

# What made primary health care resilient against COVID-19? A mixed-methods positive deviance study in Nigeria

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## ABSTRACT

**Introduction** The SARS-CoV-2 (COVID-19) pandemic overwhelmed some primary health care (PHC) systems, while others adapted and recovered. In Nigeria, large, within-state variations existed in the ability to maintain PHC service volumes. Identifying characteristics of high-performing local government areas (LGAs) can improve understanding of subnational health systems resilience.

**Methods** Employing a sequential explanatory mixed-methods design, we quantitatively identified ‘positive deviant’ LGAs based on their speed of recovery of outpatient and antenatal care services to prepandemic levels using service volume data from Nigeria’s health management information system and matched them to comparators with similar baseline characteristics and slower recoveries. 70 semistructured interviews were conducted with LGA officials, facility officers and community leaders in sampled LGAs to analyse comparisons based on Kruk’s resilience framework.

**Results** A total of 57 LGAs were identified as positive deviants out of 490 eligible LGAs that experienced a temporary decrease in PHC-level outpatient and antenatal care service volumes. Positive deviants had an average of 8.6% higher outpatient service volume than expected, and comparators had 27.1% lower outpatient volume than expected after the initial disruption to services. Informants in 12 positive deviants described health systems that were more integrated, aware and self-regulating than comparator LGAs. Positive deviants were more likely to employ demand-side adaptations, whereas comparators primarily focused on supply-side adaptations. Barriers included long-standing financing and PHC workforce gaps.

**Conclusion** Sufficient flexible financing, adequate PHC staffing and local leadership enabled health systems to recover service volumes during COVID-19. Resilient PHC requires simultaneous attention to bottom-up and top-down capabilities connected by strong leadership.

## WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Resilience scholarship during the COVID-19 pandemic has largely focused on national-level policy responses and broader health systems, emphasising the importance of governance, financing, middle-level leadership, surveillance systems and human resources in maintaining and recovering primary health care service delivery volumes.
- ⇒ Comparative, mixed-methods research is needed to understand how resilience capacities were operationalised by health managers responsible for implementing policies during the COVID-19 pandemic and how their practices may have affected the speed of primary health care service delivery recovery.

## WHAT THIS STUDY ADDS

- ⇒ Local government areas that experienced a faster-than-average primary health care service utilisation recovery were more integrated, aware of their populations’ needs and self-regulating than their neighbouring local governments.
- ⇒ While all local government area health systems increased their frequency of outreach services, high-performing local government area health systems operationalised resilience capacities by engaging senior leadership in the COVID-19 response, establishing specific local coordination structures, generating demand and awareness for essential health services through incentives, leveraging local funding sources and ensuring sufficient human resources for health.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY.

- ⇒ Characteristics and actions of high-performing local health systems suggest priority areas for strengthening health systems (financing and human resources) and best practices during future health emergencies to improve health systems resilience in Nigeria and worldwide.

**Table 1** Resilient health system definition and framework<sup>5</sup>

Resilience capability	Definition
Aware	The ability to identify assets and gaps in the health system and call on them in times of crises
Diverse	The ability to address a broad range of health challenges
Self-regulating	The ability to contain and isolate health threats while delivering core health services
Integrated	The ability to bring together or work across a range of actors, ideas and groups to formulate solutions
Adaptive	The ability to transform to improve function in response to changing needs

## INTRODUCTION

A key priority emerging from the SARS-CoV-2 (COVID-19) pandemic is understanding variations in the ability of health systems to maintain or recover essential primary health care (PHC) services. Nearly all countries experienced an initial disruption of essential health services at the onset of the pandemic in March 2020, impacting a range of health services including reproductive, maternal, and child health services, non-communicable and communicable disease diagnosis and treatment, mental health care, and other outpatient services.<sup>1</sup> As the COVID-19 pandemic continued, some health systems experienced sustained drops in prepandemic PHC service volumes, causing severe secondary health impacts to populations<sup>2,3</sup>, while others experienced a comparable COVID-19 burden but recovered quickly to prepandemic service volumes.<sup>4</sup> Understanding variation in PHC service volume recovery and how to protect essential health services during future shocks therefore has broader implications for building more resilient health systems.

Health systems resilience is defined as ‘the capacity of health actors, institutions and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learnt during the crisis, reorganise if conditions require it’<sup>5</sup>. Health systems resilience emphasises a systems approach to pandemic response, including the dual maintenance of existing services and the ability to adapt and transform in the face of new challenges (table 1).

Following the COVID-19 pandemic, there is a growing literature which examines resiliency as provision of services in good times and in shocks. Existing COVID-19 resilience scholarship has largely focused on national-level policy responses and meso-level capacities.<sup>6–8</sup> Evidence emphasises the importance of governance, financing, middle-level leadership, surveillance systems and human resources (HR).<sup>6–10</sup> A smaller body of scholarship that predates the COVID-19 pandemic emphasises the importance of micro-capacities and meso-capacities,

including how front-line health managers nurture resilience and how health care workers ‘cope’ with systems’ challenges.<sup>11–14</sup> There is a gap in understanding how subnational actors engaged in resilient practices during the COVID-19 pandemic and how their practices shaped essential PHC service recovery. Previous reviews have also emphasised the need for mixed-methods approaches to analyse resilience.<sup>15</sup>

## Understanding health systems resilience in decentralised contexts

Decentralised contexts are ideal for studying subnational variation in health systems resilience. Nigeria comprises 774 local government areas (LGAs) across 36 states and the Federal Capital Territory (FCT), each having relative health systems autonomy. Nigeria experienced four peaks in COVID-19 transmission—June 2020, January 2021, August 2021 and December 2021—with subnational variation in COVID-19 burden. Previous studies have demonstrated within and between-state differences in COVID-19 responses in Nigeria; however, it is unclear how these differences may have been influenced by existing health systems characteristics and varied subnational responses.<sup>16,17</sup> Describing characteristics of ‘resilient’ LGAs can help to strengthen pandemic preparedness, response and recovery efforts towards more resilient health systems.

## Objective

The objective of this study was to quantify within-state variation in the ability of LGAs to maintain PHC service volumes during the COVID-19 pandemic using routine health management information system (HMIS) data and qualitatively examine how PHC resilience capabilities varied across a sub-set of positive deviant (PD) and comparator LGAs. We then identify implications for building resilient health systems.

