COVID-19 AND ITS IMPACTS

ON PRIMARY HEALTH SERVICES AND PUBLIC HEALTH INFECTIOUS DISEASE PROGRAMS IN PAPUA NEW GUINEA

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Cover photo: Lorena – Fear of COVID-19 testing. Report photos: Nalisa Neuendorf.

Dedication

This report is dedicated to the people of Papua New Guinea who have experienced much loss during the COVID-19 pandemic. And to the people who continued to engage with health, and health workforce of Papua New Guinea who continued to provide health services and care amid the challenging COVID-19 environment and despite the risk this posed to them.

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Acronyms and abbreviations

2IC	Second in charge
A&E	Accident and Emergency
ADB	Asian Development Bank
AIDS	Acquired Immunodeficiency Syndrome
AMS	Area Medical Supplies
ART	Antiretroviral Therapy
CHW	Community Health Worker
COVID-19	Coronavirus Disease of 2019
CPHL	Central Public Health Laboratory
DFAT	Australian Department of Foreign Affairs and Trade
ED	Emergency Department
EHP	Eastern Highlands Province
EMC	Essential Medicine line
ENB	East New Britain Province
eNHIS	Electronic National Health Information System
FP	Family Planning
HCW	Health Care Worker
HEO	Health Extension Officer
HFR	Health Facility Review
HHISP	Health System Strengthening Program
HIV	Human Immunodeficiency Virus
HPV	Human Papillomavirus
IPC	Infection Prevention Control

IRB	Institutional Review Board
KRA	Key Result Area
LLIN	Long-lasting Insecticidal Nets
LTFU	Loss to Follow Up
MAD	Madang Province
MCH	Mother and Child Health
MDR-TB	Multidrug-resistant Tuberculosis
MOR	Morobe Province
MP	Member of Parliament
MRAC	Medical Research Advisory Committee
NCC	National Control Centre
NCD	National Capital District
NHIS	National Health Information System
NN	Not needed
NR	No response
OIC	Officer in Charge
ORS	Oral Rehydration Solution
PCR	Polymerase Chain Reaction
PHA	Provincial Health Authority
PLHIV	People Living With HIV
PMV	Public Motor Vehicles
PNG	Papua New Guinea
PNGIMR	Papua New Guinea Institute of Medical Research
PPE	Personal Protective Equipment

PPTCT	Prevention of Parent to Child Transmission
RDT	Rapid Diagnostic Test
SARS-COV2	Severe Acute Respiratory Syndrome Coronavirus 2
SIC	Sister in Charge
SOE	State of Emergency
SRHU	Sexual and Reproductive Health Unit
SSI	Semi-Structured Interview
STI	Sexually Transmitted Infection
TB	Tuberculosis
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
UNSW	University of New South Wales
USAID	The United States Agency for International Development
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WHP	Western Highlands Province
WP	Western Province

Executive summary

This report presents the findings of a study that aimed to investigate the impacts of COVID-19 on primary health services and public health infectious disease programs in Papua New Guinea (PNG) in study sites in Eastern Highlands, East New Britain, Madang, Morobe, Western Highlands and Western Provinces, and the National Capital District. We focused on maternal and child health as examples of primary health services, and HIV and TB programs as examples of public health infectious disease programs and examined malaria services provided through outpatient services. The objectives were to:

1. Evaluate the impacts of COVID-19 on the health service provision of primary health services and public health infectious disease programs in PNG.
2. Assess the impacts of COVID-19 on patient and community access and utilization of primary health services and public health infectious disease programs in PNG.
3. Document the locally led health system response to mitigate the impacts of COVID-19 on the provision of primary health services and public health infectious disease programs in PNG.
4. Examine patient and community-initiated strategies used to mitigate barriers to primary health services and public health infectious disease programs in PNG, and
5. Evaluate the ongoing requirements for sustained access to primary health services and public health infectious disease programs in PNG.

This study was designed and approved as an extensive study to explore the impacts of COVID-19 on primary health and public health infectious disease program in PNG by the human research ethics committees in Australia and PNG in April 2021 with fieldwork commencing in July 2021. At this point there had been no qualitative research exploring the research aims conducted in PNG and still today is the most comprehensive qualitative study to be conducted in PNG on COVID-19.

We primarily used qualitative methods which were supplemented by a health facility review using quantitative methods. A total of 131 participants from five population groups were interviewed across the seven provinces. Participants included community members, health care workers, provincial health personnel and clients who were engaged in or not engaged in the provision and use of maternal and child health services and TB, HIV, and malaria services. A quantitative Health Facility Review (HFR) was also undertaken to explore inpatient and outpatient services provided, health facility workforce (type, number), health information and financing, availability and access to essential drugs and other consumables. These HFRs were undertaken in at least two health facilities in each of the seven selected provinces - reflecting provincial and district level services in each of the provinces. Purposive sampling was used to sample clinics and facilities from small to large clinics, provincial and district hospitals in rural, peri-urban and urban settings, and across the key public health and infectious diseases service delivery, including TB, HIV, malaria and maternal and child health. In total, 33 health facility reviews were completed, however, due to validity and reliability factors evident in the HFR data, we have presented in descriptive form only in the report annex and caution on its use in guiding understandings and policy and practice development.

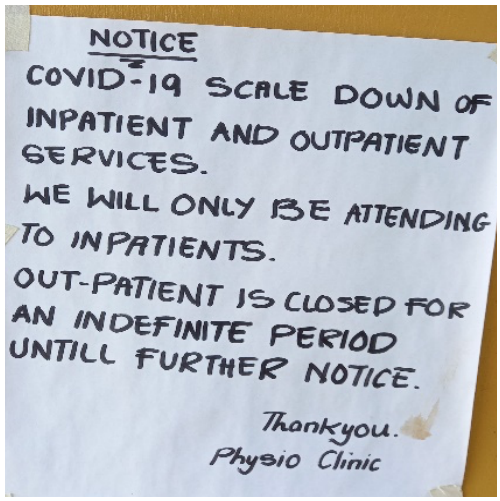
A health systems conceptual framework was used to analyse study data and present the study findings. We adapted the World Health Organisation's Health Systems Building Blocks framework, comprised of six core building blocks - health service delivery, health workforce, essential medicines, health information, health financing and leadership and governance - [1] and people and community at the centre. While the importance of people and community has been long recognised as mediators and beneficiaries as well as drivers of the health system [2], they have not to date been presented as a building block themselves, as we do here. While there are many factors crossing over and between building blocks, we present these findings through the individual building blocks as a way to articulate their complexity. We acknowledge that the boundaries between the building blocks may not be clear cut, as they rarely fall within only one building block.

Data were collected between July and November 2021 – at the time of the third, and largest, wave of COVID-19 in PNG. Therefore, our findings report on the

impact of COVID-19 at a specific time and in specific places and may not be generalisable to other provinces in PNG or to the same provinces at different time points during the pandemic. These findings showed many similar impacts and experiences within diverse geographies, varied health services and facilities, and across primary health and infectious disease programs.

Findings

Health workforce



Key themes impacting the health workforce related to the availability, composition and mix of the healthcare workforce. The COVID-19 pandemic occurred in the context of an already depleted and aged health workforce in PNG where concentration of the health workforce occurred in urban centres. Disruption of services was due to staff shortages from the ageing workforce being furloughed, redeployed to COVID-19 services, healthcare worker isolation from COVID-19 infection and fear of COVID-19. A lack of public transport, due to lockdowns, movement restrictions and changes in the numbers of people they were allowed to carry to maintain social distancing, impacted health care workers' ability to travel to and from work.

Limited education and training of the health workforce, where health care workers were unable to diversify skills, adapt or task shift, compounded the issue, with specialised and highly trained health workers seconded to the COVID-19 response. In learning to live and work within the pandemic, adaptations were made (e.g., rosters re-scheduled, shifting of roles and responsibilities) to enable the continuation of health services and care. In considering future planning, human resourcing is central to ensuring preparedness for the future and this includes not only having an adequate number of health care workers but ensuring they have been adequately trained and equipped.

Health Service Delivery

Lockdowns and the scaling back and movement of services impacted health service delivery and resulted in varied service availability and capacity and, at times, community confusion about where to access health services. Health service delivery quality, outcomes and patient experience was also impacted by the inclusion of COVID-19 specific services and COVID-19 Infection Prevention and Control (IPC) measures that began at the gate to the facility and transgressed the entire health care interaction. These changes impacted client engagement and the quality and continuity of care and treatment available at different times throughout the pandemic. Healthcare worker availability varied due to fear of COVID-19 risk and the limited ability to travel to and from health services, particularly during lockdown periods.

A focus on COVID-19 over primary and public health service delivery impacted service delivery, including the redistribution of healthcare workers. Infrastructure capacity was reported as limited with the addition of COVID-19 specific services of triage, testing and isolation alongside normal operations. Prevention measures such as spacing or distancing measures and mask wearing also constrained community willingness to access health services. Socio-ecological factors, such as the capacity to pay service fees or for medicines, changes in public transportation costs or additional transportation costs, impacted client engagement of services while public transportation was limited at various times, particularly during national and provincial lockdown periods. Healthcare workers mitigated some impacts, particularly issues related to lockdown, by changing the quantity of medicines dispensed. There were discussions regarding expanding a door-to-door service for People Living with HIV (PLHIV) to other key populations to ensure continuity of treatment and care.

Essential medicines

Key themes impacting the provision of essential medicines directedly impacted care and treatment related to both shortage of supplies and issues of procurement. While the shortage of essential drugs was exacerbated because of the COVID-19 pandemic, there was overall agreement that the issue of supplies is a longer standing and systemic issue throughout PNG. Shortage of medicine was linked to not receiving supplies from area medical supplies due to stockouts and also due to workforce shortages that impacted ordering. The lack of essential healthcare workers unable to provide the necessary treatment with strategies to address this, including providing prescriptions to patients for them to purchase at the town pharmacy, and charging user fees, enabling the generation of income. Where they were shortages or stockouts of essential medicines, facilities reported using their service networks or writing prescriptions, which then had to be purchased from private pharmacies. Healthcare workers reported feeling distressed and guilty at being unable to provide appropriate care and treatment.

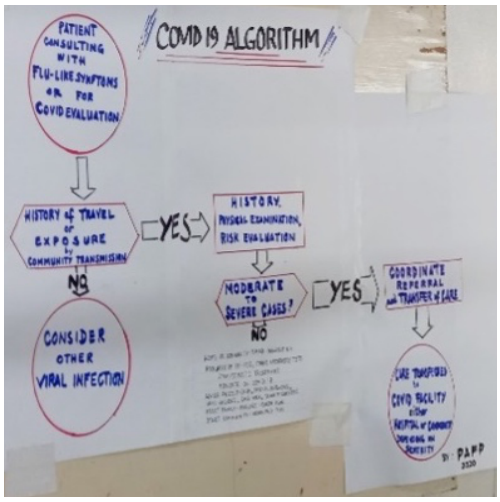
Health financing

Despite external resource mobilisation, health financing was impacted by COVID-19 across the country. Adaptations to funding sources were experienced, re-direction of funding for other health related issues remained a challenge and resource allocation to respond to COVID-19 was initiated across the country. There was a desire for health finance planning to strengthen sustainability and support consistent funding flows through health

activities. Funding allocations were re-directed from infectious disease programs and primary health care, with funding cuts noted against some infectious disease programs, impacting routine operations.

Whilst COVID-19 challenged the health financing across the country, there were also positive opportunities described to support funding mechanisms. There were opportunities for provincial health providers to leverage funding allocated for COVID-19 to share resources across programs.

Information management



Health information systems were impacted by COVID-19 due to ongoing adaptations of the surveillance and reporting requirements for COVID-19. There was a particular emphasis on the e-adaptations made to the COVID-19 surveillance program, focussing on the flow of data from the health facility or hospital through to the national government agencies. Additional human resources were established, such as the National Control Centre Taskforce and provincial incident management teams, to allow for contract tracing and increased surveillance and reporting requirements. There were additional investments in the diagnostic and laboratory capacity within the country, allowing data to be reported and systems to be strengthened that had transferrable benefit to other infectious disease programs, such as TB and malaria. Several different data management systems were referred to by study participants for COVID-19 surveillance; however, barriers to the system included limited infrastructure, consumables to support IT systems and supply chains that allowed for smooth transport of samples to laboratories. The importance of data for decision making was echoed by most healthcare workers and key stakeholders, particularly in leadership roles within the provincial or national health team; however, technical capacity to use and interpret data for decision-making purposes was difficult with resource constraints.

Introduction

This report presents the findings of a study investigating the impacts of COVID-19 on primary health services and public health infectious disease programs in Papua New Guinea (PNG). This study was undertaken primarily through qualitative methods and supplemented by quantitative methods where appropriate. We focused on maternal and child health as examples of primary health services, and HIV and TB programs as examples of public health infectious programs. To the extent it was possible, the study examined malaria services provided through outpatient services. The objectives of this study were to

1. Evaluate the impacts of COVID-19 on the health service provision of primary health services and public health infectious disease programs in PNG.
2. Assess the impacts of COVID-19 on patient and community access and utilization of primary health services and public health infectious disease programs in PNG.
3. Document the locally-led health system response to mitigate the impacts of COVID-19 on the provision of primary health services and public health infectious disease programs in PNG.
4. Examine patient and community-initiated strategies used to mitigate barriers to primary health services and public health infectious disease programs in PNG, and
5. Evaluate the ongoing requirement for sustained access to on primary health services and public health infectious disease programs in PNG.

1.1 Primary health and public health programs in Papua New Guinea

Located in the Western Pacific, the island nation of Papua New Guinea (PNG) is the largest country within the Pacific excluding the high income nations of Australia and New Zealand [3]. Over 87% of the 9.5 million people in PNG live

in rural and remote settings [4] across a variety of terrestrial and environmental terrains with over 800 distinct language groups - the country is geographically, linguistically, socially and culturally diverse [5]. Primary health services and public health infectious disease program delivery across PNG have been described as fragile and vulnerable with historical workforce, resource, and infrastructure constraints [6-9]. These health system factors are also impacted by a country that is "geographically challenging" [7], where remoteness can make the delivery of health services, and conversely the ability of community to access health, difficult, and at times impossible [4].

In PNG, the government is the main funder of health, but external assistance makes up a significant share of the total health expenditure (21%), with little investment in health care coming from the private health sector [10]. In PNG, public health expenditure per capita has declined in real terms since 2004 – in part because of population growth and because of declining external financing for health in real terms [8]. Prior to COVID-19, increasing decentralisation and operationalisation of funding to rural and remote health-care facilities and systemic bottlenecks in the distribution of operational funding also impacted health financing [10, 11]. Free primary health care and subsidized specialist services are mandated in PNG, however, this free universal health coverage in PNG is impacted by local health facilities introducing 'informal' fees to address challenges in operational funding [10].

