise professional roles (S56, S58)	Emergent	Service
Service model	Tailor testing delivery, outreach settings, and linkage to direct-acting antiviral treatment (including telehealth) to the service context and local prevalence	Change service sites (S18); Tailor strategies (S7)	Emergent	Service
Community engagement	Engage peer workers, community organisations, and people with lived experience, and use culturally tailored outreach and incentives (e.g. work development orders) to support reach and acceptability	Involve consumers and family (S45); Increase demand (S41); Provide incentives (S44)	Emergent	Both

Discussion

This retrospective case study identified a broad and dynamic configuration of 79 implementation strategies supporting national scale-up of HCV point-of-care testing in Australia. A distinctive finding was the extent of adaptation and emergence of implementation strategies despite the program building on established Australian point-of-care testing networks and their experience in governance, training, quality management, and connectivity.[19,20,22] Extending this infrastructure to HCV testing and new service environments nevertheless required additional operational, relational, and community-facing work. Implementation operated through three interdependent layers: a national backbone establishing governance, financing, infrastructure, quality assurance, data systems, and training aligned with national regulations for point-of-care testing; adaptive implementation infrastructure supporting problem detection, shared learning, and responsive modification; and locally configured service delivery translating the national model into workable testing pathways, workforce arrangements, service models, and community-engagement approaches. These layers emerged from our retrospective interpretation of

how strategies were configured and evolved. This extends prior descriptions of the Australian program[18,43–45] by making its implementation architecture more explicit and may provide a useful heuristic for planning other national point-of-care testing programs. However, the analysis does not establish that this configuration caused successful implementation or should be replicated unchanged elsewhere.

The balance of planned, adapted, and emergent strategies should be understood as complementarity rather than inadequate planning. Prospectively developed strategies established the authority, resources, standards, and operational infrastructure required for national delivery. Emergent strategies were concentrated in functions whose specific requirements became apparent through delivery, including workflow integration, local service configuration, operator support, peer and community engagement, and cross-service learning. The program initially used HCV RNA testing and subsequently introduced point-of-care antibody screening with reflex RNA testing for reactive results in appropriate populations.[46] This change reduced waiting for antibody-negative results and aimed to improve testing efficiency in lower-prevalence settings; its implementation required corresponding updates to supplies, training, standard operating procedures, quality management, and data systems. Planned-then-adapted strategies such as training and competency assessment, technical assistance, monitoring, and data infrastructure retained their underlying functions while evolving in form or delivery. This interpretation is consistent with adaptation frameworks and dynamic sustainability perspectives, which emphasize documenting what changed, who initiated the change, at what level, and why, rather than treating all departures from initial plans as losses of fidelity.[28,29,47,48]

Specification of individual implementation strategies remains essential,[24,42,49] but individual strategies alone do not fully explain how implementation operates at national scale. Strategies functioned as a configuration of mutually dependent actions spanning national, shared, and service levels. For example, deployment of testing platforms depended on connectivity, data transfer, training and quality systems, responsive troubleshooting, and local client engagement and linkage-to-treatment pathways. The three-layer model captures these dependencies by distinguishing relatively stable national functions, adaptive functions for sensing and responding to new testing approaches or environments, and locally configured functions through which testing was incorporated into care. This aligns with scholarship on implementation context and complexity, which emphasizes interactions among technologies, actors, organizations, and changing systems.[50,51] The configuration is consistent with the Dynamic Sustainability Framework,[31] which conceptualizes implementation and sustainment as an ongoing process of learning and adaptation to optimize fit between an intervention, its delivery settings, and the broader system. It also echoes the Exploration, Preparation, Implementation and Sustainment (EPIS) framework,[52] particularly the interaction between outer and inner contexts and the bridging processes that connect them. Our findings extend these concepts by illustrating how such functions were operationalized through implementation strategies during national scale-up.

The provenance analysis also identified differences in how strategies were documented. Planned strategies were usually supported by program records aligned with national standards and regulatory requirements, whereas emergent strategies were identified primarily through stakeholder interviews. This likely reflects differences in source coverage and recall, because formal records preferentially capture authorised plans while interviews elicit adaptations and unexpected problems. Evaluations of large-scale programs should therefore combine documentary and stakeholder evidence to reconstruct how implementation evolved in practice.

