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A policy roadmap for sustainable mass-testing

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Abstract

Population-wide mass testing with affordable self-tests can drastically reduce lives lost and minimize economic and societal costs during pandemics, especially if deployed before vaccines. During COVID-19, however, the development of self-test manufacturing and distribution capacity lagged behind vaccine rollout and was dismantled once surges subsided, returning us to a prepandemic state. As no new capacity has since been secured, future mass-testing would again face costly delays. To mitigate this risk, we propose a policy roadmap for an economically viable mass-testing system that can be sustained between crises and rapidly scaled during emergencies. Public investment in R&D to improve the sensitivity of affordable self-tests—not to achieve a single benchmark, but to advance point-of-need technologies across medical and nonmedical applications—is essential. Improved sensitivity would enable new uses in routine health screening, food safety, and environmental monitoring, generating steady demand and production capacity that can expand as needed. This demand would support a robust system anchored by four mutually reinforcing pillars: scalable manufacturing, real-time data infrastructure, predictive analytics, and sustainable financing. Prioritizing sensitivity can transform mass testing from a reactive measure into a durable public health foundation.

Key words: pandemic preparedness policy; mass testing; decentralized testing infrastructure; economic sustainability of mass testing; point-of-need testing technologies; diagnostic sensitivity.

Introduction

The COVID-19 pandemic exposed a critical weakness in global preparedness: the lack of scalable mass testing as a front-line containment measure.[1,2] Clinical laboratory PCR tests, while the gold standard due to their high diagnostic sensitivity, cannot reach the population-wide scale required for early isolation of infected individuals during the prevaccination stage.[3,4] Rapid antigen self-tests can and should fill this scale gap by enabling widespread at-home and workplace screening.[3,5] During COVID-19, however, these self-tests became widely available at the population level only after vaccines were already deployed and therefore did not meaningfully aid containment when they were most needed.

Although these tests were developed and authorized rapidly—for example the first US antigen test received Emergency Use Authorization in May 2020, followed by ~40 more by mid-2024—they could not be produced at scale until manufacturing capacity and coordinated procurement mechanisms were established.[3,5-7] The existence of other self-tests, such as for influenza and certain sexually transmitted infections, did not help much.[7] Facilities producing these tests were too small to allow quick expansion, and in some countries, including well-resourced ones, such facilities were entirely absent.

By around 2 years into the pandemic, global capacity had grown to the production of billions of units per year, but this came too late to have a significant impact on initial containment efforts.[8,9] The limited overall effect was further compounded by their moderate diagnostic sensitivity, which resulted in a high rate of false negatives (missed cases).[10] Sales volumes naturally fell drastically once emergency surges subsided, rapidly shrinking manufacturing capacity.[7,9] Production lines were dismantled, and expertise dispersed.

As a result, we are now in a situation similar to the prepandemic state. No sustainable capacity has been established, and if a new pandemic emerges, scaling up self-test production to the population level would again lag behind vaccine development and deployment.

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The goal of this work is to identify the root causes behind this fragile state and to propose policy recommendations to address it. International frameworks such as the 100-days mission acknowledge the importance of diagnostics and set ambitious targets for achieving large-scale testing within the first 100 days of an outbreak.[11] However, these frameworks do not offer concrete strategies to sustain manufacturing capacity, define performance thresholds, or create market incentives that would stimulate stable demand between crises. National pandemic preparedness plans often list testing as a key pillar but typically lack detailed economic and technical roadmaps. We offer such a roadmap here.

Rapid scale-up will require significant, decentralized increases in manufacturing and distribution capacity. We argue that this is feasible only if self-test sensitivity improves enough to support new routine uses outside of emergencies—such as asymptomatic screening in workplaces, schools, long-term care facilities, food-processing plants, and farms—that generate stable, year-round demand even in noncrisis periods. Higher sensitivity would also support nonmedical applications such as food safety monitoring, agricultural pathogen screening, and environmental surveillance of water and surfaces.[12,13] With steady cross-sector demand, manufacturers could justify distributed production hubs, maintain skilled workforces, and sustain quality-control systems, thereby strengthening readiness for future outbreaks. Therefore, improved sensitivity is not simply a technical upgrade—it is a necessary prerequisite and enabler of the stable demand required to maintain mass-testing capacity.