Responsibility for the management and organization of health services in PNG is shared between central and local government responsibilities. The National Department of Health (NDoH) has a statutory responsibility to oversee the establishment, maintenance, and development of the health system in PNG, while the responsibility of the provincial governments is to coordinate the operation of health facilities and provision of health services and programs in the provinces [12]. The health system in PNG has moved to a decentralised model of governance that has resulted in three main administrative levels of the health system; National, Provincial, and District. These administrative levels are further sub-divided at the local level with local-level governments, wards, communities and villages [12]. A slow transition to Government and Provincial Health Authorities (PHAs), particularly the decentralization of health care funding, has limited greater provincial fiscal responsibility for health care and service

provision and has associated challenges to consistent governance, administration, reporting and accountability [7].

Formal primary health services and public health infectious diseases programs in PNG are delivered through government and church-based health services and facilities – with government subsides provided for church-based services and more recently the emergence of public-private partnerships with PHAs [13]. These government and church-based health services are delivered through 1800 community-level facilities, approximately 800 subhealth/health centres and 22 provincial hospitals of which one is a national referral hospital, located in the nation's capital of Port Moresby [7, 8]. In each province, service delivery typically includes one public hospital and a provincial hospital, which is the regional referral hospital, as well as health centres, which provide a range of curative and preventive services. The type of health facilities differs in urban and rural settings. In urban settings, health facilities typically include the provincial hospital, urban clinics, which provide services to the population outside the immediate catchment area of a hospital, and/or a health centre. In rural areas, health facilities typically include district or rural hospitals, which are typically managed by non-government organisations, and/or through health centres.

Health services in PNG are delivered by a workforce that comprises community health workers (49% of the medical and nursing workforce), nurses and midwives (42%) and doctors and Health Extension Officers (HEOs) (9%). The majority (83%) of doctors are located in hospitals, and most (81%) HEOs are situated in rural health centres [14]. This health workforce is characterised by significant and critical gaps in number and distribution, particularly at the primary level of care [15]. This critical shortage of health care workers [16], including nurses, midwives and general and specialist doctors [17], is also compounded by the ageing population of those health care workers currently in the health system [15, 18]. An under-investment in workforce training in the public health system in PNG directly limits the capacity to produce the required skills and mix of the health workforce, capacity which is further limited by health workforce drain to private sectors and overseas roles [7]. Together, these issues critically impact the skills, composition, social and cultural diversity and sustainability of the health workforce in PNG, particularly in rural and remote settings [19].

The extent of public health programs varies across provinces, with infectious disease programs more concentrated around provinces with high burden of cases and incidence, except for HIV which has more geographic concentration than other diseases, while maternal and child health services are more nationally distributed. Provincial Health Authorities and international partner organisations like WHO, the Australian Government, UN Agencies, the World Bank, Asian Development Bank and USAID among various others, support the delivery of health services.

1.1.1 Tuberculosis

Prior to COVID-19, which is now the leading cause of death from an infectious disease, tuberculosis (TB) was the leading infectious diseases cause of death globally. Papua New Guinea is classified by WHO as a high-burden country for both drug-susceptible TB (DS-TB) and multidrug-resistant TB (MDR-TB, TB) that is resistant to the two main first-line drugs, isoniazid and rifampicin) and TB remains a major cause of morbidity and mortality [20, 21]. TB incidence in PNG is estimated at 441/100 000 population [20]. High rates of MDR-TB are present in a number of known 'hot-spot' areas in PNG, most notably in the South Fly District of Western Province and the National Capital District. In 2020 there were 28 227 new TB notifications in PNG, down 8% from the previous year; a quarter of the 2020 notifications were among children aged 0-14 years [20]. Despite the scale-up of newer diagnostic tools, the case detection gap, the number of individuals with TB who are not diagnosed and therefore put on treatment, remains significant [22]. The treatment success rate for people with TB has improved over the past 10 years to 71% in 2019 but remains suboptimal. There are areas with high rates of people lost to care and a high case-fatality ratio (12%), indicating major challenges with the access to and provision of timely and quality care to people with TB [20]. This is compounded by an entrenched weakness in the health system, centralised services and a failure to critically address the spaces and environments which maintain people at risk [23].

1.1.2 HIV

First identified in 1981, the Human Immunodeficiency Virus (HIV) quickly became a global epidemic of significant concern, disproportionately affecting particular

communities and regions. Papua New Guinea has the single largest HIV epidemic in the Western Pacific, accounting for an estimated 95% of all people living with HIV in the region alone [24]. Within PNG the main form of transmission of HIV is heterosexual transmission, including in the context of transactional sex. The HIV prevalence in PNG is estimated at ~1% with greatest burden in several provinces [25, 26]. In addition to geographical heterogeneity, particular key populations carry a greater burden of HIV than do others. In PNG this includes women and girls who sell and exchange sex [26] as well as men who have sex with men and transgender women [25]. Among women and girls who sell and exchange sex group the burden of HIV is 11.9% in Lae, 14.9% in Port Moresby and 19.6% in Mount Hagen [26]. Between 2010 and 2020 HIV prevalence among young people in PNG increased by 51% [27].

Treatment for HIV was first piloted in PNG less than a decade ago and has played an important role in turning the epidemic around, but HIV drug resistance has been an adverse outcome of poor adherence to treatment [28]. While HIV treatment can significantly reduce vertical transmission, and many countries are now on the pathway to eliminating mother-to-child transmission, poor coverage of HIV testing of pregnant women, adherence to treatment among pregnant and breastfeeding women, HIV sero-discordance and lost to follow up all contribute to Papua New Guinea's persistent HIV pandemic among HIV exposed infants (see for example, Kelly-Hanku and colleagues [29]).

1.1.3 Malaria

Globally there were an estimated 241 million cases in 85 malaria endemic countries in 2020, resulting in approximately 627 000 malaria deaths [30]. This represents about 14 million more cases in 2020 compared to 2019 and 69 000 more deaths. Approximately two thirds of these additional cases were linked to disruption in the provision of malaria control; prevention, diagnosis and treatment during the COVID-19 pandemic [30]. Between 2010 and 2019, there was a global decline in malaria incidence from 72 to 57 cases per 1000 population at risk due to an increase in investment and scaling up malaria control interventions [31]. However, globally, 2.9 billion people are still at risk of *Plasmodium vivax* malaria, with 90% of this population living in the Asia Pacific region [32].

Malaria service delivery is managed by the Malaria Program within the National Department of Health (NDoH) and almost all funding for the malaria program in PNG comes from the Global Fund [30]. Management of the malaria program is directed by the National Malaria Strategic Plan (2021-2025), which aims for "a malaria-free Papua New Guinea by 2030" with short-term goals to reduce morbidity by 63% and mortality by 90% compared to 2019, and to eliminate malaria transmission in specific provinces, such as Bougainville [33]. In Papua New Guinea, the scale up of malaria interventions, primarily the national distribution of Long-Lasting Insecticidal Nets (LLINs), scale up of compulsory testing of suspected malaria cases with Rapid Diagnostic tests (RDTs) and the switch to Artemether Combination Therapy (ACT), has resulted in a significant overall reduction in nationwide malaria prevalence from 11% in 2009 to less than 1% in 2014. Since 2016, Papua New Guinea has seen a resurgence in malaria with an estimated increase in national malaria prevalence to 7.1% [31]. In PNG, social patterns and human behaviour response to specific interventions, together with the political and economic realities, have been influences in the observed epidemiology of malaria [34].

1.1.4 Maternal and child health

In the midst of the emerging COVID-19 pandemic, a renewed promise to boost support given to the maternal and child health program in PNG was made by the WHO [35]. As recognized by Grundy et. al. [7] before the COVID-19 pandemic, the PNG health system faced challenges in improving maternal and newborn child health needs for a country with a rural majority. Maternal and newborn health needs are 'mutually dependent', reliant on access to quality care during pregnancy, labour and birth, as well as in the postnatal period, and includes the availability and accessibility of modern contraceptives [36]. Maternal and newborn mortality indicators in PNG are one of the highest in the world, and the highest in the Pacific region. These poor maternal and newborn mortality indicators are reflected in an estimated 145-900 maternal deaths per 100 000 live births that occur each year [37-40]. The neonatal mortality rate is 22 per 1000 live births [37] and a stillbirth rate of 16.1 per 1000 total births [38]. Most women in PNG (78%) attend antenatal services for care at least once in their pregnancy, but this number declines in attendance for four antenatal visits (49%), and further declines for the number of women who have a health facility birth, attended by skilled health care workers (36-52%) [38, 41].

The National Health Plan 2011-2020 was tailored with a focus on family planning, safe motherhood, access to emergency obstetric care, and sexual and reproductive health for adolescents [19]. However, the rate of under-5 mortality is 57 per 1000 live births, with rural children being reported twice as likely to die before that age of 5, and it is estimated that 1 in 13 children in PNG die each year from mostly preventable diseases while the rate of childhood immunization is stagnant at 60% and has been for at least a decade [42]. Additionally, mother to child transmission of HIV remains high, indicative that effective prevention of mother to child transmission (PMTCT) is not yet realized [43]. A Polio outbreak in 2018, some 20 years after reports of its elimination, saw a public health emergency response that involved a nation-wide vaccination campaign and included the training up of health care workers for vaccination, programs to support the improvement of vaccine storage and transportation systems and efforts to strengthen social mobilization and health communication [42, 44, 45]. Health systems support for mothers remains limited while access to quality antenatal and postnatal care is contingent on the availability of skilled health workers and mothers' attendance at routine mother and child clinics across the country [19].

1.2 COVID-19 in Papua New Guinea

1.2.1 COVID-19 infection and death in Papua New Guinea

As of September 6, 2022, the country has recorded 44 887 people infected with COVID-19 and 664 COVID-19 related deaths, with the peak of COVID-19 infection and death occurring in the third wave in July to August 2021 [see Figure 1 below]. Actual case numbers could be much higher given low testing capacity, capability, community underreporting and limited contact tracing ability [46]. Mass gatherings due to state funerals contributed to the second COVID-19 wave, where 16 616 COVID-19 infections, 502 hospitalizations and 188 COVID-19 related deaths were recorded (February to May 2021). COVID-19 transmission rates were highest in the third COVID-19 wave (August to November 2021), a wave which recorded a 45% increase in COVID-19 cases in comparison to the second COVID-19 wave and 753 hospitalizations and 352 COVID-19 related deaths [47].

Figure 1. COVID-19 infection and death in Papua New Guinea

Source: John Hopkins University COVID-19 Resource Centre [48]

1.2.2 COVID-19 prevention and mitigation response

Papua New Guinea responded with various prevention and mitigation strategies throughout the pandemic. After the first recorded case in March 2020 and the first wave of COVID-19 in PNG, the Prime Minister, the Hon. James Marape, declared a State of Emergency (SOE) on March 23, 2020, which was initially for two weeks but later extended until June 2, 2020. The first two weeks of the SOE were managed through a nation-wide lockdown, including a focus on province-to-province movement and restricting non-essential services. During these first few weeks of the pandemic a national public health emergency response was initiated by convening a parliamentary session on April 2, 2020. From this session the National Pandemic Act was developed and ratified on June 16, 2020 and the National Police Chief was appointed the Pandemic controller at this time [49, 50]. An economic stimulus package of up to K5.7 million was designated to the pandemic response, with half of these funds being part of a "direct support package" for health and security measures and K60 million allocated for preventative health [6, 51].

In July 2020 the Government mandated a further two-week nation-wide lockdown with restrictions on international travel and travel across provinces.

Mass gatherings were banned, movement was restricted, night curfews were imposed, and non-essential services, such as markets, churches, schools, businesses and workplaces, were closed [52, 53]. In August 2020, the 'Niupela Pasin' prevention and mitigation strategy was introduced, which included face mask mandates, social distancing and emphasis placed on hand hygiene (sanitation and washing); however, the implementation and community uptake of Niupela Pasin has varied across provinces depending on the nature and experience of COVID-19 in each province. Over time, nation-wide lockdowns were superseded by case-by-case lockdowns, especially following the identification of COVID-19 cases in specific provinces, like Western province, NCD, ENB, and EHP in 2020, and other movement restrictions and domestic flight bans were initiated during COVID-19 surges in 2021.

1.2.3 COVID-19 triage, testing, and isolation

The need to manage, and triage, COVID-19 in health care settings was critical across the globe to reduce nosocomial transmission [41, 54]. In PNG, triaging for COVID-19 was trailed in emergency departments (ED) in Port Moresby and Mount Hagen in early 2020 as part of the WHO recommended standardised triage tool and severity index [55]. Known locally in PNG as the 'cough triage', health care workers assessed clients through symptomatic/clinical diagnosis at facility entrance and where subsequently triaged to different section of the ED dependent on their severity index. This tool was subsequently validated in urban and regional settings [56] and a broader rollout strategy was expected to be instituted across all health facilities by the end of 2020. SARS-CoV02 testing was not incorporated into the cough triage because of capacity constraints to SARS-CoV02 testing throughout the country [57] and to date it is unclear how, or where, this cough triaging was implemented across the health system in PNG.

Capacity for COVID-19 testing continues to be a challenge in PNG due to limited laboratory testing capacity in the country. At the start of the pandemic, PNG Central Public Health Laboratory (CPHL) engaged overseas-based laboratories in Australia and Singapore to conduct SARS-CoV02 PCR testing. In the first year of the pandemic, PNGIMR also assisted with PCR testing in its laboratories in Goroka and Port Moresby [58, 59]. By 2021 PNG National Control Centre (NCC) reported a total of 146 958 SARS-CoV02 PCR tests conducted across the

country, but engagement of overseas laboratories still remains the main approach for PCR COVID-19 testing in PNG [58]. In May 2021, during the height of the COVID-19 pandemic, WHO and the World Bank provided PNG with testing equipment and consumables – specifically GeneXpert machines in provincial laboratories for point of care testing [58], which created capacity to undertake 53 552 SARS-Co-V02 GeneXpert (rapid PCR) tests across the country in 2021. Rapid diagnostic tests (Ag RDT or RDT for short) were also introduced in May 2021 as a critical response to identification, control and prevention of COVID-19 by providing timely detection and isolation of cases [60]. By the end of 2021, 62 262 RDT had been utilised to test SARS-Co-V02 in PNG. Limitations on workforce, cold storage and supply chains remain critical challenges to SARS-Co-V02 capacity in PNG [61]. These testing capacity barriers also impact the ability to case manage, quarantine and isolate positive COVID-19 cases and their contacts [61], a barrier to managing COVID-19 in PNG which is compounded by an absence of quarantine and isolation facilities in most provinces [62].