The temporal findings further show that implementation work accumulated rather than progressing through a simple sequence in which planning ended when delivery began. Planned strategies were generally introduced before or during early implementation, whereas emergent strategies continued to be added during early implementation and national scale-up. Most strategies subsequently remained active, with 84% (66 of 79) continuing during ongoing delivery, although none were first introduced in this final phase. This persistence should therefore be interpreted as continuation of supports established earlier rather than evidence of a distinct set of sustainment strategies. The purpose and configuration of these strategies may nevertheless evolve as implementation matures and the determinants of sustainment differ from those affecting initial implementation.[53–55] Technical assistance, performance feedback, training and competency assessment, relationship management, cross-service learning, and local configuration remained active after services were established, consistent with dynamic sustainment support and learning health systems in which monitoring, learning, and adaptation continue over time.[42,43,56,57] Resource models that fund equipment, deployment, and initial training without capacity for continued monitoring, learning, and response may therefore underestimate the requirements of ongoing national delivery.

The most transferable planning implication is to specify the structure required for implementation without attempting to prescribe every action. This involves three questions: What should be standardised across the program? What should be locally configurable within agreed boundaries? What capacity is needed to detect and respond to needs and opportunities whose specific form cannot be anticipated? The need for adaptation can be anticipated and resourced even when particular adaptations cannot. National requirements for safety, quality, accountability, and interoperability can define the boundaries within which staffing, outreach, workflow, and communication are configured locally. Table 2 translates these questions into planning considerations derived from the Australian case.

Table 2
Questions and considerations for prospective scale-up planning derived from the Australian case.

What should be standardised?	What capacity is needed for adaptation?	What should be locally configurable?
• Governance, accountability, and decision rights • Initial funding and formal agreements • Data, interoperability, and reporting standards • Internal quality control and external quality assurance • Operator training and competency assessment infrastructure and materials • Service readiness assessment and staged rollout • Alignment with national regulations and best practice for POCT	• Emerging client-engagement and demand-generation needs • Unanticipated operator or clinician support • Device, connectivity, or software problems • Cross-service learning and new champion networks • Strategic reassessment using performance data • Sustainment, expansion, and investment-case needs • Process changes to improve cost-effectiveness	• Testing pathways and clinic workflow integration • Adoption of new test environments and/or processes • Physical setup – equipment, assays and consumables; logistics • Staffing, task-sharing, and operator roles • Outreach model and testing settings • Communication and health-literacy tailoring • Local facilitation and relationship-building

Within this architecture, service agreements and readiness processes can clarify what is fixed and configurable; data systems can signal performance problems; technical assistance and facilitation can respond to emerging needs; and learning structures can identify local solutions and assess their transferability.[56–59] The findings also suggest that client and community engagement should receive earlier and more explicit attention.[60] Future programs could involve peer and community representatives in pathway design and readiness assessment before rollout, resource their participation, and establish regular feedback and escalation routes during delivery. Although peer involvement, outreach, incentives, communication, and linkage-to-treatment support may need to remain locally responsive, the need for these functions can be anticipated and resourced rather than treated as an unexpected addition after testing begins.[61]

The number of identified strategies should not be interpreted as evidence that larger strategy packages are inherently preferable, nor should the frequency with which a strategy appeared in the data be interpreted as an indicator of importance or effectiveness. Multiple strategies identified (e.g., those in the *Develop stakeholder relationships* group) may operate through similar mechanisms. The contribution of the analysis lies instead in demonstrating the breadth, distribution, interdependence, and evolution of purposive implementation actions during national scale-up. The three-layer model and planning categories are analytic generalizations from one national case rather than universal prescriptions, but they offer a provisional, testable framework for examining how other large-scale programs combine standardization, local configuration, and continuing adaptation.

Prospective comparative work could examine which combinations of strategies are necessary in different settings, how changes are triggered and authorised, and what continuing support costs. Repeated assessment of strategy use alongside reach, diagnostic-pathway fidelity, valid results, linkage to treatment and sustainment would allow the proposed relationships to be tested and identify strategies that can be simplified, discontinued or targeted.