More sensitive and affordable self-tests would also enable more reliable integration into public health surveillance systems, allowing authorities to track transmission trends in near real time and deploy targeted interventions before hospitalizations surge.[14-16] Improving test sensitivity thus links three critical objectives: establishing routine public health value, making decentralized manufacturing economically viable, and ensuring preparedness for future pandemics.

This paper addresses these gaps by presenting an integrated analysis that connects test performance, economic incentives, and manufacturing strategies. First, we quantify how improved sensitivity improves user confidence and, consequently, increases market size for both routine and surge conditions. Second, we estimate break-even volumes and demand thresholds for decentralized manufacturing of paper-based and microfluidic assays, based on sensitivity-driven use cases and analogies to continuous production industries. Third, we evaluate policy and implementation instruments—including guaranteed purchase agreements, technology sharing for local production, and data-integration incentives) and assess how they influence long-term capacity and equitable access to users across different income settings. Finally, we propose a decision framework that links public health objectives with technical performance requirements, financing strategies, and supply chain design. By identifying the sensitivity threshold needed to transform self-tests from episodic crisis tools into everyday health products and outlining supportive policy measures, we offer a practical path toward a decentralized, resilient, and economically sustainable mass-testing infrastructure.

Lessons from COVID-19 mass testing

In the early stages of the COVID-19 pandemic, testing emerged as a central containment strategy at a time when vaccines and therapeutics were not yet available. Testing enabled the early identification of cases and isolation of infectious individuals, thereby reducing transmission and facilitating the reopening of schools, workplaces, and other social institutions. Initially, polymerase chain reaction (PCR) tests served as the primary testing modality.[17-19] While PCR is highly sensitive and specific, it depends on centralized laboratory infrastructure, trained personnel, and complex logistics. These constraints resulted in long turnaround times, limiting the feasibility of PCR tests for real-time, large-scale outbreak control.

Inexpensive, paper-based self-tests—simple to use in nonclinical settings—soon became the default tool for decentralized testing.[3,5,20] Several countries adopted them at scale. The United Kingdom distributed over one billion tests through pharmacies and direct delivery programs.[21] Slovakia conducted population-wide screening that contributed to short-term reductions in case counts.[22] South Korea incorporated rapid testing into a broader containment strategy that included digital reporting, contact tracing, and community-based surveillance.[14,16]

Despite their accessibility, these tests historically suffered from relatively low sensitivity, particularly in asymptomatic individuals and during early stages of infection.[10,23,24] This contributed to high rates of false negatives, which undermined public trust and limited the utility of testing as a primary containment measure.[25-27] Although frequent testing can, in principle, offset lower sensitivity,[3,4,28] real-world adherence, performance variability, and inconsistent distribution constrained effectiveness.[11,25-27]

The global rollout of rapid tests also revealed structural challenges. Most countries lacked procurement frameworks, manufacturing capacity, or equitable distribution systems.[2,5,7-9] Testing access was uneven across regions, and marginalized communities often faced significant barriers due to limited digital access, low health literacy, or lack of paid sick leave.[29-31] In most jurisdictions, rapid tests were authorized under emergency-use provisions, which prioritized availability over performance standardization.[32] This contributed to further erosion of public confidence in test results, dampened market demand, and constrained long-term integration into public-health systems.

Mass testing nevertheless conferred broader societal benefits. In educational settings, regular testing supported in-person learning and protected high-risk students and staff.[33,34] In long-term care homes, workplaces, and airports, testing enabled risk-based decision-making, reduced uncertainty, and fostered a sense of collective responsibility.[35-37] Although these benefits are difficult to quantify, they illustrate the potential value of widely accessible, routine testing beyond crisis periods.

Yet as case numbers declined, testing infrastructure contracted rapidly. Production facilities closed, supply chains were dismantled, and trained personnel exited the sector. As demand fell, the absence of routine use and long-term procurement mechanisms led manufacturers to exit the market, dismantling capacity and reinforcing a cycle of divestment and unpreparedness.

The COVID-19 experience underscores a critical lesson. Mass testing can contribute meaningfully to containment and broader public health objectives, but only if it is supported by accurate tools, available supply, durable infrastructure, and sustained investment. Higher test sensitivity is essential for routine application and long-term utility. It enables integration into surveillance systems, builds public confidence, and

creates the stable demand required to support domestic manufacturing and predictive analytics. In the next section, we examine why current global preparedness strategies have failed to address this issue and outline a new policy framework for building sustainable, high-sensitivity mass-testing capacity.