## METHODS

Positive deviance studies identify entities that perform exceptionally well despite facing the same constraints as others and attempt to explain that performance variation.<sup>18</sup> We used a sequential explanatory mixed-methods design to quantitatively identify LGAs which experienced a sustained decline in outpatient and first antenatal care (ANC) service volumes (over a continuous 3-month period) since the beginning of the pandemic, and purposefully selected 12 eligible PD LGAs. We then matched PDs that experienced a recovery in service volumes to comparator LGAs within the same state that did not experience a recovery during that period.<sup>19</sup> Within-state comparisons helped control for variations in mobility restrictions and macro-level COVID-19 responses implemented at the state or federal levels.

We then conducted 70 key informant interviews (KIIs) with LGA-level, PHC facility-level and community-level actors to understand the resilience capabilities that were

key to minimising the COVID-19 pandemic's impact on PHC services.

### Conceptual basis

Kruk's resilience framework informed the quantitative definition of health systems resilience and qualitative analysis of resilience capabilities.<sup>5 20</sup> We selected this framework because of its development in a West African pandemic context and its subnational applicability.<sup>5 20</sup>

Quantitatively, we defined adaptive resilience as LGAs that experienced an initial decline in outpatient service volume but were then able to adapt and consistently provide monthly service volumes at expected (or higher) service volume levels. Qualitatively, the framework guided the development of interview guides and the initial coding structure for thematic analysis.

### Quantitative phase

Routine HMIS data were analysed with an interrupted time-series approach to estimate the percent change in the delivered volumes of services during the pandemic compared with projected volumes based on prepandemic trends. The methods for this analysis at the national level are described in greater detail elsewhere.<sup>2 3</sup> In this study, LGA-level results interpretation necessitated additional data-cleaning procedures to ensure that data of sufficient quality was considered in analysis.

Monthly data on outpatient and ANC service volume between January 2018 and December 2021 were downloaded at the facility level from Nigeria's HMIS. Outpatient volume is generally the highest quality indicator reported to the HMIS (in terms of completion, timeliness and lack of outliers), and ANC services were identified by the Nigerian Federal Ministry of Health (FMOH) as a priority preventive service to maintain through the pandemic.<sup>3</sup> Facilities classified as maternal waiting homes and hospitals were dropped from the analysis to ensure roughly comparable service volumes at the facility level. Facilities reporting data for fewer than 19 of the 26 prepandemic months (January 2018–March 2020) or fewer than 15 of the 22 months after the pandemic's onset (March 2020–December 2021) were dropped from analysis due to a lack of sufficient data to model prepandemic trends or estimate postpandemic shortfalls or surpluses. After aggregating monthly service volume to the LGA level, months with data completeness less than 2 SD from the LGA's mean completeness (ie, completeness outliers) were dropped to reduce variability in postpandemic shortfall estimates. Interrupted time-series analysis was run to estimate the average monthly postshock volume of outpatient consultations and ANC services.

The LGAs that experienced a 3-month period with lower-than-expected outpatient service volume (compared with prepandemic expected trends) between March 2020 and December 2021 were included in the PD analysis. This criterion ensured that LGAs experienced a shock that affected services (presumed to be related to COVID-19) and allowed for flexibility in identifying

when that shock occurred, accounting for the heterogeneity in the severity and timing of COVID-19 waves across the country. The cumulative estimated shortfall of ANC was calculated since the beginning of the pandemic. LGAs were then ranked for both outcomes (post-shock outpatient volume and cumulative postpandemic ANC volume) relative to other LGAs in their geopolitical zone. LGAs that ranked in the top 25% within their geopolitical zone for both outcomes were eligible for selection as PDs. Postshock service volume and cumulative service volume were reported for eligible PDs and non-PDs by Nigeria's six geopolitical zones.

### Sampling for qualitative inquiry

Once our quantitative list of candidate LGAs was developed, we applied a purposive, maximum variation sampling approach to select a diverse subset of 12 PDs based on geography (geopolitical zone and urban/rural), COVID-19 burden and feasibility of data collection for qualitative inquiry (table 2).<sup>21 22</sup> We then compiled a list of potential comparator LGAs for each selected PD and a comparator was selected for each PD. To be eligible as a comparator, the LGA could not be a PD, needed to be proximal to the PD (usually neighbours and always in the same state), and needed to have a relatively similar wealth and urbanicity compared with the PD (table 2). We selected PHC-level facility informants from within the sampled PD LGAs based on facility-level HMIS service volume recovery. Monthly facility-level outpatient service volumes were graphed throughout the pandemic, and facilities that experienced a shock and postshock recovery to outpatient services were selected. A snowball sampling approach was used to purposefully sample community-level opinion leaders in both PDs and comparators.<sup>22</sup>

### Qualitative phase

We applied a multiple comparative case study design for the qualitative phase to explore similar phenomena across a diverse group of LGAs.<sup>23 24</sup> We followed the Standards for Reporting Qualitative Research checklist (online supplemental file 1).<sup>25</sup>

We collected data from each case simultaneously and applied a consistent approach across LGAs to facilitate comparative analysis.<sup>23</sup> A semistructured KII guide was developed using the conceptual framework, piloted in English and used throughout the study (online supplemental file 2). The KII interview guide included questions on both resilience strategies or adaptations that were implemented during the COVID-19 response<sup>1</sup> and on pre-existing facilitating or constraining factors that influenced the response.<sup>2</sup> Predeveloped probes were used to improve comparability of findings across multiple cases. Additional, 'tell-me-more' probing techniques were used to elicit context-specific depth on LGA responses.<sup>23 26</sup> Guides were translated into Hausa, Igbo, Yoruba and Pidgin and back-translated by certified translators.