Strengths and limitations

This study has several strengths. It combined documentary evidence, longitudinal records from nine governance and implementation bodies, and interviews with stakeholders from policy, program, service, and community roles. The analysis also separated initial origin from subsequent adaptation and distinguished first introduction from continued activity, avoiding the assumption that any strategy documented in a later phase was newly introduced at that time.

The findings should be interpreted in light of several limitations. This was a retrospective analysis of a single national program in a high-income setting, and the three-layer model and planning categories are analytic generalizations whose transferability may be greatest to programs with comparable financing, laboratory expertise, connectivity, and governance. Program records and interviews varied in detail, so informal, locally enacted, poorly documented, or unsuccessful implementation work may be underrepresented. Classification of strategy origin and continuation was therefore sensitive to documentation completeness and recall: some strategies classified as emergent may have been anticipated but insufficiently recorded, while frequently documented strategies may appear more prominent without necessarily being more influential. Consolidating strategy instances also required interpretive judgement, and validation by program staff could not fully eliminate these biases. Finally, the analysis did not test the effects or resource requirements of individual strategies, establish causal relationships within the three-layer model, or determine which supports remain necessary over time; prospective or repeated follow-up would be needed to address these questions.

Conclusion

The Australian Hepatitis C Point-of-Care Testing Program was implemented through a configuration of strategies that combined a prospectively designed national backbone aligned with best practice and regulatory requirements with adaptive infrastructure and locally configured service delivery. This program benefitted from extensive past experience in decentralised molecular point-of-care testing for respiratory and sexually transmitted infections, as well as chronic and acute care models. Planned strategies established consistency, safety and capability; adapted and emergent strategies enabled the program to respond to operational, relational, and community-specific needs. The findings suggest that prospective scale-up planning should specify the implementation structure without attempting to prescribe every action: what should be standardised, what should be locally configurable within agreed boundaries, and what capacity is needed for continuing detection, learning, and response. These

considerations form a provisional framework for planning and resourcing large-scale implementation that requires examination in other programs.

Abbreviations

CoP: Community of Practice

EPIS: Exploration, Preparation, Implementation, Sustainment

ERIC: Expert Recommendations for Implementing Change

HCV: hepatitis C virus

RNA: ribonucleic acid

SRQR: Standards for Reporting Qualitative Research

Declarations

Ethics approval and consent to participate

The study was approved by the Human Research Ethics Committee of UNSW Sydney (HC230406). The research was conducted in accordance with the Australian National Statement on Ethical Conduct in Human Research. All interview participants provided written informed consent before participation.

Consent for publication

Not applicable.

Availability of data and materials

The qualitative interview data and internal program documents analysed during this study are not publicly available because they contain potentially identifiable participant, service, and program information and are subject to ethical and institutional restrictions. The consolidated implementation strategy matrix, the coding rules used to produce it, and the cross-tabulations underlying the figures are provided in Supplementary materials 2–4. Additional non-identifiable information may be available from the corresponding author on reasonable request, subject to ethical, institutional, and program governance requirements.

Competing interests

GF is Deputy Editor for *Implementation Science*; he was not involved in any editorial decisions concerning this article. GF has received speaker fees from Abbvie for unrelated work and has received grants from Gilead Sciences and Viiv. GF has served on MSD's Global Implementation Advisory Board. JG is a

consultant/advisor and has received research grants from Abbvie, Abbott, bioLytical, Cepheid, Gilead Sciences, Hologic, MedMira, and Roche.

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Authors' contributions

GF and JG conceived the present analysis. TR and WN coded the source data and contributed to development and refinement of the analytic approach. WN classified strategy origin, with independent review by GF. GF conducted the temporal and level classifications and led the interpretive synthesis and development of the three-layer model. ED contributed to validation of the temporal classification. JG, DS, SC, SHH, JA, KS, and Maria Martinez contributed to program-level validation of the consolidated strategies and their classification. GF, WN, TR, ED, NT, ATR, ADM, LL, DS, SC, SHH, JA, KS, Maria Martinez, CM, SM, AP, MK, Marianne Martinello, LW, and JG contributed to interpretation and contextualization of the findings. GF drafted the manuscript. All authors critically reviewed and revised the manuscript and approved the final version.