1.2.4 COVID-19 vaccination uptake and coverage

As COVID-19 vaccinations became globally available, PNG was quick to approve and implement a national strategy for vaccination rollout across the country [63]. The COVID-19 nation-wide rollout began in May 2021, but its coverage has been suboptimal for any public health benefit. As of 28 August, 2022, 347 753 COVID-19 vaccination first doses (6.8% of the PNG population), 288 304 COVID-19 vaccination second doses (5.6% of the population) and 25 817 COVID-19 vaccination boosters (0.28% of the population) have been administered across PNG [64]. COVID-19 vaccination and booster uptake in PNG is extremely low when compared to global uptake - where 70% of people have received one does of a COVID-19 vaccine and 64% are fully vaccinated [65] and coverage for COVID-19 vaccination and boosters differs greatly by province in PNG (see Table 1 below).

Table 1. Vaccination coverage by one and two doses by Province

Province	At least one dose received (n)	At least one dose received (%)	Fully vaccinated (n)	Fully vaccinated (%)	Booster dose received (n)	Booster doses received (%)
NCD	124,228	44.6	113,755	40.9	11641	4.18
Morobe	40,867	7.8	35,321	6.8	4134	0.79
Western Province	21,285	13.5	14,419	9.1	1223	0.77
East New Britain	15,439	7.6	10,077	4.9	483	0.24
Madang	14,021	3.7	12,947	3.4	1499	0.39
Eastern Highland	11,596	2.8	8,410	2	373	0.09
Western Highlands	9,546	3.6	8,137	3	662	0.16

Source: COVAX COVID-19 vaccinated update 28 August 2022 [64]

Methodology

2.1 Amended WHO building blocks conceptual framework

This mixed method study utilizes an expanded WHO Building Blocks conceptual framework. This includes six key building blocks – including health service delivery, healthcare workforces, essential medicines and medical products, health information systems, finance, and leadership and governance [1]. While these building blocks will be explored separately within the report to arrange and present qualitative study data, the authors explicitly understand, and appreciate, that doing so can oversimply what are in fact complex and intersecting domains. In 'real' health systems there are no clear-cut boundaries for any, or all, of the individual building blocks; each building block intersects with each other and vice versa. To attend to this conceptual limitation of the health systems framework, and to guide readers, where relevant we acknowledge and link study findings between the different building blocks in this report.

The conceptual framework used also adapted the original health system building blocks, which identifies six blocks, to include a seventh block – "people and community". The WHO Health System Framework was initially developed as a tool to guide health system resource investment, not originally as an evaluative or research instrument [66]. As a result, most health system strengthening conceptual frameworks are focused on supply-side issues and factors of health services and remains mostly silent on demand-side factors and influences [67]. The demand-side factors absent in this framework are people and communities – they are health care workers, they are clients, they are community members, they are key policy makers. The involvement of people and community in health services and programs improves effectiveness of health interventions [68-70] and are therefore a critical building block. To overcome this documented limitation, we have adapted the original WHO Heath System Framework using the building blocks conceptual framework to place people and community at the centre of the health system and building blocks as presented by De Savigny and Adam [2] – a location which places people at the centre of health system thinking (see Figure 2).

Figure 2. Amended building blocks for health system strengthening

Source: De Savigny and Adam (2009) [2]

Components of the Building Blocks

2.1.1 Health service delivery

Health service delivery is a critical element of all health systems and fundamental to community and population health, as this focus directs attention to ensuring health services are available and meet a minimum quality standard. The WHO Building Blocks identify that securing access to health services are key functions of a health system that are characterised by six key factors of effective and well-functioning health service delivery, comprising service comprehensiveness, accessibility, coverage, continuity of care, responsive and person-centred care, effective coordination, and management and accountability [1].

2.1.2 Human resources

The health workforce comprises all human resources working in a health facility or sector, including clinical staff such as doctors, specialists, midwives, nurses

and community health workers, as well as other human resources whose roles are to support the effective functioning of a health service, such as administration and management, accountants, drivers, cleaners and porters. The health workforce must have the appropriate "knowledge skills, motivation, and deployment of the workforce responsible for managing and delivery health service" [1]. To ensure these health workforce capabilities, priority attention must be directed towards ensuring the "recruitment of appropriately qualified health professionals with the skill sets required for the context, and the retention, professional development, and clinical support of staff" [1].

2.1.3 Essential medicines

A well-functioning health system is required to ensure "equitable access to essential medical products, vaccines and technologies of assured quality, safety, efficacy and cost effectiveness, and their scientifically sound and cost-effective use" [71]. Essential medicines need to be available at all times, in adequate amounts, in the appropriate dosage, with assured quality, and at a price that individuals and the community can afford [1]. The management of essential medicines also requires national policies, standards, guidelines, regulations and training, price information, manufacturing or procurement, supply and storage, and distribution systems. Monitoring access to essential medicines is closely intertwined with at least two other building blocks: service delivery and governance.

2.1.4 Health financing

Health financing refers to the "function of a health system concerned with the mobilization, accumulation and allocation of money to cover the health needs of the people, individually and collectively, in the health system… the purpose of health financing is to make funding available, as well as to set the right financial incentives to providers, to ensure that all individuals have access to effective public health and personal health care" [1]. Health financing must raise sufficient funding for health and spend on health care in a way that does not create severe financial hardship, catastrophe or impoverishment for those who utilise health services. To achieve this aim, focus must attend to three inter-related health

financing functions, including revenue raising, fund pooling and the purchasing/provision of services [1].

2.1.5 Health information systems

The health information system provides the underpinnings for decision-making, providing functionality to generate, compile, analyse and synthesize data into a format that informs health-related decision-making for a robust health system [1]. Health information systems focus on sound and reliable information as one of the key foundations in decision-making, and a building block that crosses across all health system building blocks. Health information is critical for health system policy development as well as "implementation, governance and regulation, health research, human resources development, health education and training, service delivery and financing" [1]. Key factors in the management of the health information system are to ensure overall "data quality, relevance and timeliness, and converts the data into information for health-related decision making" [1].

2.1.6 Leadership and governance

Leadership, governance and trust have been identified as critical pillars to resilient pandemic preparedness in LMICs, and decisive and collaborative leadership is essential during the COVID-19 pandemic [72]. Expertise from multiple backgrounds and perspectives is required to solve complex problems [73]. Leadership and governance is an established health systems building block and incorporates policies, accountability, stewardship and partnerships that intersect with all other components of the health system [72]. Across the health sector, there is increasing recognition of the role that understanding (and harnessing) cultural relationships and identity plays in ensuring activities are implemented, supported, led and owned by local actors [74].

2.1.7 People and community

The WHO define a health system as "consist[ing] of all organizations, people and actions whose primary intent is to promote, restore or maintain health" [71] and its goals are "improving health and health equity in ways that are responsive, financially fair, and make the best, or most efficient, use of available resources"

[71]. Within this definition, people – individuals and the key organisations that represent them – are critical. People influence all and each of the building blocks [2, 68, 70], but their absence in the original WHO Building Blocks Framework has led others to amend this conceptual framework. Mounier-Jack and colleagues [67] focus on the absence of demand-side factors in the building blocks – better known as people and community – by including community demand and social mobilisation within the service block. Sacks and colleagues [70] include community health workers in the health workforce building block, community-based health promotion and services in the services block and acknowledge household and social determinants of health, community organisation and societal partnerships.

To ensure that people and community are given equal attention in this study, we have created a seventh building block and named this 'people and community'. This block will explore health system-related issues that affected people in their communities and how they navigated these issues. Within this, focus is directly on documenting and exploring community-based health delivery and social mobilisation activities. We also refer to household and social determinants of health, where appropriate, in the original building block findings.

2.2 Study sites & data collection

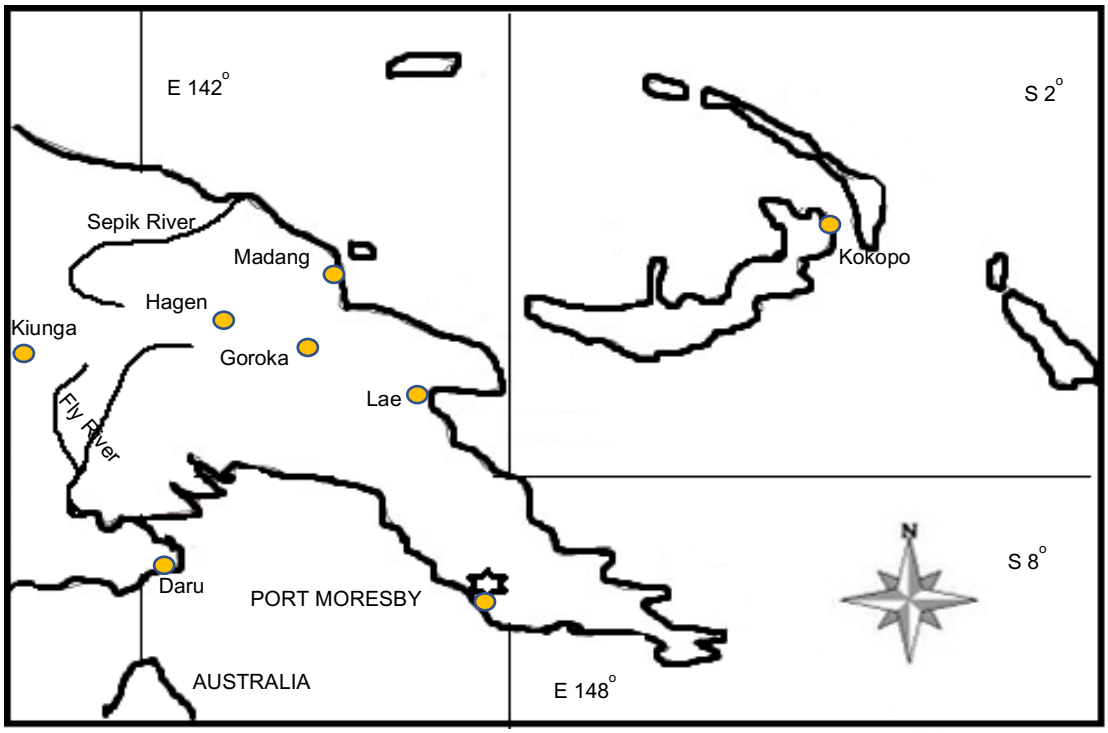
We undertook this study in eight research study sites in seven provinces, including Port Moresby (NCD), Goroka (Eastern Highlands Province), Daru and Kiunga (Western Province), Lae (Morobe Province), Kokopo (East New Britain Province), Madang (Madang Province), and Mount Hagen (Western Highlands Province) (see Figure 3). Provinces deemed at high risk for COVID 19 were selected as priority sites. Study sites were purposively selected based on going relationships with key collaborators across the country and to ensure an appropriate mix of HIV, TB, malaria programs and mother and child services were represented in the study design.

Due to the geographical spread of Western Province, the study included the island capital, Daru, in the South Fly District and Kiunga in the North Fly District. Additionally, while Daru delivers health services through a provincial hospital, no other health facility exists. In Kiunga, as a more rural site, health services are

delivered through a rural hospital and clinic and in close proximity to the Catholic-run hospital.

Data were collected from July to November 2021 by seven trained and experienced social researchers from the PNG Institute of Medical Research and two researchers from the Burnet Institute; each province was visited by at least two researchers. Fieldwork was conducted during the third COVID-19 wave, affecting not only data collection but also the findings. A total of two health facilities were selected in each of the sites and included provincial-level hospitals, health centres and specialist clinics whose managing authorities included government, non-government and international non-government organisations.

Figure 3. Map of Papua New Guinea and study sites



2.3 Sample population, recruitment, and data collection tools

All participants were identified and recruited by distinct cohorts which included clients, health care workers (HCWs) of identified primary health services – specifically maternal and child health and public health infectious disease programs [HIV, TB, malaria] – community members and key stakeholders.

2.3.1 Health Facility Review

Health facility reviews (HFR) were undertaken in at least two services in each of the seven selected provinces, with these facilities reflecting provincial and district-level services in each of the provinces. Purposive sampling was used to sample clinics and services from small to large clinics, hospitals in rural, peri-urban, and urban settings, and across the key public health and infectious diseases service delivery, including TB, HIV, malaria, and maternal and child health. In total, 41 health facilities reviews were distributed in study sites for completion to gain insight across these facilities from a range of health care workers and management.

Health care workers working at the time of facility-based recruitment, as well as personnel attached to the Provincial Health Authority or health facility administration, were asked to complete the HFR. Health facility reviews were conducted using a survey questionnaire adapted from the Service Availability and Readiness Assessment (SARA) tool [75] and the WHO facility infection control and assessment tool [76]. The key domains explored in this health facility survey questionnaire tool included inpatient and outpatient services provided, health facility workforce (type, number), health information and financing, and availability and access to essential drugs and other consumables, including COVID-19 specific resources. Thirty-three health facility review (HFR) surveys were completed by diverse health care workers, including community health workers (CHW), health Extension Officers (HEO), Officer in Charge (OIC), second in charge (2IC), clinic managers, nurses, data managers, and laboratory staff, across 16 health facilities in seven provinces. At least two thirds of all HFRs were self-completed by health care workers, after instruction about the tool by the research officer. HFR self-reporting was necessary in an environment

characterised by time constraints and facility review respondents wanting to engage and check with other health service staff before completing.

2.3.2 Semi structured interviews

A total of 131 participants from five population groups were interviewed across the six provinces. Participants included community members (general community and community leaders), heath care workers, clients who were engaged in or not engaged in the provision and use of maternal and child health services and TB, HIV, and malaria services (see Table 2 and 3), and key informants from provincial health personnel. It is important to note that these labels given to clients were not individual labels or traits of people but rather are descriptors that are socially and environmentally constructed and structured in how people accessed or did not access health services during COVID-19. Key informants in this study included those working in District, Provincial and National Health Departments and/or individuals with policy influence. Snowball sampling recruitment techniques were used, whereby trusted people such as health care workers helped to facilitate contact between potential study participants and the research team. This was particularly the case for clients and key community stakeholders. Health care workers and key informants were directly approached by members of the research team to participate (see Table 2).