Four pillars of a sustainable decentralized mass-testing capacity

A sustainable mass-testing system depends on decentralized delivery of diagnostic services through point-of-need (PoN) tools.[38-41] Unlike point-of-care tests, which are performed by trained personnel in clinical settings such as hospitals, pharmacies, or mobile units, PoN tests are self-administered in nonclinical environments like homes, schools, workplaces, and field settings. Their simplicity, room-temperature stability, and low cost make them ideal for frequent, population-wide screening. By enabling testing without reliance on centralized infrastructure, PoN diagnostics expand access, reduce delays, and minimize barriers to adoption. To function effectively in a pandemic, a mass-testing system must meet two objectives: provide individuals with timely results to inform behavior, and provide authorities with real-time epidemiological data to guide containment policies. To achieve both goals, and to ensure that testing remains viable between crises, four interdependent pillars must be in place: (1) scalable manufacturing capacity to ensure test availability, (2) real-time data infrastructure to capture and report results, (3) predictive modeling to turn raw data into short-term forecasts, and (4) sustainable financing to maintain production and system readiness. Each pillar addresses a distinct structural barrier—physical supply, data capture, insight generation, financial continuity—that are all necessary to sustain PoN testing at scale. Removing any one of them undermines either individual-level utility or population-level situational awareness, weakening the entire system during both crises and interpandemic periods.

Scalable manufacturing

A resilient testing system requires domestic or regionally distributed production capacity to avoid supply chain vulnerabilities and reduce reliance on emergency procurement. Current production models remain reactive and centralized, collapsing when demand wanes. Building geographically distributed, high-throughput rapidly scalable production capacity for paper-based PoN tests, which can be manufactured using high-speed printing techniques on continuous sheets, would ensure consistent supply. Public-private partnerships and targeted subsidies could further support these efforts. Importantly, public familiarity with self-administered testing, established during COVID-19, lower future adoption barriers and strengthen the case for decentralized mass testing as a norm.

Real-time data infrastructure

Mass testing can serve as an early warning system only if test results are captured and analyzed in real time. Laboratory-based diagnostics routinely feed into public-health reporting systems. In contrast, results from self-administered tests have historically gone unreported. An effective infrastructure must include: (1) easy-to-use, secure and privacy-protective digital platforms for voluntary result submission; (2) geospatial analytics to identify outbreak clusters; and (3) integration into national and global surveillance systems. Digital harmonization can generate timely epidemiological insights and reduce decision-making delays.

Predictive modeling and analytics

Continuous streams of decentralized testing data can inform predictive models capable of identifying infectious clusters, forecasting disease transmission, and evaluating intervention strategies in near-real time. To achieve this, models must routinely integrate daily PoN test results with other dynamic variables such as population mobility, immunity patterns, and behavioral changes, including compliance fatigue.

Data-assimilated compartmental and agent-based models can be used to convert raw decentralized testing data into actionable insights, enabling a shift in public-health response from reactive crisis management toward proactive disease mitigation. Such models are already in operational use: a school-focused agent-based model deployed in Ontario demonstrated how regular preventive testing combined with rapid isolation effectively mitigated COVID-19 outbreaks in educational settings; similarly, the US COVID-19 Scenario Modeling Hub employs multimodel ensembles to inform federal pandemic planning across diverse scenarios.[42,43] The latter has been rigorously evaluated, showing a 39%-58% improvement in short-term forecast accuracy for hospitalizations and deaths compared to baseline projections. These precedents illustrate that data-assimilated scenario modeling is no longer merely experimental, but a critical component of effective decentralized testing infrastructure.

Sustainable financing

During COVID-19, mass testing was largely supported by short-term emergency government funding. Once this ended the diagnostic capacity collapsed. To avoid repeating this boom-and-bust cycle, a diversified and durable funding strategy is essential. Public investment must be complemented by private-sector engagement and insurance-based reimbursement for routine PoN testing. Long-term procurement contracts, employer-sponsored coverage, and tax incentives can help stabilize both demand and supply by supporting continuous production. Sustainable financing mechanisms may include: integrating PoN testing into health benefit plans, as employers have incentives to reduce absenteeism; providing government subsidies to ensure access for underserved populations, thereby protecting tax revenues; and encouraging corporations to enter advance purchase agreements to derisk investment in manufacturing capacity.