**Table 2** Qualitative sampling approach by informant category

Informant category		Purposive criteria
Local government area health officials (LGAs)	Positive deviants (PD)	<ul style="list-style-type: none"> <li>▶ At least one state per geographical zone represented in the final LGA sample, for geographical representativeness across Nigeria</li> <li>▶ Prioritise states with the highest number of COVID-19 cases reported to Nigeria Centre for Disease Control in each zone</li> <li>▶ Balance of urban and rural geographies</li> <li>▶ Exclude areas with known security concerns for in-person data collection</li> </ul>
	Comparators	<ul style="list-style-type: none"> <li>▶ Not eligible to be a positive deviant</li> <li>▶ Similar geography (urban or rural) as the PD (usually geographic neighbour)</li> <li>▶ Similar relative wealth as the PD</li> <li>▶ Within the same state as the PD</li> <li>▶ Exclude areas with known security concerns for in-person data collection</li> </ul>
Primary health care facility (PHC) officers in charge	PDs	<ul style="list-style-type: none"> <li>▶ If no clear PHC facility-level pattern emerged in the quantitative analysis, PHC facilities were randomly selected from a list generated by LGA officials.</li> </ul>
	Comparators	<ul style="list-style-type: none"> <li>▶ Randomly selected from an available facility list of non-positive deviants</li> </ul>
Opinion leaders	Both positive deviants and comparators	<ul style="list-style-type: none"> <li>▶ LGA and facility informants were asked to identify additional informants critical to the local COVID-19 response</li> <li>▶ A list was generated of these suggestions and relevance of suggestions confirmed.</li> <li>▶ Individuals were randomly sampled from the final list</li> </ul>

Data were collected from June to July 2022 by 12 pairs of interviewers and notetakers with qualitative research experience, residency or experience in the sampled state, and no known connection to the COVID-19 response. A 3-day training promoted a standardised approach across each LGA.<sup>23</sup>

Informants were approached via phone. Data collectors carried an introduction letter from the FMOH describing the study as understanding local COVID-19 responses. We recorded no refusals. Interviews were conducted in-person at a work location and lasted approximately 1 hour. Following confirmation of informed consent, interviews were recorded and transcribed, and field notes were taken.

We coded LGA, PHC-facility and community informants within each LGA as one 'case', using the resilience capabilities from the study's conceptual framework as a starting point for the codebook. We coded the data blinded to the LGA's categorisation (PD/comparator) to reduce confirmation bias. Within the framework capabilities, we inductively identified resilience capabilities and barriers emerging from the Nigerian context.<sup>27</sup>

A dualistic technique of deductive/inductive coding for thematic content analysis was used for the coding.<sup>27</sup> Multiple coders were engaged in the analysis process. One coder coded the entirety of the data, so they had a comprehensive view of the entire qualitative dataset,

while additional coders coded a subset of the transcripts to ensure there was agreement in the findings and interpretation of themes.

The entire research team engaged iteratively with the qualitative data throughout the analysis process—including conducting a close read of the transcripts in raw form, reviewing the coding process, discussing and validating inductively generated codes and the subsequent development of themes, and discussing the interpretation of themes. This validated the coding and improved trustworthiness.

Two established approaches for cross-case thematic analysis were used together to derive our findings: tabulation of themes and case summaries.<sup>23 24</sup> To tabulate the themes, we identified the presence or absence of a theme across all the KIs in the LGA. Aligned with the well-established principle of saturation in qualitative research, multiple KIs needed to refer to a specific theme in the LGA to tabulate the theme as 'present' in a given LGA. For example, if multiple KIs from the same LGA described the importance of a specific local leader in guiding the local COVID-19 response, we counted that LGA in the tabulation as describing local leadership as a resilience capability. The tabulation was then used to compare themes across PDs versus comparators and display this comparison transparently in the manuscript.<sup>28</sup> LGA case summaries contextualised the



tabulation, promoted triangulation and helped identify minor themes. The case summaries also preserved key informant perspectives that were not included in the tabulation to maintain an element of ‘thick description’ in the qualitative analysis and to allow us to interrogate our findings in broader context. Finally, the case summaries also provided an audit trail to compare to the theme tabulation.

### Patient and public involvement

None.

## RESULTS

Monthly service volume data from 34269 facilities between January 2018 and December 2021 were obtained from Nigeria’s HMIS. A total of 3842 non-primary health care facilities were dropped due to ineligibility. A total of 13443 facilities were dropped due to low data completeness. The interrupted time-series analysis included data from 16984 facilities in 717 LGAs.

After running the interrupted time series analysis, 227 LGAs did not experience a period of lower-than-expected outpatient service volume and were not eligible for selection. Among the remaining 490 LGAs that experienced a shock, 57 were PDs. At baseline, average monthly outpatient and ANC consultations were similar across PDs and comparators nationally, but some differences exist in baseline OPD in the regions with the smallest number of included LGAs (South East and North East Zones). Nationally, PDs had an average of 8.6% higher service volume than expected after experiencing a COVID-19-related shock, while comparator LGAs had 27.1% lower than expected service volume after experiencing a shock (table 3). PDs had 18.7% higher-than-expected ANC1 volume after a shock, while comparators had 17.2% fewer ANC1 consultations. Cumulatively, PDs had roughly the same OPD volume as expected (2.8% higher) since the beginning of the pandemic, while comparators had about three-quarters of expected OPD service volume (24.6% lower). Interestingly, comparator LGAs had slightly higher-than-expected cumulative ANC1 service volume compared with PDs, suggesting that the initial disruption to services may have been more severe in PDs (19.1% higher vs 12.2% higher).

From the 57 PDs and 433 remaining LGAs, 12 PDs and 12 comparator LGAs were purposefully selected for qualitative inquiry, representing 10 states (Abia, Edo, Gombe, Imo, Kano, Lagos, Ogun, Oyo, Plateau, Rivers) and FCT. We conducted 70 KIIs at the LGA (n=28), facility (n=28) and community (n=14) levels.

### Analysis of resilience capabilities in recovering PHC service volumes

We present our qualitative results in two sections. First, we compare the actions taken by PDs and comparators to maintain and recover PHC service volumes, which we term PHC resilience capabilities. We then compare

challenges that limited the resilience of PDs and comparator LGAs, which we term resilience barriers.

### PHC resilience capabilities

Table 4 tabulates the number of PDs (out of 12) and comparators (out of 12) in which informants cited various resilience capabilities along dimensions of the conceptual framework and provides indicative examples. Compared with comparators, PDs clearly demonstrated greater integrated and awareness resilience capabilities which supported their ability to maintain PHC service availability and recover service volumes. In particular, strong leadership and pre-existing community engagement structures were facilitating factors that supported the response. Nearly all PDs described these capabilities as critically important, whereas fewer comparators did the same.