Table 2. Participant numbers by location and cohort

	EHP	WP	NCD	ENB	MAD	MOR	WHP	Total
Health Facility Review	8	8	2	4	3	3	5	33
Semi-structured Interview								
Health care worker	10	18	4	9	6	3	6	56
Clients – Engaged	4	5	5	4	2	5	4	29
Clients – Disengaged	3	3	1	1	0	4	1	13
Community	3	5	4	3	4	4	2	25
Key Informants	2	1	1	1	1	1	1	8
SSI Total	**22**	**32**	**15**	**18**	**13**	**17**	**14**	**131**

Table 3. Client participants by public and primary health type

		EHP	WP	ENBP	Morobe	NCD	Madang	WHP	Totals
TB	Engaged	1	1	1	0	2	2	1	8
	Disengaged	0	2	1	0	0	0	0	3
HIV	Engaged	1	2	2	1	2	0	2	10
	Disengaged	1	0	0	1	0	0	0	2
HIV/TB	Engaged	0	0	0	2	0	0	0	2
	Disengaged	0	0	0	0	0	0	0	0
MCH	Engaged	1	0	1	2	1	0	1	6
	Disengaged	1	1	0	2	1	0	1	6
MCH/HIV	Engaged	1	0	0	0	0	0	0	1
	Disengaged	1	0	0	0	0	0	0	1
Malaria	Engaged	0	2	0	0	0	0	0	2
	Disengaged	0	0	0	1	0	0	0	1
TOTAL		**7**	**8**	**5**	**9**	**6**	**2**	**5**	**42**

2.4 Data analysis

2.4.1 Quantitative data analysis

While 41 HFR were distributed, showing a willingness to complete a HFR at time of interview, only 33 were completed and returned. Of these, 33 were included in analysis (see Table 2). Health facility review data was processed using Microsoft Excel. Stata version 16 was used to clean and summarise the data and to conduct the final descriptive analysis for the report. Proportions were calculated and tabulated by province and level of health facility to provide accounts of availability of services and resources. The impact of COVID-19 on availability of services and resources at the health facilities was determined by calculating the differences in the accounts of availability and absences of services before and during the COVID-19 pandemic. Health facility results were also tabulated by province or level of health facility to assess the any differences in responses between these different provinces and service types (see Annex 1 – Health Facility Result Tables).

2.4.2 Qualitative data analysis

All 131 SSIs were digitally recorded, transcribed verbatim, translated from Tok Pisin to English where necessary and included in qualitive data analysis. All interview transcripts were stored, managed and coded in the qualitative data management software program, NVivo version 12 (QSR International Pty Ltd). Analysis of qualitative data in this study was conducted in four rounds using deductive and inductive thematic analysis. Deductive and inductive thematic analysis guided all rounds of data coding and analysis [77]. Deductive coding involved carefully reading the interview transcripts for any data pertaining to the key building blocks of being the same and different, whilst inductive analysis permitted further ground-up exploration of the themes within these building blocks.

Author (JN) conducted a first and second round deductive coding of all interview data and data were organised to reflect the amended health systems strengthening building blocks – or key domains – including health service workforce, health service delivery, essential medications, health information systems, finance, management and leadership, and people and community. Authors (JN; NN; LV; AM; RF; MS; MW; ZK) undertook a third round of coding of specific building blocks to further explore through thematic analysis the findings specific to these building blocks and service types. Data coding and analysis at the third round of coding also sought to identify patterns, sameness and difference across province, health service types, locations and stakeholders. For the final steps in data analysis, the drafting of third round data coding and analysis for each building block was read and re-read by Authors (JN; NN; LV; AM; RF; MS; MW; ZK) to cross-check codes, analysis and interpretation of the data and to review findings across the diverse building blocks. Extensive reviewing across the different components of the building blocks was an important data analysis phase that attended to the criticism of the building blocks being too simplistic and not capturing the dynamic interactions between the blocks and elements of the health system [67].

2.5 Informed consent and ethical approval

All participants were provided with information and consent forms to read. If they were unable to read, the information sheet was read to them by the field researcher. Information and consent forms were provided in English and in Tok Pisin. All participants provided written informed consent to participate in the study. Participants were provided with the opportunity to ask questions and clarify any issues prior to participation and were reminded of their right to privacy and to withdraw from the study at any time without any adverse consequences, including their right to access health services. All SSIs were digitally recorded with consent and pseudonyms have been used throughout this report to ensure confidentiality and anonymity of participants.

Ethical approvals for this study were obtained from the Papua New Guinea Institute of Medical Research Institutional Review Board (IRB #2015), the PNG Medical Research Advisory Committee (MRAC 20.35) and the University of New South Wales Human Research Ethics Committee (HC210172). Authorisation to conduct the research in each of the seven study provinces was also received from the governing PHA body prior to the research being conducted in these settings.

Findings

The impact of COVID-19 on primary health and public health infectious disease programs in PNG was similar across different types of health services (clinics, hospitals, government-run, church-run), located through the study provinces (provincial, urban and rural), and across primary health (maternal and child health) and public health programs (HIV, TB and malaria). In view of these similarities, findings from this study will be presented on the key themes of this impact across the amended building blocks: heath service delivery, health workforce, essential medicines, health financing, health information systems, leadership and governance, and people and community.

3.1 Health service delivery

> *There is always some kind of epidemic coming up, it's like maybe after five years or after 10 years or you know if that's happening, if that's a trend, then it will still happen in the future … the innocent patients are the victims. They become the victims of it and it's not good. It's not good. It is us who are causing this breakdown in the services because of preparedness we are not prepared for it. We should be prepared for disaster. Disaster preparedness is one of the KRAs [Key Result Areas] in the National Health Plan there so we should implement that. It's not when the epidemic is here and then we start running around and quoting that KRA … This preparedness thing it has to happen before any epidemics.*
>
> Relma, F51, HCW/Nursing OIC, HIV & STI services
> Provincial Urban Hospital, Western Province

In this section, we examine how health service delivery was impacted by COVID-19 across the country and to what extent this was the same or different across the sites and the different health programs. It was clear, despite some differences, that COVID-19 was prioritized, sometimes at the expense of primary and other public health services, and that a fear of health facilities as spaces of

risk for community, clients and health care workers affected engagement and delivery of services in the time of COVID-19. The elements of heath service delivery most impacted by the pandemic were health service delivery comprehensiveness, accessibility, and continuity of care.

3.1.1 Health service delivery disruption

Health service closure during COVID-19

Closures of health facilities were reported because of public lockdowns to contain the spread of COVD-19 at the beginning of the pandemic and following the identification of a person with COVID-19 in a health facility and the need for a deep clean, as well as for non-specific reasons throughout the entirety of the pandemic. Service closures as the result of public lockdowns were reported in Western Province, the National Capital District, and East New Britain Province where services were reported to have closed for two weeks (see Annex 1 – Tables 7, 8 and 9). There were also a limited number of reports about non-COVID-19 specific facility closures during the pandemic, which included vandalism and disruption to water and power access, the latter two issues having existed before the pandemic.

> *Before COVID-19 got worse in Papua New Guinea, I mean Western Province, it was normal. If we come in, we come straight to the clinic but then after some months later, we came they told us that it's two weeks lockdown, so you have to go home. So, we went home, and then when we came back after two weeks, we had to make a long line outside of the hospital to come into the hospital.*
>
> Danica, F19, Client not engaged in MCH services
> Provincial Urban Hospital, Western Province

> *The first lockdown that we had in 2020 and it restricted our movement too. As a TB treatment supporter, the clinic was closed so we didn't*

have access to the supplies. Sometimes we ourselves at the community level we didn't have the drugs, we ran out due to the COVID-19, so, most of the time the clinic was shut down.

Clinton, M47, Community member & TB treatment supporter
Urban Day Clinic, National Capital District

The hospital closed for about two weeks. So, you know when we were closed during those times, the service, every service was put off, this means that everyone had to go to wherever they could access the health facilities.

Andre, M42, HCW/Nurse, HIV & STI services
Catholic Urban Hospital, East New Britain Province

There was some general reporting of facility closure, however, in these instances the reason for facility closure or for the period in which the closure took place was not reported.

I came here and the gate was locked. The gate was closed, no hope [of service] so I went back [home]. I had only four tablets [HIV ART] left. I had only four tablets left, and they said, "the Hospital is closed." And when I came down the Clinic was open, and the other sister with the other man were about to go out and were sitting on the bench. That's when I arrived at the same time and they said, "You came at the wrong time. You go back.", they said that. So, I went back [home] and stayed and I think, I forgot [how long] … Around four days went by and then I came back again.

Jane, F (age not reported), Client engaged in HIV services
Provincial Urban Hospital, Eastern Highlands Province

During COVID-19 when the Base Hospital was closed, we were really affected, and even the patients were affected also. They couldn't go in to Goroka Base [Hospital] because it was closed. So, we made all the

decisions there. And we said, "Sorry, the Base Hospital is closed, so we are helping with whatever we can. So be calm and have peace of mind and you go and help yourself."

Aiya, M44, HCW/Nursing OIC, General Services
Urban Day Clinic, Eastern Highlands Province

The closure of facilities for deep cleaning following a known person with COVID-19 within the facility and/or due to workforce shortages was also reported. Usually lasting only a couple of days, these closures were typically shorter in duration than those associated with public lockdowns. In at least one setting, these facility closures were reported to have occurred on more than one occasions.

I think we closed; the hospital services were closed [a] number of times. Maybe twice and they only see [saw] emergency [cases] and then those necessary to see because of staff strength and then space capacity was not enough to keep the patients.

Kerapeng, M (age not reported), Key Informant
Provincial Public Health, Western Highlands Province

Scaled back, service movement, and varied service availability

Across all provinces and health programs, the scaling back of services was preferential to entire closure. This was particularly the case with ensuring health service delivery for HIV, TB, malaria and maternal and child health services continued. The cost, though, was that other services were suspended (see Annex 1 – Table 7).

We issued an announcement through our local media and through notices that during the lockdown, the hospital didn't go on a lockdown, the hospital services were continuing … only other parts … like the normal clinics, review clinics went on a scale down, but our emergency meetings and our functions operated fully … All other services were going except for day clinics, like STI clinics and all this other we have

scaled down … There was a [public] lockdown, we were scaled down but most of the services operated as normal and we encouraged patients to come.

Stan, M49, HCW/Manager, Infection Control
Provincial Urban Hospital, Morobe Province

We did actually have many changes during the period of COVID-19. Such as when COVID-19 came in, we shut down. We completely shut down all our immunization programs, antenatal programs and family planning programs and we only catered for the COVID-19 vaccination plus the outpatient. For the outpatient, we just operated for half of the day and saw only 100 patients and then we sent the rest of them to some other clinics and such. Because of the extra workload of the COVID-19 vaccination that we are taking on board, we needed more manpower to shoulder the responsibility.

Morris, M37, HCW/Nurse, MCH & COVID-19 services
Urban Day Clinic, Morobe Province

There was no shut down of our health facilities at all, because all the facilities need to be open, so we address some other diseases as well. The message given by the management to all our health facilities that there should be no shut down but give alternatives but, in the main hospital we scaled down … So, we didn't attend to other services but only to emergencies and not … but we scaled down our services but not shut down.

Kerapeng, M (age not reported), Key Informant
Provincial Public Health, Western Highlands Province

The closure of specific services and programs within facilities across provinces resulted in what was described as service movement – where existing services and programs were closed these services and clients were 'theoretically' moved

to another that was still providing these services and programs. Several reasons for these service and program closures can be inferred from the data, including COVID-19 services taking over whole departments, the deployment of large numbers of staff to COVID-19 related services and workforce absenteeism either from COVID-19 infection, fear of caring for people with COVID-19 and being infected and a furloughing ageing workforce (see Section – Health Workforce).

> *The Vasectomy Clinic has now been taken over by COVID-19 [services including triage, testing and vaccination]. The officers came and are staying over there, so they sleep over there, and they come and work here, so he could not work in there.*
>
> Benita, F58, HCW/Snr Nurse, Family Planning services
> Provincial Urban Hospital, Eastern Highlands Province

Whilst some of this movement occurred within the existing facility, at other times, programs and services were moved to other service locations.

> *During the time of COVID-19, at first, we only provided for TB, HIV/AIDS, and the outpatients. And we send the antenatal, immunization and family planning clients to Susu Mama. So, Susu Mama is the NGO group that is looking after all our mothers and the babies for antenatal, immunization and family planning during the pandemic and now we are trying to create space and squeeze in the programs.*
>
> Morris, M37, HCW/Nurse, MCH & COVID-19 services
> Urban Day Clinic, Morobe Province

Health care workers spoke of the confusion that this movement and amalgamation of services and programs had caused for clients and directly linked this movement to client disengagement and loss to follow up.

> *Okay, since especially with the setup of PPTCT [Prevention of Parent to Child Transmission of HIV], with COVID-19 I see that COVID-19 it has disturbed many of our clients who were supposed to come on their review dates, but they did not come. Because they know of our setup of PPTCT at Goroka Base [Hospital] but once we moved here [to North Goroka], they are lost. They don't know where to go … So many went*

there, they saw the place was empty and some asked around. Those who asked came here. Some who did not ask, they went back, and they did not [return]. They don't know where to go so, they didn't get their medicines. For that, most are now defaulters. So many things didn't work well because of COVID-19.

Annie, F49, HCW/Nurse, HIV/PPTCT services
Urban Day Clinic, Eastern Highlands Province

During that period when the lockdown was in place, we saw that patients were not that many because a lot of people they thought that our hospital was totally shutdown all the services. So, for our cases, our TB cases as well, there was an increase again in the lost to follow-up cases … Most of the [public] services were not operating [during lockdown].

Lola, F34, HCW/Nursing OIC, TB & HIV services
District Rural Hospital, East New Britain Province

People from the community who access these services as clients spoke of these significant changes differently from the health care workers. For those clients who remained engaged with health service and care during COVID-19, these changes in health service delivery were moderated by health care worker attitudes. Clients spoke favorably of their health care workers, saying that they provided and prioritised quality care, despite the pressures of COVID-19 and significant service disruptions. Less frequently some clients said that the quality of care, and the attitudes of health care workers were mixed. Amongst those who reported receiving poor quality of care, some expressed that this was not particular to health service delivery in the time of COVID-19.

Focus on COVID-19 over operational public and primary health service delivery

A focus on COVID-19 over the operational delivery of primary and other public and health services was reported by health care workers, clients, community, and key policy stakeholders across all provinces. For health care workers and key

policy stakeholders, the prioritisation and focus on COVID-19 was described as a reason that services were stopped or discontinued. For some, this was described with respect to the deployment of public and primary health workforce to COVID-19 responses and services, COVID-19 responses and services taking over vital space within a health facility and the prioritisation of health system funding being directed towards COVID-19 responses.