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Figures



Figure 1

Strategy activity across program phases: all 79 implementation strategies

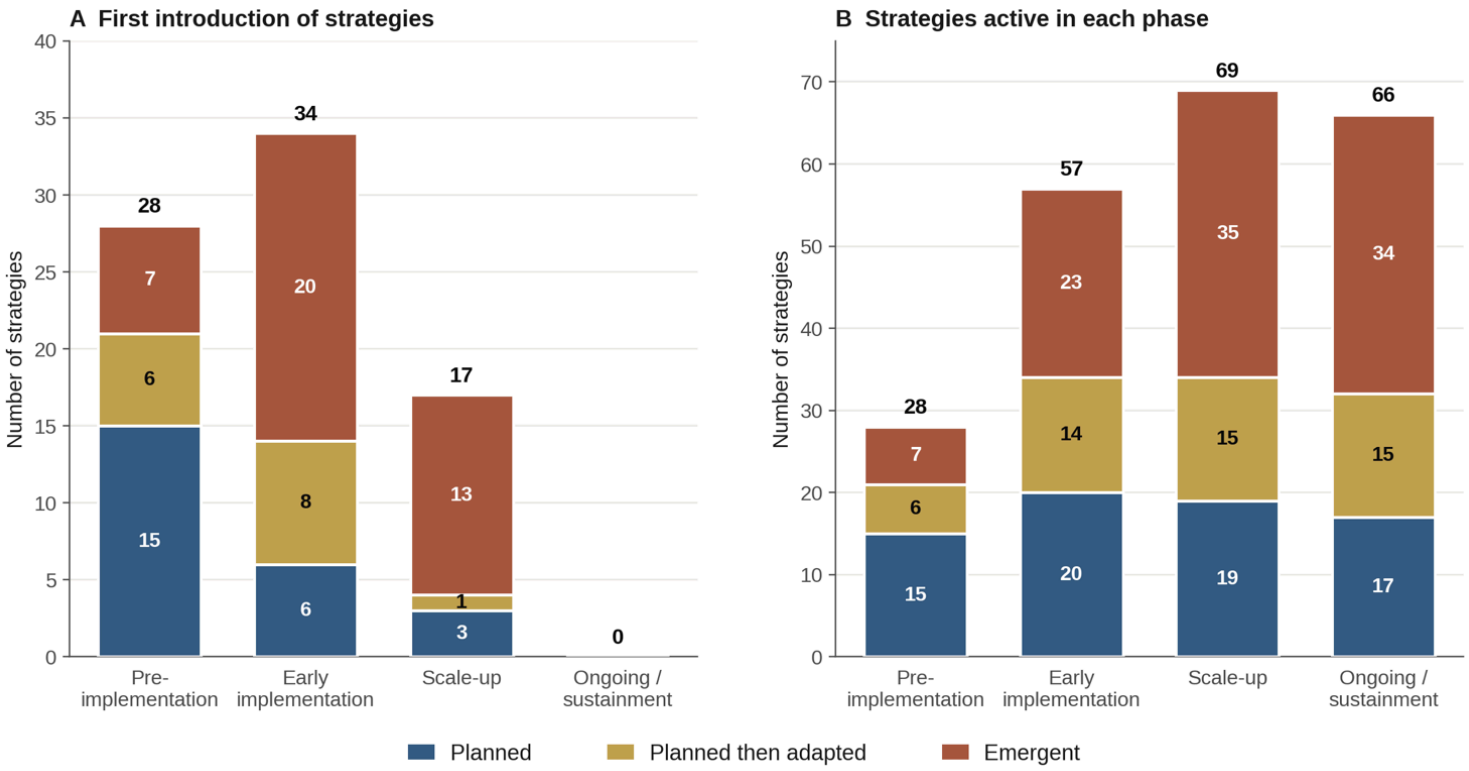


Figure 2

Strategy lifecycle across program phases, by trajectory. Left panel: program phase at which each strategy was first introduced. Right panel: phases in which each strategy was active (first introduction plus documented continuation). Bars are split by analytic trajectory (planned; planned then adapted; emergent).