PDs and comparators both demonstrated adaptive resilience capabilities by implementing specific strategies during the response; however, there were subtle differences in the most common types of adaptations used. PDs were more likely to focus on demand-side adaptations such as providing incentives to increase service use and implementing home visits, while comparators were more likely to engage in supply-side adaptations, including task shifting and social distancing at the facility. Comparators were more likely to demonstrate self-regulation capabilities through their use of reserve human resource capacities, largely in response to pre-existing HR shortages which were a constraining factor. The importance of ‘diverse’ capabilities within the Kruk framework was not often described, with minimal difference across PDs and comparators.

### Integrated capabilities

Both PDs and comparators emphasised a whole-of-society pandemic response by working across levels of the health system and by engaging community leaders. All LGAs described an increase in community outreach activities during the pandemic. Informants unanimously described working through existing, community-level structures—including ward and facility development committees, traditional and religious leadership structures, market women’s associations and youth associations—and leveraging trusted community gatekeepers for risk communications.

Informants from PDs additionally described combining COVID-19 specific risk communications with messages to drive demand for PHC. This approach explicitly recognised that communities were concerned about contracting the virus, as well as misperceptions that facilities were impacted by pandemic shutdowns. A community leader described their outreach approach:

I often go house to house because there may be sick persons at home who may not be aware [...] that the door of the hospital is still open – Community leader, PD

**Table 3** Expected local government area service volume by geographical zone

Zone	No of LGAs in study	Prepandemic monthly OPD volume (average number of visits)				Cumulative postpandemic OPD volume (percent change)				Prepandemic monthly ANC volume (average number of visits)				Cumulative postpandemic ANC1 volume (percent change)			
		OPD volume (average number of visits)		shock (percent change)		volume (percent change)		volume after shock (percent change)		ANC volume (average number of visits)		shock (percent change)		volume after shock (percent change)		volume (percent change)	
		Comparator	Positive deviant	Comparator	Positive deviant	Comparator	Positive deviant	Comparator	Positive deviant	Comparator	Positive deviant	Comparator	Positive deviant	Comparator	Positive deviant	Comparator	Positive deviant
North Central	77	88.4	85.8	-16.1%	15%	-17.1%	6.6%	17.2	17.0	-1.9%	47%	18%	9.4%				
South East	52	78.9	380.2	-28.5%	16%	-25.2%	7.3%	10.4	8.3	-18.1%	56.3%	18.2%	16.7%				
South West	106	102.7	67.3	-24.9%	3.4%	-24.5%	-1.2%	14.3	11.6	-17.9%	14.2%	69%	10.8%				
Niger Delta	82	72.4	60.0	-37.4%	6.9%	-31.9%	2.5%	11.9	9.2	-16.4%	8.5%	34%	11.2%				
North West	113	203.2	240.0	-16%	12.7%	-15.6%	4.7%	46.5	49.9	-21.9%	-29%	-6.7%	8.9%				
North East	60	411.7	188.0	-39.3%	-2.8%	-33.1%	-3%	60.9	33.4	-26.9%	15%	-17.7%	16.1%				
National	490	154.9	145.2	-27.1%	8.6%	-24.6%	2.8%	27.4	19.3	-17.2%	18.7%	19.1%	12.2%				
Percent change in services relative to the expected volume, where negative numbers are a shortfall, 0 is equal to expected volume, and positive numbers are greater than expected service volumes during the reported period. A shock is defined as three consecutive months of lower-than-expected volumes. The “volume after shock” column reflects the cumulative percent of expected services after the last month of the first shock experienced by an LGA. The cumulative column reflects the cumulative percent of expected service volume between March 2020 and December 2021.																	
ANC1, first antenatal care visit; LGA, local government area; OPD, outpatient department.																	

**Table 4** PHC resilience capabilities of positive deviants and comparator LGAs

Capabilities identified by Kils	Comparison of PDs and comparators	PD Examples	Comparator Examples
Integrated—coordinating across actors, sectors and engaging communities			
Senior LGA leadership was engaged in managing and/or supporting the response	Large difference, more frequently cited by PDs	<b>10/12 cited this capability</b> ‘[The] local government chairmen, [he] tried his best funding our movement, giving us money for data, the local government provided enabling environment. If we go for village mobilization they provided. The chairman of the local government will now call the town criers; they will bring out people. They did a lot for us.’ LGA official, PD	<b>2/12 cited this capability</b> ‘The first and foremost it has to be the support from the political leadership, the response was satisfactory, actually the chairman gave us support both financially and morally during the pandemic, so that helps us’ LGA Official, Comparator
Specific local coordination structures were developed for the COVID-19 response	Large difference, more frequently cited by PDs	<b>9/12 cited this capability</b> ‘During the pandemic, the honorable chairman constituted a COVID-19 monitoring committee headed by the supervisory counsellor special duties, supervisory counsellor for health, head of department health is the secretary of that committee, the disease notification officer, our office and some relevant key holder, SSS, DPO and some representatives of CAN chairman and Chief Inam were members of this committee that we have at the area council. We went to places of worship, schools, some companies,...)That committee really help during that time. We were even giving recommendation from FCT area council secretariat, [this LGA] was the first to constitute that committee in [a state in Nigeria].’ LGA official, PD	<b>2/12 cited this capability</b> ‘The LGA team comprises of all the secondary facilities and the local government team, so we work as a team(...) inaugurated by the chairperson of the local government as a task force. This task force works seriously towards helping the spread of COVID-19 in the local government.’ LGA official, Comparator
Dialogue with communities focused on generating continued demand for and awareness of essential health services	Moderate difference, more frequently cited by PDs	<b>8/12 cited this capability</b> ‘The facility has gone out of the catchment area to health educate the women of age of childbearing age on the importance of coming to the health facility despite the COVID-19 pandemic, and they assure them that they are going to use all preventive measures to ensure that nobody comes to the facility and goes back infected with the COVID-19.’ Facility OIC, PD	<b>3/12 cited this capability</b> ‘After the engagement with the community, we have [increases in] utilizing our services because they became(...)more reassured that one, the services are still available, and two, that if they come around, there won’t be any risk of exposure or contracting the COVID.’ LGA official, Comparator
Increasing the frequency of community engagement and outreach activities during the COVID-19 pandemic	No difference between PDs and comparators	<b>11/12 cited this capability</b> ‘During the Covid period, we really needed community mobilization, community dialogue, trying to sensitize the people on the risk factors for contracting Covid and the safety profile of the health facilities.(...)We do our ward development community meetings once a month and that was enough to pass the message across. But during the Covid, it had to be almost routine because we needed to get the message presented to the people.’ LGA official, PD	<b>11/12 cited this capability</b> ‘There is increase social mobilization, there is increase mobilization of the people. We increase our dialogue with the community.’ LGA official, Comparator
Existing platforms were leveraged and strengthened to engage with community leaders	Minor difference between PDs and comparators	<b>12/12 cited this capability</b> ‘The existing community relationship helped(ed) by ensuring community dialogue and sensitization(...). We work hand in hand with them.’ Facility Officer in Charge, PD	<b>11/12 cited this capability</b> ‘The lesson learned? strengthening of the already existing relationship with the community members(...)this COVID-19 has brought(...)us close together, we have been working as a team’ LGA official, Comparator