> *Because of COVID-19—the people working in the COVID-19 centre are utilizing this as a dormitory and they have this 24-hour shift work, so they are doing that. And again, the public health team's meeting room is converted into a children's ward for the COVID-19, those who got COVID-19, children, they converted that into COVID room. And then the other part of the office or place is now also converted into adult (ward) with oxygen, so the public health area is surrounded by COVID-19 … That place where we store (our medicines and supplies for malnutrition) is now dismantled and taken over by COVID-19 centre. Now in the hospital ward we have a lot of malnutrition.*
>
> Bernie, F65, HCW/Nurse & Manager, MCH services
> Provincial Urban Hospital, Eastern Highlands Province

> *The Government's focus now is on COVID-19 where huge funds are going there and now it has forgotten about AIDS where it hardly funds us to support us in our work … COVID-19 is getting all the attention and AIDS is forgotten now … It isn't good because you just imagine about our clients now; they are just being forgotten.*
>
> Tania, F58, Community member & HIV Treatment Supporter
> Rural area, East New Britain Province

Clients also described the prioritisation of COVID-19 over primary and other public health in health service delivery. For people with a disability, the change in focus to COVID-19 over primary health during the pandemic was described in relation to their ability or inability to access assistive devices, which had been accessible pre-COVID-19.

> *Before the COVID-19, it was a bit all right, and when COVID-19 came, all their concerns were focused on COVID-19, and not about these things. Maybe not long some of these wheelchairs bound people will crawl on their legs now. And like me too, I will only sit down in the house only and stay because there is no foot [prosthetic] and the other things for making new foot [prosthetic]. Since last year I went back and forth to check but there wasn't any. And the socks we used to wear and also to wear it on the leg [prosthetic] was not there. Some are buying it from the stores, and it's like that so.*
>
> Anion, F31, Community leader & PLWD
> Urban area, Morobe Province

Clients in TB services also described a focus on COVID-19, a prioritisation which they report has already led to an increase in TB.

> *TB was here before the COVID-19 so if we leave TB out and concentrate with COVID-19, the TB will rise and that is what happened. TB was increasing because most of the staff were mostly concerned about COVID-19 and did not really much worry about TB and TB was increasing at the same time.*
>
> Joss, F65, Client engaged in Malaria services
> Provincial Urban Hospital, Western Province

Infrastructure capacity and the built environment

When discussing infrastructure capacity and health service delivery during COVID-19, the type, quality and age of buildings and facilities, and the arrangement of the built environment, featured prominently in the accounts of health care workers and clients across all provinces and service types. Study participants were concerned particularly about the additional COVID-19 services – including COVID-19 triage, testing, vaccination, and treatment – that were added to a health service and system that had systemic issues with ageing and

inappropriate or non-existent infrastructure. The built environment, space and arrangement, and quality of health service infrastructure directly impacted quality of care across all provinces and service types.

Infrastructure capacity to respond to COVID-19 and to provide routine services was variable. There was varied availability of sanitation facilities (toilet and washing), and supply of power and water across health facilities (even within the same provinces). In some facilities, designated wards were inadequate to cater for the general burden of client care, let alone COVID-19.

A concern shared by all was the need for maintenance of existing buildings and a request for better infrastructure and/or renovation/upgrade to existing buildings to respond to health crises like COVID-19 to provide continuity of testing, treatment and care. The acknowledgement of limited and/or old infrastructure and health service overcrowding prompted several participants – mostly health care workers, but also reported by clients and community – to identify a structural response and need for preparedness to ensure renovation and/or new buildings be prioritised as necessary in future pandemic or health emergency responses.

These systemic infrastructure issues were compounded by the need to rearrange service delivery for HIV, TB, malaria, and maternal and child health to outside spaces to mitigate nosocomial transmission of COVID-19. The provision of services outside of buildings occurred in an environment where these spaces were also co-located and used in conjunction with COVID-19 related health services, compounding the space and subsequent overcrowding in services. The movement of health services to outside spaces impacted health care workers and clients alike.

> *Okay for this, as for me, I would say I get angry while working. When we were at Kama, everything was set, and we go and just worked and came. But now I am tired of carrying this umbrella, chair, and table back and forth. They must build a house here and it must be just there so that I come and work and go. Due to that, I am always upset, and I become disobedient [and don't come to work] too.*
>
> Andrew, M53, HCW/Community Health Worker, MCH services
> Urban Day Clinic, Eastern Highlands Province

> *[We need] Permanent [infrastructure], because like we have said, 'Covid is here to stay,' so building too must also be permanent that will be here. This one [tent] is a temporary one. Yes, so infrastructure wise we still need to upgrade this facility with some buildings so that there would be space. With Covid there will be space for us [health] care workers to work, because now we are currently squeezed and that's why we are moving our outpatient outside and we are screening outside because there is not enough space.*
>
> Clarise, F43, HCW/Clinical HEO, General & COVID-19 services
> Provincial Rural Hospital, East New Britain Province

Changes to the spatial configuration of health facilities due to the additions of COVID-19 related services and the movement of services to outside spaces limited the physical space at facilities and the coordination of workspaces for service delivery. These changing workspace configurations and service-based operations, particularly waiting areas and outside service, impinged on the ability of health care workers to have immediate access to the medical resources and supplies – which were typically stored within a facility – as well as computers, desks and chairs (where available) to be able to ensure appropriate client and service data recording. Infection prevention and control (IPC) measures, known as Niupela Pasin, particularly the setup of COVID-19 specific services (such as triage, testing and isolation, and vaccination) in existing health facility spaces took away space from other health services.

3.1.2 Client avoidance of health services during COVID-19

A ubiquitous finding across all provinces and service types was that since the outset of the COVID-19 pandemic clients have avoided health services. Instead, clients spoke of staying home and using home and traditional remedies, and of avoiding public transport and crowded spaces (including public health facilities). For example, participants reported using steam baths to assist with respiratory conditions like asthma and treating other respiratory issues, including possible COVID-19 infection, by rubbing Vicks®. Health care workers across all provinces believed that there was an increase the number of people 'lost to follow up' in TB, HIV and maternal and child health programs because of this desire to avoid being infected by visiting a high-risk setting. The exception to this health service

avoidance was where a limited number of clients reported presenting to health services during emergencies or when seriously ill, or to ensure testing, treatment, care and support for primary health and infectious disease. Those who attended services did so despite their belief and fear of exposure and possible infection.

> *During COVID-19 it was quite scary you know walking up people say you will catch COVID-19 you know, but due to the current situation I mean I had to, I had to. I had to really stand up and go and get the services just to help me get better. So yeah, I had to force myself, put everything aside, going through the new normal way of living, but the services are very, very good in terms of medication in this one.*
>
> Rhona, F34, Client engaged in TB services
> Provincial Rural Hospital, East New Britain Province

> *I was scared [of COVID-19] and I stayed home but then I had a positive thought, so I am now attending the clinic … I said COVID-19 is here but the important thing is, I go and get the medication. I go check-up and know how the baby is and the nurses would tell me that my baby is fine, or they tell me to eat well and check my health. That's why I used to go back and forth to the health centre and get medicines to help my blood.*
>
> Gina, F27, Client engaged in MCH services
> Urban Day Clinic, Morobe Province

Health services as spaces of COVID-19 risk

Clients reported a general dread and fear of being infected with COVID-19 through exposure in a health service, including from infected staff and clients as well as exposure to others when travelling on public transport to and from the facility. Health services were believed to be the highest risk space for infection and that accessing services (or going to work) posed the greatest risk of exposure and infection; health care workers were frequently assumed to be infected. This belief was not confined to clients and community but was equally a belief and fear of health care workers (see Section – Health Workforce).

Our mothers have at the antenatal, firstly they were really afraid. Sometimes we didn't get enough mothers to the clinic and then eventually, we usually hold a health education every morning in here and we tell them that it is okay and it's safe for them to come [The] antenatal mothers were little bit afraid of delivering in Ward 7 thinking that ward somebody with COVID-19 is also delivering in there.

Rashida, F54, HCW/Nursing OIC, MCH & HIV services
Provincial Urban Hospital, Western Highlands Province

Most clients come with their parents but now the majority fear COVID-19 and some of them do not come for treatment. They said, 'The hospital contained COVID-19 so instead of going to get medication we might contract the virus.' Their mentality convinces them and most of them became lost to follow up.

Trisha, F35, HCW/Nursing OIC, HIV services
Provincial Urban Hospital, Madang Province

The other thing too is we are thinking about our doctors at the hospital. They are serving the sick [COVID-19] patients and when we go, are we also going to get the sickness from the doctors? There are many thoughts, so many thoughts coming up because of this. So, we are noticing that we aren't going to be safe, so we must stay on our own at home or we must take our wives and children and go and hide in a place for our safety from this sickness.

Bonny, M36, Community member & traditional healer
Urban area, Eastern Highlands Province

COVID-19 triage, testing, isolation, and vaccination impacted service engagement

People were also afraid of COVID-19 services; they feared being tested for COVID-19 because if they tested positive to COVID-19 they would be placed in

an isolation ward/hospital and separated from family and community, and likely be left alone in isolation to what they feared would be death. For those with co-morbidities, there was the fear that having COVID-19 would lead to the unwanted disclosure of another infection like HIV, exacerbating discrimination and stigma.

> *They are afraid ... They were afraid of the hospital because in the hospital, what did they said, they will put them in the COVID-19 ward … in the halls and they said that 'You are going to be departed', I mean, 'You will be alone, nobody will look after you, you're not going to see your family and your children. You will be alone in there and if you die, you die.' So that's the first impression they had so they are running away from hospitals … They were not afraid of COVID-19, they were afraid of going into isolation.*
>
> Bomali, F49, Community Leader
> Urban area, Eastern Highlands Province

The availability of COVID-19 vaccination and people's beliefs about them, compounded people's fear it would be made mandatory, impacting upon people's willingness to engage with health services. People started avoiding any, and all, health services because they feared they, or their children, would be forced to take the COVID-19 vaccination. For the adult population, this fear was generally expressed without an explicit link to health service avoidance, however, this fear was a common across all provinces and health services and an important factor that can influence engagement and disengagement with care and COVID-19 vaccination.

> *Many are sacred, the only ones that are getting the vaccine are the workers and educated people. Otherwise, if you go in—like mostly 99 percent of people in Port Moresby did not get the vaccine, and they didn't want to, we don't want to get the vaccine. They (health care workers) don't provide good awareness to us. The government is just forcing us to get the vaccine, so we don't want to get the vaccine.*
>
> Cynthia, F29, Client not engaged in MCH services
> Provincial Urban Hospital, National Capital District

In contrast, the belief that attending health services would result in forced COVID-19 vaccination of children was commonly reported as an explicit and key factor for why mothers (and guardians) would actively avoid health services. The impact of the rollout of the COVID-19 vaccine on routine immunization for children has been significant across the whole country. Countless stories from mothers were recounted of instances where they avoided services and/or ran away with the babies, fearing that their children might be forcibly vaccinated, even though the COVID-19 vaccination was not, and is still not, approved for those under 18 years in PNG to date. This belief about forced vaccination was influenced by the general belief about forced vaccination in community, but also may have resulted from services tried to 'piggyback' of each other programmatically, which led to confusion about which vaccinations were being given at any one time.

> *Many mothers they didn't bring [their children] on that time. That was after rumours about the vaccination was going around. So, some assumed that we were currently taking the COVID-19 vaccine around and giving it … Some they hesitated a bit, they did not come to the clinic. We sent out words and they came, and we told them that, 'no this is like this. Don't take COVID-19 [vaccination] the wrong way' … this COVID-19 vaccination is for protection.*
>
> Tobras, M61, HCW/Nurse, General & COVID-19 services
> District Rural Hospital, East New Britain Province

> *When we take the vaccines around, those normal vaccines, the mothers run away. The mothers take their babies, and they ran away. And they said, 'That's the number 666. They want to give [inject] us [with] COVID-19.' … the number of the children for the vaccinations that we normally give has decreased. It has dropped.*
>
> Ainna, F52, HCW/Nurse, MCH services
> Urban Day Clinic, Eastern Highlands Province

Client transport and transfers

A lack of health service transport in which to transfer clients, particularly in emergencies, was reported as a systemic barrier to client engagement and client health outcomes – with one health care worker from the National Capital District discussing this issue with frustration due to a lack of response to her advocacy for transport with politicians and policy makers over many years. Limited availability of client transport and ageing vehicles with mechanical issues directly impacted health services' ability to transfer patients, including emergencies, and created an environment where services were reliant on others for client transport – sometimes in the absence of formal referral pathways. This absence of referral pathways for client transportation became more problematic during COVID-19 when an increasing need for emergency transport was reported in order to transfer clients to services for appropriate COVID-19 isolation and/or treatment, as well as the increasing travel demands of contract tracing as COVID-19 infections increased.

> *So, there's a tent there, they said, 'When patients go in for testing and if like severe cases, they just keep observation and refer to either Aquatic [Centre] or 3 Mile [Hospital].' But our referral pathway is through St. Johns (ambulance service) and St. Johns (ambulance service) to whichever either Rita Flynn, Aquatic (centre) or POM Gen (Port Moresby General Hospital), but now St. Johns (ambulance service) is not responding [and] we are using either taxi to bring the patient over … We don't have a vehicle; we don't have an ambulance now.*
>
> Fiona, F49, HCW/Nurse, General services
> Urban Day Clinic, National Capital District

3.1.3 Socio-ecological factors impacting health service accessibility

Clients' socio-economic capacity

COVID-19 had a direct impact on clients' and community members' job security and income generation, with people across all provinces reporting how reduced

financial capacity during COVID-19 directly impacted their ability to pay for general expenses in daily life, including costs associated with health service engagement. Reduced financial capacity was described as a key factor in the ability to access transport to travel to and from the service, to buy medications and prescriptions, and to purchase additional consumables that were not provided by services.

> *[COVID-19] made my life very hard in here. That is, when I was turned down from work, my wife got sick now it was very hard for me. Take her to the hospital, get medication for her, and then like we had to go, sometimes when we forgot to get the mask and you are not allowed to go into the stores to buy her medicine. I have not come to the hospitals.*
>
> Vince, M46, Community Leader & TB Peer Volunteer
> Urban area, National Capital District

Socio-economic capacity also directly impacted people's access to mobile phones and phone credit that influenced clients' ability to contact health services and health services' ability to contact clients. Economic capacity to pay for mobile phone services compounded the confusion that surrounded the closure and movement of health services during COVID-19.

> *For the patients… I think so. Yeah, because lately, we were just going through the charts, and we found out that few patients are mostly the ones that don't have our contact and don't have a phone. So, it was a bit difficult for them to come because of the distance and the issue of minimizing spacing in the transport, the transport too.*
>
> Vyv, F49, HCW/Nursing OIC, HIV/STI/TB services
> Catholic Urban Hospital, East New Britain Province

The requirement to wear a mask, which were compulsory to enter health services, was an added cost to all health service engagement during COVID-19, except for TB services where masks were used by clients in services prior to COVID-19. Whilst some services provided masks to clients for free, this was not uniform across the country. A small number of participants spoke of being able

to use home-made masks; however, this was not universally accepted across different types of health services.