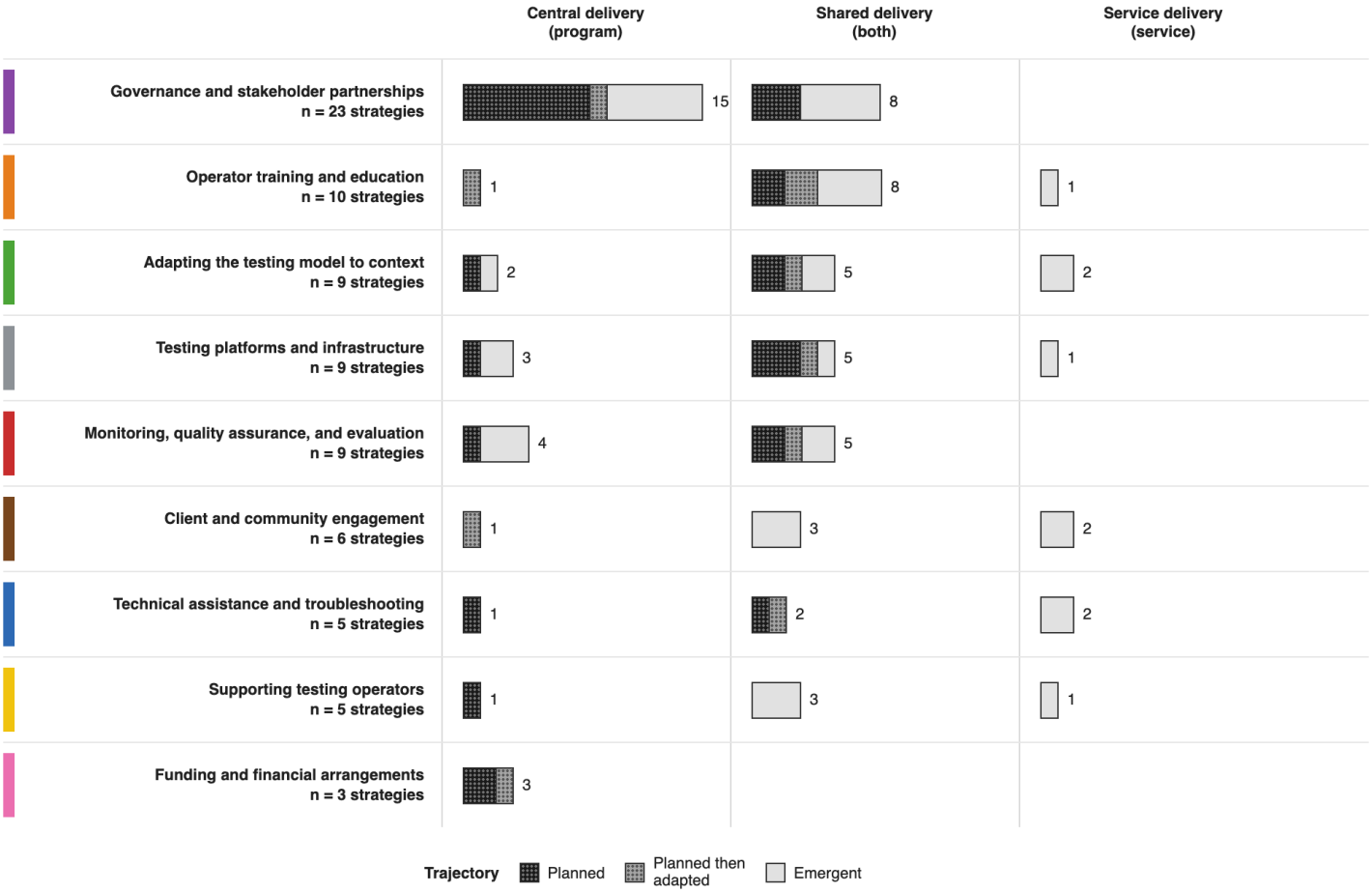


Figure 3

Delivery level and trajectory of implementation strategies.