Continued

Table 4 Continued

Capabilities identified by KIs	Comparison of PDs and comparators	PD Examples	Comparator Examples
A 'teamwork' mentality was strengthened across the health system	No difference between PDs and comparators	<b>11/12 cited this capability</b> 'We worked as a team(...).we also come back to review our activities and deliberates on our challenges, our strengths, our weaknesses, the opportunities we had and threats to the opportunities.' LGA official, PD	<b>11/12 cited this capability</b> 'The local government chairman, all the heads of departments were all involved. So it was a, it was a team thing in all in the whole local government. So everyone was available, everyone was ready.' LGA official, Comparator
Aware—understanding of resources to draw from, with data to identify threats			
Local funding sources were leveraged to fill resource gaps in the response	Large difference, more frequently cited by PDs	<b>10/12 cited this capability</b> 'The facility management have made it mandatory every week to remove money from its account to support the COVID-19 response and the facility have tag some staff to ensure that there is strict maintenance of those preventive measures.' PHC facility staff, PD	<b>11/12 cited this capability</b> 'We would join hands to see that we found a solution to the problem that arose or may arise. They [the LGA] even provide batteries for megaphone, refreshment etc.' LGA official, Comparator
Adaptive—transforming processes in the short and long term in the face of threats			
Incentives for service use were increased	Small difference, more frequently cited by PDs, but not reflected by a large number of sampled LGAs in either category.	<b>5/12 cited this capability</b> '(Pregnant women) were given free ANC drugs and a mama kit. So, you find out that since they knew that if they come for or registered for antenatal, they will be given free nets, free drugs and delivery items. It motivated them to come.' LGA official, PD	<b>2/12 cited this capability</b> 'One major thing we did was [we] made delivery free of charge,(...)we also declared registration for ANC free—which was not there [before]—to win people to continue to access our facilities.' LGA official, Comparator
Home visits were used	Small difference, more frequently cited by PDs, but not reflected by a large number of sampled LGAs in either category.	<b>5/12 cited this capability</b> 'Before we go for outreach, we go to the people, [on this] date we will be coming for an outreach, since they no longer come to us, we are now going to them.(...)Yes it was not easy because you don't sit at home or use your phone, you must have to go looking for them and for you to go, at times you dip your hands in your pocket to... that is why if you are not really committed to this job, you cannot do all these approaches because for you to talk to them, you go looking for them.' LGA official, PD	<b>1/12 cited this capability</b> 'Home visiting, some don't like coming to the facility, they say if they come to the facility, they will check them, they will take them for Covid, so we will meet them at their homes.' LGA official, Comparator
Reduced appointments to prevent overcrowding of PHOs	Small difference, more frequently cited by comparators, but not reflected by a large number of sampled LGAs in either category.	<b>1/12 cited this capability</b> 'If you have gone through our health centres you will see they are small buildings, so putting people clustered in one place was not what we were trying to encourage during the COVID-19 pandemic. So, we had to do more, lesser numbers of persons in the facilities per time just to prevent the spread among the health care workers.' LGA official, PD	<b>5/12 cited this capability</b> 'With these top services [MNCH], we continue but we try to reduce the number of people inside the health facility to prevent the spread since we already know that COVID virus was airborne. We are using physical distancing, and we reduce the number of the sessions, number of persons that attend every vaccination session and in some cases, we had to schedule dates for mothers to bring their children and babies for vaccination' LGA official, Comparator

Continued



**Table 4** Continued

Capabilities identified by KIs	Comparison of PDs and comparators	PD Examples	Comparator Examples
Human resources were re-allocated via task shifting or changes in duty schedules	Small difference, more frequently cited by comparators, but not reflected by a large number of sampled LGAs in either category.	<b>2/12 cited this capability</b> 'One person can manage 2 or 3 services, because some service providers cannot transport themselves from where they are residing to the facility[so] you see 1 person has to manage 2 units in the facility' PHC facility staff, PD	<b>4/12 cited this capability</b> 'Of course, that's the strategy we used, since all the health workers won't come at the same time. In the initial stages, there was an overall staff shifting, the midwives too could offer routine immunization services, not necessary health care workers and the pharmacy technician too could assist in vaccination and a lab scientist too could be deployed for record purposes, we did this task shifting to be able to cope.' LGA official, Comparator
Self-regulating—contain threats while continuing core operations			
Accessed reserve human resource capacity via voluntary, contract or other temporary health workers	Small difference, more frequently cited by comparators	<b>4/12 cited this capability</b> 'I don't think there is another clinic that has a complete component of staff. That is why we formed the health development team to complement what the facilities needed.(...)there are staff on voluntary services, some are casual, so we used them based on their qualification to fill that gap' LGA official, PD	<b>7/12 cited this capability</b> 'Retired matrons, retired health workers came to assist us during the COVID pandemic, and we were able to benefit from their experience and add [to] our workforce, but after the pandemic started declining, they all disengaged.' LGA official, Comparator
<p>Note: Tabulations displayed in this table are derived from qualitative findings and should be interpreted as descriptive in nature. Informants from the LGA, PHC facility and community levels within a single LGA are considered a 'case' and represented jointly in the numerical tabulation of LGAs. Diverse capabilities were described in a small number of LGAs and did not rise to a level of sufficient saturation for inclusion in the results.</p> <p>KIs, key informant interviews; LGA, local government area; PDs, positive deviants; PHC, primary health care.</p>			

PDs were more likely to also describe new LGA-level coordination mechanisms and specific leaders who coordinated and motivated local responses. Effective LGA-level leaders determined a unified subnational strategy during the pandemic, mobilised resources from within and outside the LGA, and created a culture of accountability. This motivated LGA and PHC staff to take on the dual responsibility of pandemic response and routine PHC service provision. An LGA official in a PD described this as the defining success of their response:

This is the lesson, [...] we worked seriously with the LGA team to look [at] all nooks and corners of the communities [...] The local government Chairman organized a committee with his councils, they rushed [to] meet in the community all together to achieve a positive result —LGA official, PD

### *Aware capabilities*

Local leaders' ability to integrate different actors into a unified response was supported by awareness capacities. Sourcing local human and financial resources helped maintain integrated coordination and community engagement, while pre-existing knowledge of community actors supported community outreach. A community leader in a PD described how existing community networks and relationships, supported by a timely injection of financing, worked together to reach rural communities:

We compiled the list of [Community Development Associations] [...] Government provided enough transportation for us to go to the in and out of the inner places [...] and mobilized us with cash package. [...] Enough staff were provided. —Community leader, PD

The added ability to source local financing for community engagement was one of the largest differences between PDs and comparators. This financing came from a range of sources including donations from LGA officials, local philanthropies and local institutional mechanisms. LGAs with existing revenue generation and pooling mechanisms activated these to support the response, including an LGA welfare scheme that paid for community mobilisation, a community-level scheme to cover drug costs, facility bank accounts with flexible funds, and staff resource mobilisations. An LGA official in a PD described their pooling mechanism as a flexible, community-based approach to meeting local needs:

The LGA has what we call "resources mobilization" among the staff in the LGA. We usually donate a little thing out of our pockets and put it in one of the LGA treasury, so that when we have a challenge, we [...] fuel our bike and go to those wards —LGA official, PD

This type of local financing was described consistently by PDs as enabling other aspects of the response; in contrast, several comparator LGAs described that

an absence of local funding was a barrier to actualising planned community engagement approaches (.

### *Adaptive capabilities*

Demand and supply interventions were both identified. On the demand-side, five PDs and one comparator implemented targeted outreaches and/or home visits when EHS volumes decreased. Adaptations included calling pregnant patients in their catchment area to remind them to come to ANC appointments, bringing routine preventative services to communities, implementing fee waivers, and temporarily providing free drugs to generate demand. An LGA informant describes a new system to find children who had missed vaccination:

During Covid-19 [...] when a mother is expected to bring a child for vaccination [...] they check those that didn't come. We go to their house, put a call across, 'We didn't see you, what happened?'. Some will say 'I don't want to come because of Covid-19'. They will say 'Don't worry next week, we have our community health workers that will go for outreach'. So, they will catch all those clients [...] [who] did not come because of Covid-19. —LGA official, PD

On the supply side, health workers struggled to reach facilities during movement restrictions, particularly in urban LGAs where staff relied on public transportation. There was also an increased workload for PHC staff who triaged COVID-19 screening, conducted vaccination campaigns, implemented new infection prevention and control (IPC) measures, and increased community outreaches. LGAs primarily used two adaptations to maintain adequate staffing: increasing transportation support to health workers and changing staffing schedules to rebalance the workload. A comparator LGA described how the local government transported staff and consolidated the workforce into 'prioritised' PHC facilities to keep them operational:

Some of our staff [are] coming from a very far location [...] my medical officer had to get some of them through the ambulance, and you can't go to all staff houses, so some of the facilities were prioritized. Ten people is meant to be there, [but] we might have eight people. — LGA official, Comparator

In addition to HR adaptations, all LGAs in our sample described the implementation of new IPC practices at health facilities—the screening and triaging of patients, use of masks, and handwashing practices—following new guidelines provided by federal and state government agencies. Additionally, one PD and five comparators described reducing the number of patients seen at one time during vaccination or ANC clinics to reduce overcrowding of facilities.

### *Self-regulating capabilities*

Related to HR adaptations, seven comparators and four PDs illustrated self-regulation by drawing on reserve human worker capacity. Staff strength was supplemented with ad-hoc or contracted staff, retired health workers,

**Table 5** Summary of resilience barriers experienced by PDs and comparator LGAs

	Comparison of PDs and comparators	PD Examples	Comparator Examples
<b>Aware</b>			
Financing gaps reduced the ability to conduct community engagement and outreach	Large difference, only cited by comparators	<b>0/12 cited this barrier</b>	<b>7/12 cited this barrier</b> 'Challenges, is the usual one, is money.(...) If I'm sending five people out to outreaches, I will reduce it to two, because we could not afford to cater for the five every week' LGA official, Comparator
General lack of funding support for PHC	Small difference, only cited by comparators	<b>0/12 cited this barrier</b>	<b>3/12 cited this barrier</b> Poor funding of health facilities.(...) Nobody reimburses you except your salary. Then anything extra you spend is from your own pocket. Facility Officer in Charge, Comparator
<b>Adaptive</b>			
Long-standing human resource shortages placed additional burden on health workers	Small difference, more frequently cited by comparators	<b>4/12 cited this barrier</b> 'the staffing that you mentioned, not that it's not working, but we added some additional responsibilities to the little staff we had.' LGA official, PD	<b>8/12 cited this barrier</b> 'We are having shortages of manpower, and that's a long challenge. We tried to redistribute staff, so that areas of need we send more staff there and areas that are minimally manned, we maintain it at that level. The health work force has never been [enough], but we try to make do with what we have.' LGA official, Comparator
<b>Self-regulating</b>			
Health worker shortages caused the temporary closure of facilities or reduction in services	Moderate difference, only cited by comparators	<b>0/12 cited this barrier</b>	<b>5/12 cited this barrier</b> 'We formed a team in every health facility which we called [infection prevention and control] IPC team.(...) We were able to mop up people [by] clos[ing] all those other facilities, [to] have enough staffs.' LGA official, Comparator
Note: Tabulations displayed in this table are derived from qualitative findings and should be interpreted as descriptive in nature. Informants from the LGA, PHC facility and community levels within a single LGA are considered a 'case' and represented jointly in the numerical tabulation of LGAs. No diverse or integrated barriers were identified at saturation. LGA, local government area; PDs, positive deviants; PHC, primary health care.			

students and volunteers. An LGA official describes this practice:

Some facilities [...] it's just a one person. If that person falls sick or go[es] for training, the facility stops functioning. [...] we have volunteer community health workers who bridged that gap.—LGA official, Comparator

These arrangements varied in formality; some staff were contracted to the PHC with financial support from LGAs while others worked as volunteers. What united them was their limitations—LGAs or facilities could not hire permanent staff, so they resorted to creative, stop-gaps to keep PHCs operational.