Despite broad recognition of the importance of PoN diagnostics, the four foundational pillars of sustainable mass testing remain underdeveloped. Existing frameworks, such as the 100 Days Mission,[11] acknowledge the need for decentralized testing but offer no roadmap for maintaining capacity between crises. Enhancing test sensitivity is therefore an essential prerequisite and the most critical step: it expands the relevance of PoN tests beyond emergency use, generates stable demand, and supports all four pillars: manufacturing, data, modeling, and financing.

Improved point-of-need test sensitivity as the linchpin of sustainable capacity

A sustainable decentralized mass-testing infrastructure depends on consistent demand for PoN tests to justify long-term

investment in domestic manufacturing. This vulnerability is particularly evident in low-population countries like Canada, which lacks domestic production lines for rapid antigen tests. This challenge is even more acute for low-income countries. There is no single benchmark for "acceptable" sensitivity, as required detection limits vary widely by application; policy and scientific focus should be on improving the sensitivity of PoN platforms to enable reliable testing across both medical and nonmedical domains. The primary obstacle to sustained demand is the limited sensitivity of PoN tests. Such limited-sensitivity tests are tolerated under emergency conditions despite high rates of false negatives because of the urgent need for scalable tools.[44,45] However, this level of performance is generally unacceptable in routine nonemergency settings. When test results cannot be trusted for early stage infections or asymptomatic cases, they are less likely to be adopted outside of emergencies. Expanding their use in routine settings will require not only higher sensitivity and reliability, but also consistent performance and quality control to rebuild trust in self-testing and thereby generate consumer demand.

Improving diagnostic sensitivity would unlock broader use beyond pandemics, including screening for influenza, early bacterial infections, chronic disease markers, and therapeutic drug monitoring. It would also enable broader application in nonmedical domains such as food safety, water and air monitoring, and industrial quality control. Sensitivity enhancement expands the relevance of PoN diagnostics beyond crisis use, generates steady consumer demand, and supports all four pillars of sustainability: scalable manufacturing, real-time data infrastructure, predictive modeling, and stable financing. Detailed sensitivity benchmarks required to enable these high-demand applications are provided in Table S1.

Improving test sensitivity is not merely a technical enhancement but a prerequisite for sustained use of paper-based PoN diagnostics between pandemics. Most current tests of this format are optimized for high-prevalence respiratory infections, where moderate sensitivity may be sufficient under emergency conditions. However, many high-volume routine testing applications—such as latent tuberculosis screening, HPV self-sampling, cardiometabolic wellness monitoring, and consumer food and water safety—require significantly lower detection limits to meet public health or regulatory standards. These routine applications are not driven by outbreak incidence but by continuous, population-level demand across medical, agricultural, and environmental domains. When PoN sensitivity improves sufficiently to meet these lower detection thresholds, interpandemic demand could expand significantly. Supporting Note 1 presents a conservative, evidence-based model showing how existing non-COVID testing volumes (~1.8 billion tests per year) combined with new applications enabled by improved sensitivity could realistically sustain an annual demand exceeding 8 billion tests. This level of routine demand is essential not only for public health benefit but also for maintaining scalable mass-testing capacity and decentralized diagnostic infrastructure between crises.

Among available technologies, paper-based PoN tests, particularly assays similar to COVID-19 rapid antigen tests, remain the most promising for broad deployment. However, their sensitivity remains too low for reliable nonpandemic use. Efforts to improve these platforms through signal amplification, nanomaterials, and other innovations are ongoing. While alternatives to paper-based tests exist,[46-49] they remain operationally complex and less feasible for self-administered, low-cost use. A detailed comparison of test formats and performance parameters is provided in the Table S2.