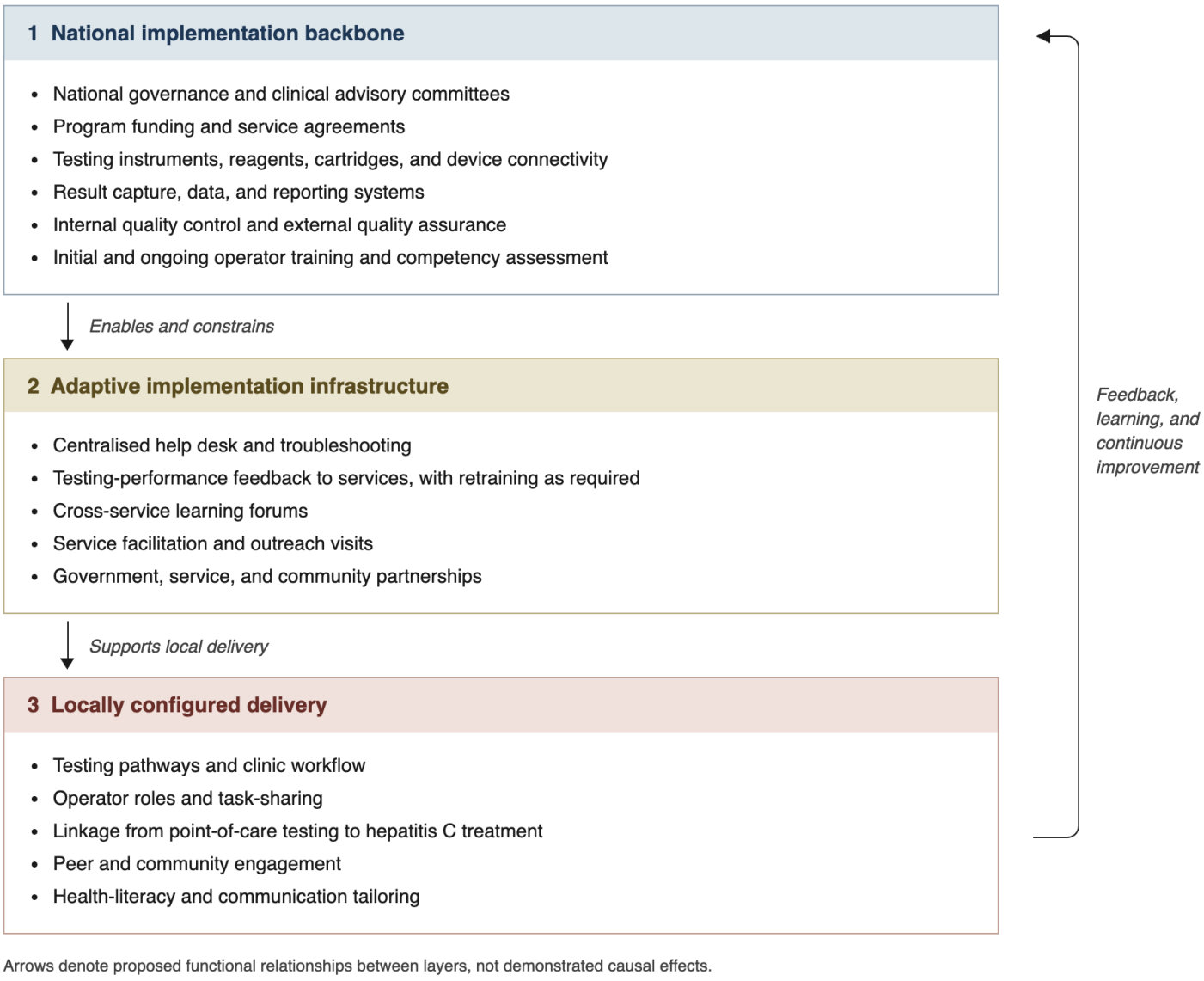


Figure 4

Interpretive conceptual model derived from the case to summarise the configuration of implementation strategies across the Australian hepatitis C point-of-care testing program.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Supplementarymaterial1SRQRchecklist.pdf
- Supplementarymaterial3Codingrulesanddatasources.pdf
- Supplementarymaterial4Crosstabulations.pdf
- Supplementarymaterial2Strategymatrix.pdf

- Supplementaryinformationlegends.docx