#### Barriers that limited PHC resilience

Resilience barriers limited LGAs' ability to be aware, adaptive and self-regulating, limiting mitigation and recovery of service volumes. Comparators' resilience capacities were particularly limited by two constraining factors—HR shortages and a lack of funds (table 5)—which were described as constraining the LGA's ability to sustain increases in community engagement and outreach. Only comparators reported temporary PHC availability disruptions during the pandemic's acute phase.

#### Barriers that limited awareness capabilities

All LGAs described increasing community engagement as central to their response; however, seven comparators described challenges with funding outreaches. This manifested as a lack of transportation funding for outreach, and a lack of funds to compensate or incentivise community-level actors. Including additional outreach to facilities' schedule required fuel, funds for gathering individuals and paying town criers, and extra staff to send on outreach. These were described as chronic challenges, or existing constraining factors, that became acute during the pandemic, when LGAs needed to rapidly increase the intensity of community engagement.

The absence of pooled funding to support community outreach led informants to 'draw from their own pockets' to fuel vehicles, buy phone minutes, and procure masks and hand washing supplies. In contrast to a teamwork approach, these informants characterised a resigned, 'go it alone' mentality:

The work is ours, if you risk us or risk our lives, the life belongs to us. When the things provided by government are not enough, we make use of our own personal

resources to keep our job going.—Facility Officer in Charge, Comparator LGA

### *Barriers that limited adaptive capabilities*

Eight comparators and four PDs emphasised long-standing HR shortages as a constraining factor in the health system which then became a major limitation in their response. The adaptations described above strengthened PHC facilities' ability to maintain service availability, but they also required PHC workers to cope with higher workloads. As the pandemic wore on, PHC workers shouldered more responsibilities—screening for COVID-19, referrals for testing and COVID-19 vaccination campaigns. PHC facilities took on these new responsibilities, but they had different absorptive capacities due to differential staffing strength. This reduced general service availability in some cases. An LGA official in a comparator described challenges managing vaccinations while keeping PHC services running:

During that pandemic, [PHC] services were rendered only when [patients] come [...] We go out [for] COVID-19 vaccination, and if you have one or two workers, you have to leave the facilities —LGA official, Comparator

### *Barriers that limited self-regulation capabilities*

Similarly, self-regulating service delivery using temporary staff was, by definition, not a long-term solution but rather a temporary adaptation to manage a local systems-level challenge:

If I need personnel [and] 40 or 30 came in as interim, does it solve the problem? We are talking about what is going to keep the system going. COVID-19 has [gone], are they still here? They are not. —LGA official, Comparator

As a result, informants in five comparators describe temporary closures of lower-level PHC facilities to consolidate staff into prioritised PHC centres in the early phase of the pandemic. A health worker in a comparator LGA describes how they adapted to staffing shortfalls in the early days of the pandemic:

The ANC clinic and deliver[y] services, there is no way we can provide it, so we have to refer them to the comprehensive center to go and join the other pregnant mothers there for the continuation of the ANC and the delivery — PHC worker, PHC facility, Comparator LGA

## DISCUSSION

Resilient health systems are described as aware, adaptive, integrated, self-regulating and diverse.<sup>5 20</sup> Our study demonstrates that these factors were not reflected in equal measure by Nigeria's LGAs during the COVID-19 pandemic. PDs demonstrated more integrated capacities (local leadership and coordination mechanisms), awareness capacities (local funding) and demand-side adaptations aimed at increasing service use (home visits and incentives for services). Comparators were more likely to implement supply-side adaptations (social distancing and

task shifting) and self-regulation efforts (hiring of temporary staff), which were in part necessitated by HR challenges. While all LGAs reported community engagement efforts, comparators were more likely to describe specific resilience barriers including a lack of funding for effective community engagement. Comparators were also more likely to report chronic HR shortages, which were related to the need for task-shifting during the pandemic response. These HR shortfalls led to temporary service closures or reductions in five comparator LGAs.

Our findings demonstrate the particular importance of having multiple, mutually reinforcing integrated and awareness capacities to demonstrate PHC systems resilience. On average, PDs were more likely to display many resilience capacities and described fewer pre-existing challenges. In contrast, comparators often described only a few resilience capacities with a larger number of pre-existing challenges that constrained their responses. Our findings emphasise the importance of local leadership and financing, which enabled local adaptation capacities, reinforce the importance of adequately resourced PHC (especially HR), and challenge the notion that adaptation strategies alone are a sufficient pathway to building resilient health systems. Finally, this study demonstrates the untapped potential of analysing routine health systems data to learn from variation in subnational performance and source within-country lessons to strengthen health systems.

### **Foregrounding local leadership: the importance of integrated and awareness resilience capacities**

The biggest differentiators between PDs and comparators were their level of integration and awareness. PDs consistently demonstrated an integrated approach, with effective local leadership aware of the LGA's available human and financial resources and able to draw on those resources via specialised local coordination mechanisms. Community leaders were active participants in the local response through COVID-19 risk communications, identifying those at risk of missed appointments, encouraging health facility patronage and raising funds. This aligns with evidence from the 2014–2015 Ebola epidemic and recent COVID-19 response research—engaging communities as active participants in the PHC system via existing local structures can strengthen the relationship between communities and health facilities.<sup>14 29</sup>

These results also add further credence to the importance of governance in resilience to health shocks.<sup>30</sup> A growing body of scholarship argues for the central role of leadership and coordination in defining national-level COVID-19 responses; our findings emphasise the additionally critical role of subnational leadership and coordination.<sup>6 31–35</sup> Capable leadership is likely especially important; in our qualitative results, local leadership was described as enabling other resilience capacities by supporting the LGA team in carrying out response strategies (eg, by steering coordination bodies, coordinating local funding, and motivating PHC planners and health



professionals to engage in demand-side adaptations to drive service utilisation). We expect that sampled PD and comparator LGAs had a similar decision space to implement local strategies; it is possible that some local leaders were more effective at using this discretion to support resilient local responses. This matches findings from a 2022 scoping review on health systems resilience which emphasised the importance of ‘middle-level’ leadership in building resilience, and recommendations from the WHO’s Building Back Better report which emphasise effective leadership as a part of whole-of-society responses.<sup>9 34</sup> Future research should further explore the role of leadership as enabling or driving other aspects of local health systems resilience and consider how local leadership can be strengthened or supported to support resilience capabilities.<sup>36</sup>

### The promise and pitfalls of adaptive resilience

Local adaptations to increase task shifting and draw on temporary staff were short-term adaptations, inherently limited by front-line actors’ authority to change permanent staffing levels. These adaptations were considered unsustainable, and, in some cases, led to a temporary reduction in PHC availability. Demand-side adaptations were dependent on flexible financing available to LGAs and PHC facilities. PDs were far more likely to describe access to, or the ability to generate, flexible financing than comparators. However, in some cases, generating that funding relied on front-line staff using their own financial resources. A key takeaway from these findings is that resilience appears to have been more influenced by pre-existing factors that facilitated or constrained response (eg, HR strength, funding availability) rather than specific strategies or adaptations during the response.