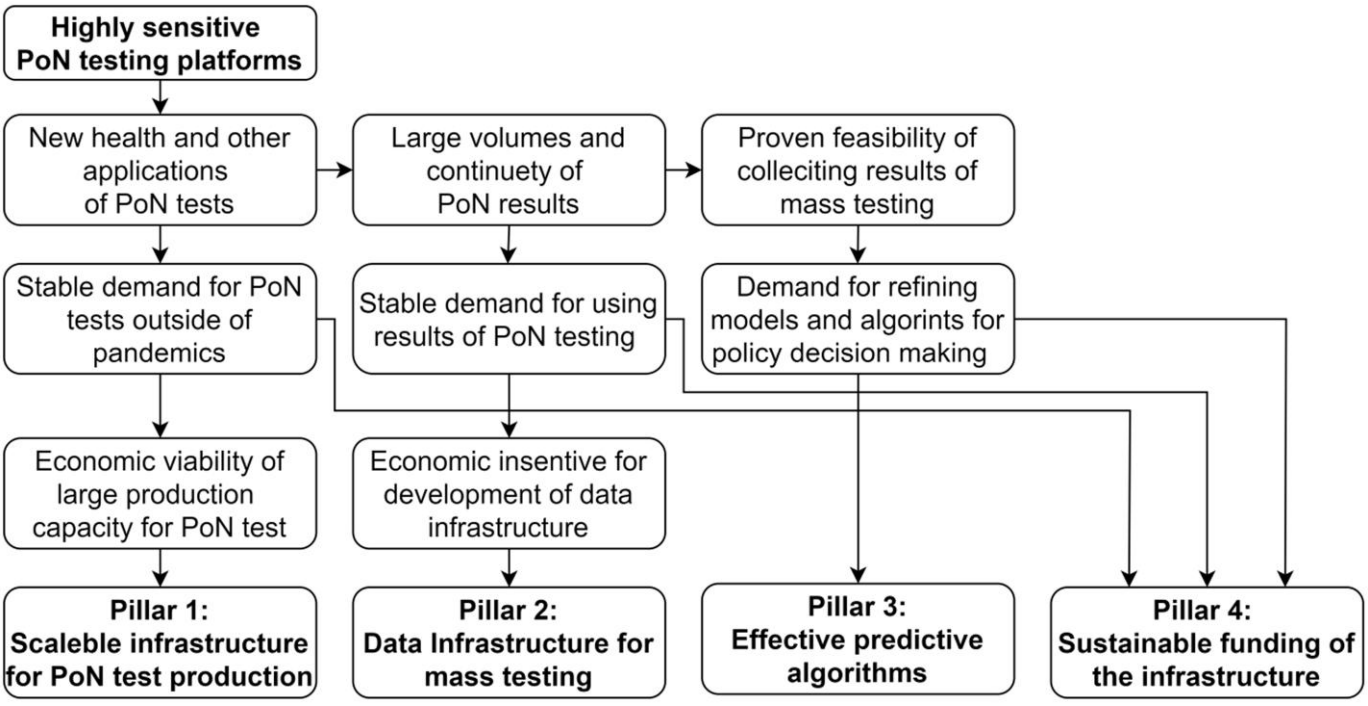

Figure 1. Framework illustrating the four pillars of sustainable mass-testing infrastructure centered on highly sensitive point-of-need (PoN) tests. Arrows indicate directionality of influence: an arrow pointing from one component to another means that the first enables or strengthens the second. Diagnostic sensitivity, shown at the top, supports all four foundational pillars, which in turn reinforce each other and the overall system resilience and equilibrium.

Table 1. Policy framework and strategies for sustainable mass testing.