Public transportation availability

Across all provinces, COVID-19 lockdowns at the beginning of the pandemic resulted in movement restrictions across and within provinces, and in many cases the ceasing of public transportation services (known as PMVs – public motor vehicles), impacting clients' ability to access health services for antenatal and postnatal care and accessing services for testing, treatment, and care, directly impacting TB and HIV treatment adherence.

> *When my medication finished, and my review appointment date was at the same time during the lockdown, I didn't have ways to come and collect my treatments, so the lockdown was not good. It disturbed our service accessibility and our access to ART.*
>
> Larry, M45, Client engaged in HIV services
> Urban Day Clinic, National Capital District

Movement restrictions and additional costs associated with transport contributed to health care worker availability to travel to work, as reported in East New Britain Province, resulting in disruption to the continuity of care for clients. When transport resumed after lockdown, mitigation strategies to ensure social distancing reduced the number of people allowed at any one service, resulting in increases in PMV fares. This increase of individual PMV fares was also compounded by clients potentially having to travel further to health services if the services they attended pre-COVID-19 had been closed or scaled back, in addition to clients and community fear of public transport as a high-risk and unsafe space for COVID-19 infection. These transport service disruptions, increasing prices and fear of COVID-19 in public transport spaces were factors that significantly influenced people's willingness and ability to get to the health services they needed during COVID-19.

3.1.4 Health service delivery adaptations

Changes to the quantity of medications dispensed

Health care workers were acutely aware of the many service-based and socio-ecological barriers that existed that prevented clients from accessing and remaining engaged with health services during the pandemic. In several cases, this awareness changed the way that HIV and TB medications were dispensed during the pandemic. In these instances, HIV clinics starting multi-month dispensing where they could (determined by ongoing supply), reducing the number of times a client would have to attend a service whilst still maintaining treatment adherence. In the case of TB, many services transitioned from directly observed therapy (DOT), recommended by the PNG National TB program, where a heath care worker distributes and observes treatment daily, to supplying clients on TB treatment to take their own treatment home and take of their own volition (self-administered treatment, SAT), aligning much more with WHO TB guidelines [78] and how HIV treatment is administered globally (see Section - Essential Medications). However, this experience of treatment dispensing was far from universal, with a similar proportion of clients and health care workers also reporting a reduction in the quantity of medications provided (see Section - Essential Medicines).

> *Those few staff who were working, maybe two or three staff who were working, when they saw the patients, they manage to supply three or four weeks in advance. Like if the medicines were finished in that week, they had to supply extra weeks again, because they were seeing that the patients were not able to come back, they were not able to come back again to the hospital or to the clinic to collect medicine so they were supplying extra; two or three months extra, so they could take them at home.*
>
> Belinda, F47, HCW/Nurse, TB & HIV services
> District Urban Hospital, Western Province

Introduction of door-to-door transport service for key populations

There was only one instance of service-based adaptation in this study that directly attended to the barriers of transportation for client engagement with health services. This was the adaptation to an existing door-to-door transport service in Port Moresby that was designed pre-COVID-19 to facilitate people living with HIV (PLHIV) who were on ART with direct transport assistance to ensure HIV treatment adherence. During COVID-19, this was adapted to allow any of the registered key population client members to access the door-to-door service for transport to health services in times of emergency. The designers of this project suggest that this transport service model would be of great use for other health services and an important adaptation in future pandemics and health emergencies.

Acknowledgement of the value of telehealth service delivery

Whilst the use of mobile technology was used by health care workers to communicate with each other and distribute COVID-19 education, information and discussion forums, the use of mobile technology – telehealth – was not utilized by services to engage with clients during COVID-19, and in some instances was discouraged. Whilst noting the barriers that the use of mobile technology has for client engagement in PNG (see access to mobile phone credit and data reported earlier in this section) this service delivery adaptation should be considered where it is available in future pandemics.

> *I think some nurses are [using phone calls and texts for health services and support during COVID-19] especially with the TB clients. I think their nurse is trying to do, but with the others, the sick patients really affected. They come to the health centre, and we just work on them … There is no phone call or no other contact back and forth, nothing.*
>
> Fenela, F44, HCW/Nurse, MCH & General services
> Rural Day Clinic, Madang Province

No [we do not use telehealth and remote working] … Not too much, I discourage; I want everyone to be seen at a proper place … No [health care workers do not use the phone or text for services with clients] it never happens but here we have rules around that time during COVID-19, we say – maybe we see first ten [clients] sitting here [at the clinic] on the space, distancing them, we see them, and they are gone and we are finished, I think. First serve and then for using phone calls and all these never happen.

Bolboll, M54, HCW/Community Health Worker, HIV services
Provincial Urban Hospital, Eastern Highlands Province

3.1.5 COVID-19 disrupted health services, client engagement, and the quality and continuity of care

Health services across the country described a reduction in the number of clients seen and cared for since the pandemic started. Service adaptations, particularly the dispensing of larger quantities of treatment medications for HIV and TB to overcome service disruptions and public lockdowns, were also reported to reduce the number of clients accessing care during COVID-19. Other more significant reasons for the reduction included disruptions to services due to closures, movement and scale back – a factor that created significant confusion for clients as to where and when they could access the services they needed. Client numbers also reduced because of a fear that clients had of COVID-19 infection in health facilities. Clients also feared COVID-19 services (triage, testing, vaccination and treatment) themselves and in some cases these were perceived as unacceptable services to be run alongside traditional primary and other public health services. COVID-19 uncertainty and the relocation and/or redirection of services disrupted the continuity and quality of care across service types across the country.

When COVID-19 was first diagnosed and most patients were supplied three to four months and they were sent home, and during that time maybe for two or three months are not seeing patients, because they were supplied enough medicines to take home because of the COVID-19. There were restrictions that patients were not to come for certain time, even there who were staff who had Corona virus, and so the less number of staff were working. So, place was shutdown, the hospital itself was shut down, and so we didn't have patients that period of time.

Christolyn, F44, HCW/Community Health Worker, TB & Malaria services
Rural Day Clinic, Western Province

Client avoidance of services relates now to an increase in 'lost to follow up'. However, this reduction in client engagement has not been static. For some health services, client engagement changed over the course of the pandemic – with changes in client engagement during previous COVID-19 surges and public lockdowns returning to what was considered 'normal'. For these services, changes in client engagement over the different stages/waves of the pandemic suggest that health service disruptions, client fears of COVID-19 infection and associated prevention and mitigation services may be short-term.

Key to the effectiveness of health service delivery during COVID-19 in this study was the coordination and integration of health service delivery across building blocks and levels of the health system – particularly how workforce, management, financing and information intersect. But also, key was how COVID-19 was managed and delivered as a separate health service – whilst simultaneously being prioritized over operational service delivery for HIV, TB, malaria and mother and child health – within the facilities' health service delivery.

3.2 Health workforce

> *[Within] the nursing staff I see that the population… the aging ones are overpopulated, we have more aging staff then our younger ones…but overall, more aging staff then the young people.*
>
> Beetrus, F57, Key Informant
> Provincial Public Health, Eastern Highlands Province

In this section, we examine how the health workforce was impacted by COVID-19 across the country and to what extent this was the same or different across the sites and the different health programs. Key themes impacting the health workforce related to the availability, composition and mix of health care workforce – factors that were described as systemic but significantly compounded during the COVID-19 pandemic. These key health workforce findings are described below as they related to disruption and adaptation of public and primary health services during the COVID-19 pandemic in PNG.

3.2.1 Disruption of services

Ageing workforce

One of the key areas discussed at length by health care workers was the ongoing issue of the ageing workforce in PNG. Knowing that COVID-19 more frequently resulted in poorer health outcomes, including mortality and morbidity, among older people, there were some strategies put in place to try and prevent infection in older members of the health workforce. These strategies included furloughing health care workers in some settings – staff over the age of 55 years were advised not to come into the health facility – while in other settings these older members of staff were assigned roles and responsibilities away from public areas and direct clinical care, where the risk of COVID-19 infection was greatest. The option to stay at home was offered in two different provinces, with some older health care workers choosing not to return to the workplace after the initial lockdowns.

The concern raised [about our aging workforce and COVID-19 risk] and we told them, yes; we didn't tell them to stay home, but we redirected them away from too many contacts with patients, so we put them in places where there are less contacts, yea.

Peter, M (age not reported), Key Informant
Provincial Public Health, Western Province

The number of staff attending to work has decreased because of their age group…They said if you are 55 and above you stay away and then come back… some have come back, some have not come back.

Bernie, F65, HCW/Nursing OIC, MCH services
Provincial Urban Hospital, Eastern Highlands Province

In some settings there were reports of older health staff resigning out of fear of coming to work and contracting COVID-19, and/or being afraid of having to care for patients with COVID-19. Their own health and risk of death from COVID-19 led to the decision to resign. Linked primarily, though not solely, to the older workforce, was the perceived risk and fear of COVID-19 for health staff with coexisting comorbidities. These staff faced an increased risk for contracting COVID-19, and they were more likely to report in sick. The situation of those choosing not to come to work, taking time away sick and retiring or resigning left an already struggling workforce with a depleted number of staff to provide much-needed health services at a critical time.

Yes, now especially our NCDC [National Capital District Council] Nurses, most of them have medical conditions so and they are aging as well so when this COVID-19 thing came on now we have this shortage of manpower so sometimes in a day they have only two or three working, three nurses or mostly its three to four Nurses working in a day, but we do manage because now we are going by COVID-19 protocols, we are strict, we are seeing those patients. Those outpatients where they can treat themselves at home, we just tell them to go, and we see those very sick ones only so that's how we manage the clinic [and] manage the patients. Ah currently um, especially the Government Nurses currently

we have two are finishing now, going out retiring ah, we have two-two sick ones, three sick ones, they are going on and off, on and off so-so that's how we work but we still manage.

Fiona, F49, HCW/Nursing OIC, General services
Urban Day Clinic, National Capital District

Staff shortages

Highlighted during the pandemic was the concern of a lack of health care workers generally, with staff retiring, staff terminated on disciplinary grounds, staff who were in mandatory isolation for COVID-19 infection, and staff who have died, many of which had not been replaced (see Annex 1 – Table 10). While these factors were not all necessarily a result of COVID-19, they were compounded by the lack of staff not coming into work due to being of older age (described above) and/or fear of COVID-19 (described below). The COVID-19 pandemic occurred in the context of an already depleted and aged health workforce.

Aging work force we have too many aging [in the] workforce. And those ones who have retired have not been replaced; those ones that have died have not been replaced; those ones who have been terminated for some disciplinary ground; we have not replaced them yet. So, the gap is still widening, the gap is still widening.

Kerapeng, M (age not reported), Key Informant
Provincial Public Health, Western Highlands Province

The need to train and deploy health care workers to support the COVID-19 pandemic response, including being trained to support triage, testing, vaccination and surveillance activities, again compounded systemic workforce shortages. In some contexts, highly trained health care workers, including family planning nurses and midwives, were sought to undertake COVID-19 training and be deployed to the pandemic response, reducing both the number and the skill base to continue the provision of non-COVID-19 related public and primary health services.

Yeah, it affected a bit and also it added a little load on the staff whom we left to work directly in the health centre. When they pulled us out, the staff strength went down, So, when the patients came to the health centre, those poor remaining staff had a bit of hard time working because their staff strength was down, and they pulled us out.

Tobras, M61, HCW/Nurse, General & COVID-19 services
District Rural Hospital, East New Britain Province

Fear of COVID-19

Heath services were sometimes disrupted as health care workers refused to come to work out of fear of being infected, vaccinated or having to care for COVID-19 infected patients. Others who came to work refused to be involved in the care of those with COVID-19 and claimed they were not trained or were not adequately provided with Personal Protective Equipment (PPE) to do so. There was a general feeling that only those who had attended specific training for how to identify and manage COVID-19 patients should be involved in their care. In some situations, fearing a patient had COVID-19, health staff would refer them onto another facility for management and care.

Yes, some bad side that is happening is that COVID-19 came, and the doctors and nurses are also scared and some of them do not come to work. So, when we come, they normally say, 'no! sik KOVID-19 [COVID-19] came and they are not coming to work.' And so, we used to leave and go back.

Molina, F22, Client engaged in TB services
Provincial Urban Hospital, Eastern Highlands Province

It is still a problem because some didn't [attend] in this training and if a patient comes in and they suspect them with COVID-19, they would say, 'Look for the ones who were in training. Look for them because they are also scared'… Maybe one of them came, he/she was scared but was brave enough to come and approach the patient and assured him/ her but most of the nurses are scared and they ran away. They locked themselves and stayed. So, I see that this will still be a problem if there

> *is an outbreak. If we detect some positive cases most of the nurses will run away and they wouldn't attend to the patients.*
>
> Clarise, F43, HCW/Clinical HEO, General services
> District Rural Hospital, East New Britain Province

An absence of training in COVID-19 generally, but also specifically in the management of COVID-19 patients, created fear of COVID-19 and resulted in staff not attending patients, or being afraid to manage and care for patients. In one setting, a staff member refused to be moved to support a busy clinic, hesitancy which appeared to be influenced by the death of one staff member and knowledge of another colleague who contracted COVID-19 in that setting.

Despite their fear, many health care workers continued to work to ensure quality and continuity of care for their clients. That health services continued in PNG during the pandemic, shows the level of commitment and dedication many had, even though they may have held the same fears as other health care workers.

> *They gave us a staff, but the staff said, 'I did not apply for that position [and] I'm not sure what kind of duties I will actually perform. I'm afraid of the job. Because it will be a burden to them that instead of working on the patients, they will be teaching me again. That would be bad. It would be better for someone who is trained for the job'. So, we were desperate for staff but that was [not possible]. The HR [officer] saw us on the road and told us, 'Sorry, the staff we selected to come here, is scared to come.' Her explanation was that, she said, 'I didn't train on that. I did not even apply too.' We really need someone but since there's none we leave as it is and we accept that.*
>
> Annie, F49, HCW/Nurse, HIV/PPTCT services
> Urban Day Clinic, Eastern Highlands Province

Perhaps in considering their role as a health care worker some health care workers spoke of the health workforce as not only afraid of contracting COVID-19, but also of passing it onto patients under their care. This was particularly so when staff were being moved to different departments, wards, and services within a facility. This fear of nosocomial COVID-19 transmission was also a

concern for inpatients. One participant described how all the focus was on outpatients, with good screening for those coming to the hospital, but adherence to IPC by the health workforce led to the inpatient outbreak.