Past research has identified ‘maladaptive’ practices which improve resilience in the short term but risk masking structural deficiencies in the long term.<sup>11 13 37–39</sup> An extensive body of research has highlighted the substantive toll of the COVID-19 pandemic on front-line health workers and their well-being across countries and the importance of core capacities of the health system in supporting front-line managers, including in Nigeria.<sup>40–46</sup> In our study, adaptation similarly shifted the burden of resilience to LGA managers, front-line PHC workers, and community leaders who were forced to adapt to keep the health system running. PHC resilience required more than, ‘a need for a strong and committed health workforce, characterised by health personnel who show up for work that might be difficult and dangerous’.<sup>5</sup> Those committed health workers needed to be posted in sufficient numbers, and needed to be supported with adequate funding and LGA leadership.

This evidence surfaces a key tension for health systems resilience—how to learn from and foster bottom-up adaptation without ignoring the structural issues that forced adaptation in the first place? In decentralised governance arrangements where local governments

have considerable decision space or discretion, such as Nigeria,<sup>47–49</sup> providing a timely increase in flexible resources to the front line is critical during emergencies.

### Where communities meet systems: areas for future research

Examining COVID-19 responses from the perspectives of PHC actors surfaced the dynamic and relational nature of resilience capabilities. Local leadership and coordination created positive feedback loops for integration and awareness capabilities, while pre-existing health systems weaknesses exerted path dependency that limited resilience.

Our findings, although exploratory and associational, demonstrate a clear pattern between the resilience capabilities exercised by PHC actors and the outcomes they achieved via a recovery in PHC service volumes. Future research can test the mechanisms linking resilience capabilities and quantitative resilience outcomes. PDs’ focus on demand-side adaptations and community outreach messages that encouraged general PHC attendance are two plausible mechanisms that could have increased PHC service volumes. Conversely, social distancing at PHCs and short-term PHC facility closures may have sent implicit signals to communities that health facilities were harbingers of transmission.

It is equally plausible that communities within PDs demonstrated stronger societal resilience capabilities. This alternative pathway underscores an often-overlooked reality in resilience scholarship—communities are core to the health system and individuals within them exercise agency within broader power dynamics and governance structures.<sup>37</sup> Relatedly, differences in PDs and comparators could have been driven by underlying differences in social capital, which Grimm *et al* called, ‘the interconnected mechanism to unlock health systems resilience’.<sup>50</sup> Similarly, emerging from the COVID-19 pandemic, a 2023 qualitative study with health systems experts emphasised the importance of including community engagement and contextual factors as core to future health systems resilience frameworks, which aligns with other recommendations as well as our findings.<sup>7 34 51</sup> We identified this in our results through the importance of local leadership and financing and how this enabled adaptive capabilities. Social capital is a possible multiplier of these capabilities and is likely to underpin or enable each of the individual components of the original Kruk framework.<sup>50</sup> Future research should explicitly examine adaptive relationships between ‘societal’ resilience, ‘health systems’ resilience and social capital.<sup>37 52</sup> Future decomposition analysis could also explore the relative contribution of the different resilience components in driving differential outcomes.

### Strengths and limitations

Using routine data to identify PDs was a key strength. This approach can contribute to subnational performance monitoring and evaluation efforts, particularly in decentralised health systems where local leaders have

discretion in implementation.<sup>49</sup> Using routine data to learn from local capabilities within decentralised contexts can facilitate within-country, context-specific learning to strengthen health systems.<sup>53–56</sup>

Our matched comparative case study design was another strength.<sup>57</sup> This deepened our analysis of resilience capabilities and barriers beyond what LGAs had in common to focus on how and with what resources their responses were carried out. A limitation is that our qualitative findings relied on key informant perspectives, and we did not evaluate how well the resilience capabilities were implemented. Another limitation is that our quantitative definition of resilience was based on the ability to recover outpatient and ANC services. We selected these indicators specifically to focus on facility-based services, but if different definitions or indicators were used, we may have identified different PDs or comparators. It is also possible that dropped facilities had lower resilience than included facilities, and we were unable to systematically assess this due to the limited availability of LGA-specific data. Our purposeful sampling was done with consideration to COVID-19 case burden at the state-level; however, no data were available to consider differential LGA-level COVID-19 burden. Since comparators were neighbouring LGAs, we do not expect substantial differences in awareness of the pandemic, fear, and trust in the health system between PD-comparator LGA pairs. Further, although the qualitative component of our study explored all the dimensions of the study's conceptual framework, our quantitative definition of resilience was limited to adaptive resilience defined by a return to prepandemic (or higher) service volume output after experiencing a disruption. These limitations highlight the exploratory nature of our findings, which can serve as a basis for future research.

Our study sample of key informants included community perspectives via snowball sampling of local opinion leaders (eg, heads of ward development committees, community associations), but we did not sample service users directly. This is a limitation and highlights the importance of capturing direct patient and community voices in future health systems resilience research.

## CONCLUSION

This study identified resilient, subnational PHC systems in Nigeria using routine HMIS data, matched them to comparators and then qualitatively investigated their resilience capabilities during the COVID-19 pandemic. PDs were more integrated, aware and used more demand-side adaptations than comparators. Health workforce strength and the availability of flexible local financing supported or limited resilience.

There is no adaptation that can substitute for PHC financing and an adequate number of skilled personnel. Building stronger, more resilient health systems requires simultaneous attention to adequately resourcing PHC from the top-down while supporting bottom-up

innovations responsive to community needs. In Nigeria, these two components worked together to drive subnational variation in PHC resilience and recovery.

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