Policy area	Challenges to address	Policy recommendations	Implementation strategies
1. R&D Investment to enhance PoN test sensitivity	• Lack of sensitivity for routine nonpandemic use. • Limited variety. • Limited adoption and demand. • Limited incentives for diagnostic innovation. • Inconsistent postapproval quality assurance.	1.1. Establish large-scale R&D funding for PoN test sensitivity enhancement. 1.2. Incentivize academic-private sector collaboration for ultra-sensitive PoN technologies. 1.3. Develop regulatory pathways for fast-track approval of high-sensitivity PoN tests. 1.4. Require regular postmarket quality evaluation to maintain diagnostic reliability.	• Granting programs to fund R&D. • Public-private partnerships to support commercial viability. • Pilot programs to integrate high-sensitivity PoN tests into routine healthcare. • Integration of quality assurance protocols into regulatory frameworks.
2. Scaling up manufacturing of high-sensitivity PoN tests	• Lack of stable market demand for PoN tests between pandemics. • Boom-and-bust cycles disrupt supply chains. • Overreliance on foreign suppliers for diagnostics.	2.1. Support high-sensitivity PoN development to drive private-sector manufacturing incentives. 2.2. Ensure regulatory predictability and market stability. 2.3. Provide financial incentives (tax credits, subsidies) for PoN production. 2.4. Standardize global benchmarks for PoN diagnostics.	• Advance purchase agreements to ensure steady demand. • Policy-driven incentives to regionalize supply chains. • Industry engagement to sustain long-term PoN production capacity.
3. Overcoming barriers to PoN test adoption	• Public hesitancy toward PoN testing. • Misinformation and distrust in diagnostic accuracy. • Fear of consequences (eg, stay-at-home protocols, job loss).	3.1. Launch public education campaigns emphasizing PoN test accuracy. 3.2. Provide financial incentives for routine PoN testing in workplaces and schools. 3.3. Implement behavioral interventions (eg, future-oriented messaging) to increase compliance.	• Nationwide awareness campaigns using traditional and social media. • Collaboration with employers, schools, and healthcare providers to normalize testing. • Subsidized PoN test distribution to at-risk communities.
4. Integrating high-sensitivity PoN tests into digital health systems	• Lack of real-time data integration for self-administered PoN tests. • Poor interoperability between decentralized and centralized diagnostic networks. • Inconsistent mechanisms of reporting for mass-testing data.	4.1. Develop standardized digital PoN test reporting systems. 4.2. Incentivize smartphone-based PoN analyzers with image-assisted result validation. 4.3. Ensure data privacy protection while enabling real-time public-health tracking.	• National digital infrastructure to integrate PoN test results with epidemiological surveillance. • Collaboration with tech companies to develop user-friendly self-testing apps. • Real-time analytics for predictive outbreak modeling.
5. Global coordination for high-sensitivity PoN test implementation	• Lack of standardized international policies for PoN testing. • Inequitable access to PoN diagnostics in low-income countries. • Limited cross-border collaboration for pandemic preparedness.	5.1. Align PoN test development with WHO pandemic response frameworks. 5.2. Establish cross-border procurement agreements for high-sensitivity PoN tests. 5.3. Promote global technology-sharing agreements for PoN innovations.	• Coordinated international PoN adoption policies by WHO and global public health agencies. • Public-private partnerships for equitable access to PoN diagnostics. • Integration of PoN testing into global outbreak surveillance systems.
6. Integrating PoN testing into the One Health surveillance strategy	• Limited integration of human, animal, and environmental disease surveillance. • Insufficient early warning systems for zoonotic outbreaks. • Lack of intersectoral coordination between global health agencies.	6.1. Establish a national PoN testing coordination unit within the One Health framework. 6.2. Expand Global Public-Health Intelligence Network (GPHIN) data integration to incorporate PoN testing results. 6.3. Strengthen intersectoral collaboration across public health, veterinary, and environmental health agencies.	• Incorporating PoN testing into the One Health strategy for early detection of emerging diseases. • National and global real-time data-sharing frameworks. • WHO and GPHIN partnerships for cross-border pandemic surveillance.

Enhancing the sensitivity of low-cost, self-administered tests would generate a self-reinforcing cycle of sustained demand, and therefore ongoing supply and capacity. Broader utility stabilizes demand, which in turn supports investment in local manufacturing, digital reporting systems, and predictive modeling. This would allow testing infrastructure to persist outside of emergency periods and scale rapidly when needed. As shown in Figure 1, diagnostic sensitivity strengthens all four pillars of sustainable mass testing: manufacturing, data, modeling, and financing.

Investment in sensitivity is not a purely technical matter, but a policy choice. Governments that prioritize sensitivity as a public-health objective can create the conditions necessary to stimulate innovation, derisk private-sector investment, and transform mass testing from a temporary crisis measure to an enduring public-health tool. This relationship has been demonstrated in programs such as the NIH RADx initiative in the US, the UK's lateral flow device (LFD) "Moonshot" program, and the CARB-X global accelerator, all of which linked public funding to performance improvements and successfully incentivized development and scale-up of high-sensitivity diagnostics.[50-52] Quantitative gains across these programs were substantial: NIH RADx invested US $1.5 billion to bring over 40 PoN tests with $\leq 10^2$–10^3 RNA copies/mL limits-of-detection to market and scaled US production from under 1 million to over 100 million tests per month; the UK LFD program, backed by a £2.8 billion purchase guarantee, tripled analytic sensitivity and reached around 20 million tests per week; and CARB-X grants (over US $450 million) advanced 13 high-sensitivity diagnostics to pivotal trials. The following section outlines a strategic policy framework to operationalize this transformation.