> *Infection was coming up here, it was rising and then into the ward. Patients were going down and then we were just infecting each other. And Doctors were infected as well because during rounds, being with the patients and the nurses like they would say that ah; masking was not really taken in onboard. They thought they were smart, and they were doing this, yes, smartness was there, thought 'I would not get it because I'm a nurse or because I'm a doctor.' But then not long after that, everyone falls, they all fall with the illness, but we tried our best, we were at the back of the nurses and just reinforcing them to overlook at themselves. Anyone presenting with any cough, flu symptoms, we were pulling them out from the workforce, pushing them in for testing.*
>
> Lenora, F55, HCW/Management, General services
> Catholic Urban Hospital, East New Britain Province

There was also concern for overcrowding in the outpatient areas, with rooms that lacked ventilation, leading to health care workers being concerned for both themselves and their patients (see Section – Health Service Delivery). Despite these fears and concerns, clients, community and health care workers reported that some health care workers were continuing to work and provide services to their clients.

> *When we come and see that there are no workers, we go back again. And when we come back the next day, only one was there, and they used to say, 'No, it is because of COVID-19, all the nurse and doctors are scared, and they are not coming to work. I am the only one here, so it's okay, I will serve you people. And you people already know the coronavirus rule, so you people stay afar apart, wear your masks and stay and I will serve you people.'*
>
> Molina, F22, Client engaged in TB services
> Provincial Urban Hospital, Eastern Highlands Province

With the COVID-19, then you know many officers were scared. They were scared and they did not go really close to those people who were having cough or shortness of breath and as such. So only few were handling the sick people with compassion, and they were counselling them, giving treatment and like that and they took them down [to main hospital], referred them as such, but many workers heard the name 'COVID' only and they were scared.

Ainna, F52, HCW/Nurse, MCH services
Urban Day Clinic, Eastern Highlands Province

Health workforce transport during COVID-19

COVID-19 lockdowns and movement restrictions significantly impacted the ability of staff to get to work, increasing staff absences for those who used public transport and had no access to other forms of transport. In some instances, health care workers reported being denied access to transport services due to being a health care worker because of a fear of COVID-19 infection, directly impacting health care workers' ability to get to work. In many instances, where a vehicle was available at a health service, including ambulances, this was used to transport health workers to and from the health service. For some services, this was managed through the collection of individual health care workers, for others a centralised pick up and drop off location was arranged to manage the transportation of multiple health care workers. However, it was also acknowledged that the use of service transport directly impacted client transfers and emergency transport. Given the problematic transport access for staff, some facilities developed specific staff housing on site. Whilst this was not an adaptation for COVID-19, the provision of staff housing within those services directly reduced the impact on lockdowns and transport barriers during COVID-19.

3.2.2 COVID-19 education and training

Access to training, and to trusted information and awareness-raising activities, proved important in increasing health care workers' resilience and their ability to adapt.

When COVID-19 came, I had an experience with a District Health Facility that encountered a COVID-19 patient, who was already positive. And when the ambulance went to pick that patient, you know it was for the first time, and the police also went together, and the people panicked. And when it happened like that, and at the facility level, you are talking, those workers there, whose ages are already over 45 years, so they were afraid, and for the first one or two weeks they didn't come to work. There were few of us who were thinking that we would stay, so we maintained during the period when it first came and when the people were afraid. Many of our aging staffs didn't come for work, so it was only us a few active ones, we stayed and worked and tried to maintain and follow all the new norms introduced due to COVID-19. We have tried to follow these, and it did not go away slowly. But all these awareness and trainings came in and started to educate us the workers gradually and then we started to come back. Somehow, we adjusted and coped with this problem of COVID-19, and we came through then and now we are staying.

Aiyah, M44, HCW/Nursing OIC, General & Management services
Urban Day Clinic, Eastern Highlands Province

Training in COVID-19 was not universally provided, with a significant number of health care workers across all provinces and health facility types speaking of COVID-19 training in terms of its absence. Health care workers working within a management role or seconded to COVID-19 teams were more likely to report that they had received formal COVID-19 training and awareness. For other health care workers, education and training was absent, something that 'others received'. Information received from the training sessions did not always effectively filter through to the workforce for informal and on-the-job learning.

There [is] information coming from the department [health], a circular comes or instructions that come then we would follow them. However, I don't think we are well equipped to handle this [pandemic] if there is a huge outbreak. I mean in terms of training and as such, I don't think it's adequate … I don't know whether it is for the sake of allowances or for the sake of what it is they often exclude us out and they (people in

management team) themselves attend those trainings. When they came back, and they are not doing anything here.

Alu, M64, HCW/Theatre technician
Urban Day Clinic, Eastern Highlands Province

Yeah, the people who organize, as I did not take the COVID-19 training but there were another four officers so I wouldn't know what they may have discussed with them. They are working with the four officers that have attended this COVID-19 training. I do not know what they said in case I might say something that I do not know therefore, I do not know what to say.

Talita, F42, HCW/Community Health Worker, TB/HIV services
Rural Day Clinic, Madang Province

This absence of training not only impacted health care workers' ability to work in a COVID-19 environment safely and efficiently but was also reported to be a reason for not providing care to patients.

Those ones who didn't attend the training would ran away. So, I have already noticed it with this patient. I heard rumours that all of them ran to the MCH room and stayed quiet. They didn't want to come attend to the patient. So, another officer came and talked with the patient and then they called me from Kokopo, and I called St John's [Ambulance Service] and they brought him to [the Base Hospital].

Clarise, F43, HCW/Clinical HEO, General & COVID-19 services
Provincial Rural Hospital, East New Britain Province

Content of COVID-19 training received

Health care workers who attended COVID-19 training reported that information was received through formal training sessions, informal debriefing between teams, service-based circulars, informal discussions and on-the-job learning. Most commonly, this training was described as short, one-off presentations on

the way to use PPE. Much of the training included general information relating to COVID-19, prevention of COVID-19 and use of PPE.

> *We received this training. It wasn't a training where we attended for some days or whatever. They just came and showed us how to use the PPEs and that was all. They came for just a day and demonstrated on; how to use the PPEs, gown on and off. That was the only training and we headed straight into work. Because there was no proper training where [they] said, "oh, we will take you there to attend this training like that for the [COVID-19 program] for this number of days." No, they just showed us this and that, and that was finished.*

Tobras, M61, HCW/Nurse, General & COVID-19 services
District Rural Hospital, East New Britain Province

While many health care workers did not speak about COVID-19 triaging as a specific training component, those who had attended training on general prevention were more likely to report that they understood the process required.

> *…whoever has flu and what (running nose), do not stay inside here. You go and stay outside, because we did awareness...*

Alu, M64, HCW/Theatre technician
Urban Day Clinic, Eastern Highlands Province

> *Some of us, we are not being you know taught to do a proper triage and all these things, so there should be somebody who can bring a professional, can be, yeah, train someone to yeah of course, train someone to do triage properly.*

Gladys F44, HCW/Nurse, MCH services
Urban Day Clinic, National Capital District

Only those staff who would be involved in COVID-19 triage and testing appeared to be provided with training about testing.

> *For us, we had one, two, about three went for [COVID-19 testing] training but we did not do it … [Sometimes there are no tests and sometimes] the person who is going to do the test is down with Covid so he cannot do it.*

Talita, F42, HCW/Community Health Worker, TB/HIV services
Rural Day Clinic, Madang Province

Less commonly reported was the provision of training for caring with patients with COVID-19. Where this was reported it was reported from health care workers in provincial hospitals in rural and urban locations and within those services that had developed standard operating procedures for COVID-19 (see Section – Health Workforce).

> *In here we do not attend to the very sick ones, so I think this training applies to the ED [Emergency Department] and all that because they attend to patients every day. We mostly attend to those who are not so sick when they come, we practice this hand sanitizing and wearing of facemask.*

Trisha, F35, HCW/Nursing OIC, HIV services
Provincial Urban Hospital, Madang Province

Health workers described being trained in COVID-19 vaccine awareness and COVID-19 vaccine administration. Similar to COVID-19 testing, training delivered for COVID-19 vaccination appeared targeted at the staff who would be doing awareness and vaccination.

> *I did go for vaccination [training]. So, in the facility I am the vaccinator, there are two of us … We attended the vaccination training that was held in Madang Resort, and we came back. So, we did an in-house [training] for our nurses and we expected them to be vaccinated but unfortunately, our vaccine fridge is damaged and none of us was vaccinated … As for this training like I have mentioned earlier, the two of our male staffs, the CHW attended it as for other facilities those people who were trained for screening they went back again for vaccination.*

Daphne, F54, HCW/Nurse, HIV services
Rural Day Clinic, Madang Province

3.2.3 Health workforce adaptations

Health service hours of operation and workforce rostering

After an initial reaction of fear of COVID-19, several health care workers went on to describe the importance of learning to live and work with COVID-19, adapting their services to enable the continuation of health services and care. Some health services described reducing the hours of operation to ensure that health care workers could get to and from work. For example, an urban clinic in the Western Highlands Province changed their service closing hours; prior to COVID-19, the clinic had closed at 4pm but was now reported to close at 2pm, because most of their staff live outside of the central business area. Some settings reported no specific changes to shift patterns or changes to routine work. Others reported disruptions to transport having an impact on staff arrival times, disrupting shift turnover and the opening of services. At times staff lateness and staff shortages left patients waiting for their care, being told to wait for the new shift of staff arrived.

> *Yeah ah, it's like what I mentioned before, like the night shift nurses they continue working right until the AM staff. That's the time, the PM and AM…shift, so there's a lot of like, argument amongst themselves due to lateness where the nursing officer on duty will say, "I am due for the shift, but you didn't make in on time and I am filling-in for you." Sometimes the patients become the victims as the nurse [on duty] would say, "this is not my shift, you have to wait for that particular nurse as it is her shift so in the meantime you can sit down and wait until she comes in." However, for an asthmatic child it is an emergency where I do not have to wait as he can die anytime so it is indeed a grave concern as well.*
>
> Flora, F39, Client engaged in MCH services & support worker PLWD
> Catholic Urban Hospital, East New Britain Province

> *Yes, we had enough. Now because of COVID-19, some are at North Goroka, some are at [the clinic in West Goroka], and six of us are here… I used to have 9, uh I mean 13. We used to have 13 [staff]. When we were displaced, they put us in you know those 3 clinics, that's why people want to stay wherever they stay…And they thought that this one*

[clinic] won't cater for so many, now we are seeing a lot of them and we are really exhausted but, yeah, we make sure we live.

Balah, F57, HCW/Nurse, MCH services
Provincial Urban Hospital, Eastern Highlands Province

Other services adapted by rescheduling staff rosters and shifting roles and responsibilities to allow for the continuation of key services to be provided at the facilities. Different settings developed their own ways to tackle issues relating to staff shortages and managing a new way of working. While some facilities adapted and managed with the workforce they had, others described movement of staff from within and outside the facility. This particularly seemed the case with staff who had been trained to manage COVID-19 patients. In an urban Catholic Hospital in East New Britain Province, rosters were adjusted to account for the time that people would need to travel to and from work. In an urban clinic in the Western Highlands Province, staff who could not travel to work were placed on sick leave to focus on transport provision for those staff who lived closer to the health service or alternatively were told to stay home if they could not access transport.

During this time? No, we were with our own staffs, but we were doing, just reshuffling yes. And reshuffling was mainly these two departments that they would bring the staffs out to outpatient and maternity and paediatric medical ward. But no new ones from outside coming in, it was still our staff.

Lenora, F55, HCW/Management, General services
Catholic Urban Hospital, East New Britain Province

Yes, they moved staff's fair bit, uh especially the midwives. Some of the midwives were trained so they moved around. I think four or five midwives were actually had COVID-19 training as well and they just came in as casuals as well so that's why were moved around uh quite a fair bit fitted into roster. And then from time to time we were complaining, I was complaining ..., But other than that us the medical team no, we were just performing our normal duties.

Albert, M44, Key Informant
MCH services & Provincial Health, Madang Province

Health care worker communication and information sharing

The way that health care workers gathered, communicated and shared information with each other also adapted, with use of mobile phones and platforms being described as important in the way that health care workers communicated and shared COVID-19 information, education, and support during the pandemic. The use of WhatsApp as a communication and information sharing platform was reported in East New Britain Province, the National Capital District and across the Catholic Health System. The increased use of online conferencing software was also described as an adaptation during COVID-19.

> *From Catholic Health Services we had our WhatsApp group on information received from the office, who are basically the ones who are giving us information about COVID-19 the current and statistics and so we share information and others are sharing what's happening in their facility and all these things so, I'm also in that group so I also read about information's about COVID-19 and what's happening.*
>
> Renita, F52, HCW/Nursing OIC, HIV & STI services
> Urban Day Clinic, National Capital District

> *With training we, where in trainings we had through our partners Burnet Institute they were very helpful too, you know at least to guide us give us some information on how we could enforce and implement infection control activity in the hospital. So, there were very helpful trainings I forgot to mention that we had zoom trainings also supported through our partners I mean deliver through our partners for inner trainings. So, it was very helpful and even the modules for infection control on COVID-19 modules that we were able to do online.*
>
> Sylvia, F46, HCW/Nursing OIC, Infection Control
> Provincial Urban Hospital, Western Province

3.2.4 Future needs

COVID-19 has taught many health system lessons, not just how to manage patients but how to prepare and have specialist staff on hand ready to support any further pandemics. Human resourcing is central to ensuring preparedness for the future and this includes not only having an adequate number of health care workers but ensuring they have been adequately trained and equipped.

> *Training as well is also another one [need]. Training and refresher because we could get trained now. Ten years down the line we didn't do a refresher so we need to get trained again – but there should be experts in these different fields that we can tap into when we need so we are not always relying on outside. So now is also a good time that these are some of the lessons that we've learned. We need to have epidemiologist. We need to have data managers, you know. We need to have critical nurse – critical care nurses and anaesthetics, we only have seven…. And provinces have been given a what we turned capacity assessment, yeah. Capacity assessment to all that, they got back to us for how many they needed you know they identify their own gaps, in main power, in structures and in the system. So that was actually the provinces who told us, "I need this manpower, I need this number of beds, number of oxygen concentrators", but I also need specialized skills that in terms of critical care and whether it's an anaesthetist, emergency physicians, and I need the resources for these you know, I need the money, I need-. So, actually the province has to give us those (that) information and there we have to put them all together and give that to the Prime Minister under current minister.*
>
> Graclyn, F43, Key Informant
> National Public Health & COVID-19 Response, National Capital District

3.3 Essential medicines

> *Yeah um, my other concern is the drugs, drugs is a big concern, [the] facility cannot run without the drugs, hospital or any setting cannot run without drugs, our drugs are not coming in on time so even I can't, I'm a health worker but if I don't have drugs, that's my tools to treat patients. So, I don't know, is our office failing or the supplier there? We need to have drugs come on time so in time, so that we can treat our patients.*
>
> Fran, F39, HCW/Community Health Worker, MCH & Outpatient services, Rural Day Clinic, Western Province

In this section, we examine how essential medicines were impacted by COVID-19 across the country and to what extent this as the same or different across the sites and the different health programs. Key themes discussed by health care workers, clients and key informants related to a shortage of supplies as well as issues of procurement, and how healthcare workers sought to ensure availability of key essential medicines at their facilities by implementing user fees, with the income used to supplement increasingly scant health facility supplies. The lack of essential medicines had an impact on health care workers being able to provide the service they wish to, and clients were often asked to procure their own prescriptions at the town pharmacies.