Policy roadmap for sustainable mass testing

Enhanced PoN test sensitivity is central to sustaining adoption and driving demand. To translate this into durable public health infrastructure, a coordinated policy framework is required with six strategic domains: research and development (R&D) investment, manufacturing, public engagement, digital integration, global coordination, and a One Health surveillance approach that integrates human, animal, and environmental health monitoring. The challenges and policy recommendations are summarized in Table 1 with more detailed policy proposals provided in Supporting Note 2.

Our policy framework draws on proven strategies from global health and biomedical innovation, demonstrating the feasibility of achieving a sustainable, high sensitivity PoN mass-testing infrastructure. In the R&D domain, the Combating Antibiotic-Resistant Bacteria Biopharmaceutical Accelerator (CARB-X) initiative exemplifies how long-term public–private funding partnerships can address market failures in high-need areas.[52,53] By accelerating the early stage development of diagnostics and therapeutics for antimicrobial resistance, this initiative offers a relevant model for PoN diagnostics, which face similar challenges in market incentives, global health significance, and innovation needs. Manufacturing scale-up is supported through instruments such as advance purchase agreements and investments in adaptable manufacturing platforms. For instance, The Netherlands' COVID-19 testing strategy leveraged a public–private partnership to rapidly establish high-throughput diagnostic infrastructure using adaptable manufacturing platforms, highlighting a model that could be applied to future production of high-sensitivity PoN diagnostics elsewhere, and demonstrating the importance of regulatory coordination and pooled resources in building domestic capacity.[54]

To address barriers to public uptake, initiatives to detect and modify unwillingness to engage in protective health measures,[55,56] like the United States "Say Yes! COVID Test" campaign,[30] can be implemented. Such measures have shown how behavioral science, combined with targeted financial incentives,[57] can normalize self-testing and drive adoption, particularly in underserved communities. These approaches illustrate how behavioral engagement strategies can translate into broader population-level participation.

In the realm of digital integration, efforts by the US National Institutes of Health and other organizations to develop self-reporting platforms for at-home testing have laid the foundation for privacy-preserving, standardized systems capable of integrating PoN data into live surveillance and outbreak response networks.[58]

For global coordination, initiatives such as the Global Health Innovative Technology (GHIT) Fund show how governments, philanthropic organizations, and industry can align to advance R&D and equitable access to health technologies.[59] This model could be adapted to support the scale-up and improve equitable global distribution of PoN diagnostics. Finally, integrating PoN diagnostics into the One Health framework could involve formal data-sharing agreements with GPHIN, real-time dashboards for local health agencies, and cross-training of surveillance personnel to aggregate and interpret combined human, animal, and environmental data streams. Incorporating decentralized PoN data would further strengthen surveillance of zoonotic and environmental health threats.[60]

Collectively, these historical precedents demonstrate that our proposed policy roadmap builds on well-established models. The primary challenge is not invention, but coordinated adaptation to support resilient, decentralized PoN systems that operate both during and between public-health emergencies. Ongoing quality control and re-evaluation of PoN diagnostics will be essential to maintain reliability as pathogens evolve. This will ensure that decision-making remains evidence-informed over time.

Conclusion

PoN testing capacity may survive only during acute emergencies if it continues to rely on low sensitivity and crisis-based funding. Improving the sensitivity of PoN tests is a fundamental prerequisite toward building a self-sustaining, economically viable mass-testing system. Without sufficient sensitivity, PoN tests have limited use, sporadic demand, and reliance on emergency needs. By investing in research and development of highly sensitive, cost-efficient, and scalable PoN technologies, governments can transform mass testing from a temporary crisis tool into a permanent component of global health infrastructure. The sustainability of this transformation must be supported by strategic policies, including targeted procurement mechanisms, incentives for decentralized manufacturing, and the seamless integration of PoN testing into public health systems. By systematically implementing strategies focused on sensitivity enhancement, PoN testing can: serve as a routine public health tool; enable earlier detection of disease to prevent surges in transmission; promote economic stability and productivity through predictable procurement and

domestic production; and strengthen global pandemic preparedness through coordinated action. Realizing this vision will require not only scientific innovation, but also sustained strategic leadership, international coordination, and a long-term commitment to diagnostic equity.

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Supplementary material

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Conflicts of interest

Please see ICMJE form(s) for author conflicts of interest. These have been provided as supplementary materials.

Notes

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