3.3.1 Essential medication shortages

Most participants spoke of a shortage of medical supplies, including essential drugs. While this had been somewhat exacerbated because of the COVID-19 pandemic, there was overall agreement that the issue of supplies is a longer-standing, and systemic, issue in PNG.

> *The shortage of drugs is an ongoing thing, even before COVID-19 shortages of drugs has been an ongoing problem, I'm not sure how we are going to address it, how we are going to resolve it, but it is still*

ongoing. Ah COVID-19 well maybe but otherwise shortages of essential drugs have been an ongoing problem even before COVID-19 came up.

Stan, M49, HCW/Manager, Infection control
Provincial Urban Hospital, Morobe Province

Yes, we also did experience such stock out before COVID-19, [we did experience it], and now it's happening again. Before COVID-19, there were such issues happening as well not only now.

Daphne, F54, HCW/Nurse, MCH services,
Rural Day Clinic, Madang Province

Health care workers from all provinces reported not receiving their supplies from area medical supplies (AMS) due to stockouts for essential medications, including those used to treat malaria, TB and HIV as well as antibiotics, such as amoxicillin, and pain medication, specifically paracetamol. Others reported not receiving their supplies because of workforce shortages (see Section – Health Workforce), as they were unable to complete the required paperwork to request the supplies from AMS. Issues with stocktaking and ordering were compounded by the impact that COVID-19 had on all the health system building blocks, but particularly health service delivery and health workforce. Without the necessary reporting, the further supply of drugs and consumables could not be released.

Other health care workers reported no change in their supplies being received from the AMS, although the amount received was insufficient for the need of the community. This was felt more so with the increased population in PNG generally, but also due to the movement of people through the community and from urban to rural areas because of the COVID-19 pandemic and lockdowns. The increases in the population, together with those seeking care outside of their catchment areas, intersected with a lack of staff and closure of facilities, leaving patients with no option but to seek services elsewhere, resulting in an increased burden on services. Facilities were running out of supplies because patients were moving around and attending facilities out of their catchment area, exceeding stock ordering predictions.

The flow of the supplies is fine, but you know at [the] health centre usually has what would I say? It has its catchment areas, the number of population under this health centre catchment area, the number of people are under the care of the health centre. So, the supplies that come are based on the how many population [served] under the supervision of the health centre. But you know the health centre—the population which [this] health centre takes care of [and] with the population which another health centre looks after, when they come, they quickly make us run short of supplies here… The people who were displaced by the volcano … When they come here, they exhaust the supplies for the Tatavul people here.

Tobras, M61, HCW/Nurse, General & COVID-19 services
District Rural Hospital, East New Britain Province

The availability of supplies at some facilities, in particular Paracetamol and Amoxicillin, has been insufficient since the pandemic began. As some facilities scaled down their services due to shortages of staff, people in need of treatment sought care elsewhere, placing an increased burden of supplies on other services not equipped for an influx of patients and their treatment needs. Even where supplies could be sourced from the AMS, there was also mention of a longer turnaround in processing requests due to COVID-19. In Madang and Western Provinces there was also concern that the lack of drugs at the health facilities was due to the supplies being taken from the facilities and being sold on the streets during the pandemic.

Yeah, I mean last month ago. And I begin to work out that these drugs are passed out from here to the street that's why we are running short of drugs.

Fred, M45, Community & Hospital security officer
Provincial Urban Hospital, Western Province

Outside Mugil's catchment area. Then lately our sister [a health] facility, eight of their staffs were down with COVID-19 so they scale down. So, patient [living] close like Talidi, Banam [and] Burunas are coming to us.

> *So, we are still like that, yes. Patients [numbers] go down only when we are short of drugs and when we said, 'we don't have syringes at the moment. We didn't receive our orders for September and now November is here [but] still order is not here; we are running low with these supplies maybe due to COVID, or we are not sure. No syringes, no gloves and also there's a shortage with the drugs. So only this resulted in the decrease in the flow of the patients. If we have all the stocks and fully stocked, we would still have patients coming.*
>
> Daphne, F45, HCW/Nurse, General & MCH services
> Rural Day Clinic, Madang Province

While many of the participants spoke of a shortage of key essential medicines and commodities, including family planning methods, childhood immunisations, antibiotics, syringes, gloves, Paracetamol, TB and antiretroviral drugs, this was not reflected on the data collected at the facility level. In Table 11 (Annex 1) we report the availability of and access to essential medicines and consumables and resources, including access to essential medicines and RDTs reported in the facility review.

Common contraceptive methods, including the oral contraceptive pills, Depo-Provera injection and condoms were reported to be available by 42-49% of all respondents. There was little change in the ongoing lack of availability of these contraceptive methods during the COVID-19 pandemic.

Of the 33 health facility respondents who completed the facility review, up to 40% stated that the extended program of Immunisation (EPI) vaccines was available at the health facility they were working at. In terms of availability of essential medication, including antibiotics and first line treatment for malaria, 35-50% of the respondents reported that items were all currently in stock. There was no change in the availability of antiretrovirals for prophylaxis for HIV exposed newborns, and second line treatment for severe malaria was reported in two thirds of facilities; however, this availability did not always extend to the clients requiring HIV treatment medications. This issue was not discussed by health care workers in this study, except as being generally overburdened due to workforce shortages. Availability of rapid tests for HIV, malaria and syphilis was reported by less than 45% of respondents (see Annex 1 – Table 11). Changes in the availability of essential medicines due to COVID-19 cannot be determined by this data.

Yes, and with gloves too, the supply is not coming very much. The supply of the health centre keeps on running out because as I said, the catchment populations of other settings keep on coming here so our supply here keep on finishing quickly. Inside the facility, the gloves with the masks are the problem, and the syringes to work on the patients. The syringe we are using, if I tell you would not want to hear it. One syringe, I now use it for you, I would rinse it in the sterilized water, and I would keep it and then I would use it on you for the next dose, and then next dose and next dose until four doses until you are stabiles your shortness of breath or whatever.

Fenela, F44, HCW/Nurse, General & MCH services
Rural Day Clinic, Madang Province

One participant reflected on receiving orders not reflecting the actual order placed, with some facilities receiving items they will not or cannot use, such as intravenous fluids, or excessive boxes of oral rehydration solution (ORS) that were not needed, thereby wasting essential medicines.

Medicine supply is a problem, we don't get them on time, like I said we, most of the time we depend on [the] outstations, when they get the full stock of the medicine supplies they had, they will [have] excess so we always communicate with them to, if they have excess on their shelves, please bring some for MCH clinic so they bring them up but it does, they do come but not on time, yeah. But not most of the drug cartons that we receive are necessary basic drugs, there's a like, like last time we received 103 cartons, but those cartons are all the, only or three or few cartons tasol yah [only!], [are] basic drugs, like they might put plenty, two or three cartons are ORS packets, we don't have plenty of diarrhea cases where you will put [plenty of them], or there's um, safety boxes, how many boxes have safety boxes but we don't really need those safety boxes [planted] many or [IV] fluids like um, normal saline yes 4.3%, all this okay but like ah, Hartmann's [solution], they might put five-six cartons only ya, it's not really [needed], but we, we take them down to Kiunga General Hospital gets them, yeah.

Fran, F39, HCW/Community Health Worker, MCH & Outpatient services,
Rural Day Clinic, Western Province

3.3.2 Procurement issues

Linked to the shortage of drugs and supplies, participants spoke of a breakdown in communication and action between health department orders and logistics. There was some thought that the logistic companies moving and supplying the drugs and equipment were not being paid, and therefore not distributing the supplies. A breakdown in the supply chain demand, with goods not getting through, led to a shortage of drugs in the area medical supplies and the knock-on effect was an inability to be able to fulfil all orders. These delays, while ongoing were thought to have been made worse with the COVID-19 pandemic.

> *The department financing was okay, sending the medicines here but the way it comes here like plane or sea or what, you know it has to come under quarantine and all these kinds and it slowly reaches the place in bulk and in good condition, so we still receive them.*
>
> Bolboll, M54, HCW/Community Health Worker, HIV services
> Provincial Urban Hospital, Eastern Highlands Province

Participants described the need for developing a new system to procure regular supplies with a supply chain at the Provincial level, rather than centrally.

3.3.3 Impact of shortages of essential drugs

Impact at the facility

As a means of being able to continue to provide a service for their patients, a number of health care workers from across all Provinces, urban, and rural locations, and Catholic and government services for HIV, TB and maternal and child health spoke of borrowing medications within a local service network.

> *For our case we start borrowing from other clinics to maintain our flow of patients to come and collect their ART. So, to get ART there are lots of things that happen, continue getting and suppressing the viral load so that infection they don't infect anyone else. That's why we try our very best to make sure that we have ART around so when we see we are*

running low, we run here and there looking for elsewhere so during the COVID-19 we maintain our patients.

Bolboll, M54, HCW/Community Health Worker, HIV services
Provincial Urban Hospital, Eastern Highlands Province

In other instances, and again across all provinces, locations, service types and management, many clients and health care workers reported the charging of user fees when clients attended for care. Where client fees were charged, these were used to buy essential drugs from private pharmacies, which were then distributed in the health facility.

Before COVID-19 came too, we used to have shortage of drug supply until now. There used to be times where there are no drugs. So, what we do, we get the user fee again and we used to go and purchase again at the pharmacy at Tropicana [Private Business], just like to cater for the time being when there are no medicines at AMS. Some of the order comes, but how they unpack and such, they don't do it quickly. They do that and for us here, because it's a big catchment [area] so the drugs always run out.

Lola, F34, HCW/Nursing OIC, TB & HIV services
District Rural Hospital, East New Britain Province

In other situations, staff provided patients with a prescription to buy their own treatment at the private pharmacy. This was not only for one-off treatment such as antibiotics or pain relief medication, but also for patients on long term treatment. One respondent reported asking a patient to buy a syringe for an antibiotic injection. When asked or advised to purchase their own drugs, health care workers advised that the items are purchased at a pharmacy, and not from market traders where medicine may be substandard.

Impact on workforce

Health care workers reported not being able to offer the service they want to, and for which they are trained and employed to give. Having to refer patients to

pharmacies to seek treatment, or simply not to be able to offer the service need, made several participants felt distressed and guilty at being unable to provide appropriate care.

> *[We refer them] down to the main hospital, and to get from the dispensary. However, when there is absolutely no injection, and if a patient needs it is about to die, we always cry with the patients. Or if there is no IV [intravenous] fluids to put into a patient who really needs it, then we suffer together. We lift and carry [transport] them down to the A&E [Accident & Emergency]. And at the A & E, if the patients goes and waits for another hour, they die in front of their eyes. It's like that so we always put the drip here, give them injection to stabilize them and then bring them there.*
>
> Annie, F49, HCW/Nurse, MCH services
> Urban Day Clinic, Eastern Highlands Province

There was also concern for not being able to provide basic routine care for pregnant women, with a lack of fefol (iron and folate) for treatment of anaemia and syphilis test kits.

> *Ah that's the most shameful thing we do, yes we are sending them to private pharmacies to buy medicine, and we shouldn't be doing that, we are the bigger health care facility and we are supposed to be, we are supposed to have all those things available for them but unfortunately we are giving them prescriptions to [go and buy] and in fact for some that we are telling them to go and buy their own scalpel blades and even the stitches or even painkillers, that's how serious this thing is.*
>
> Stan, M49, HCW/Manager, Infection control
> Provincial Urban Hospital, Morobe Province

In relation to health care workers working in the pandemic response services, health care workers trained to provide COVID-19 vaccinations were unable to provide this service due to a shortage of vaccinations, and/or due to the lack of cold chain supply logistics and refrigerators to transport and store the vaccines.

While much attention has been given to vaccine hesitancy even among health care workers, being able to be vaccinated was not always in their control.

> *Yes, I did go for vaccination [training]. So, in the facility I am the vaccinator, there are two of us. We attended the vaccination training that was held in [a] Resort, and we came back. So, we did an in-house [training] for our nurses and we expected them to be vaccinated but unfortunately, our vaccine fridge is damaged and none of us was vaccinated. We're supposed to go to [the health service] and get it but we were tied up with all kinds of hospital work. And when we travel on PMV into town to [the health service] you would wait for a long time there. So, we didn't get it and most of us said that we want to get it at our facility and that's why we [didn't get it].*
>
> Daphne, F54, HCW/Nurse, MCH & General services
> Rural Day Clinic, Madang Province

Impact on clients

The impact of seeking and receiving treatment was discussed by participants across all provinces, including health care workers and engaged and disengaged clients and community support workers. Both health care workers and clients described being asked to purchase treatment – pain relief medication, antibiotics and malaria treatment – from private pharmacies. Reflecting on the lack of supplies of essential medicines at the facilities, health care workers spoke of their concern for their clients; providing a prescription is not the same as providing care. One health care worker in NCD spoke of her concern, recognising that at times clients do not always attend a pharmacy with their prescription, returning to the facility a few days later with the same complaints, having been unable to pay for the prescription.

> *But then when we give them prescription, we don't [know], whether they go buy or not, we don't know, many [patients] use to come with the same problem again, hence, we know that they didn't go and buy the medicines.*
>
> Fiona, F49, HCW/Nursing OIC, General & Management
> Urban Day Clinic, National Capital District

In another setting, a disengaged client reported being sent to the pharmacy for malaria treatment without a prescription for the correct malaria treatment.

> *Well, the last time I came to [the] Urban Clinic was last year. I come and get my medicines which are doses. They sometimes or mostly write prescriptions and refer us down to the pharmacies/chemists to get [buy] medicines. But yeah, normal for malaria, they just give [supply] Panadol and Amoxicillin and yeah, that's it. They don't just give the exact [right] malaria medicine. They just refer us down to the pharmacies/chemists, "go and buy medicine from the store [chemist] and drink it."*
>
> Abel, M19, Client disengaged in Malaria services
> Urban Day Clinic, Morobe Province

In addition to the cost of prescriptions, there were also additional costs to the clients and patients having to move from facility to facility seeking care and treatment. (See Section - Health Service Delivery). This was also an issue for clients on long term treatment, such as ART for HIV and TB treatment. Health care workers and clients commonly reported the changing of quantities of medications supplied during COVID-19; however, the experience of this practice was not uniform. For some, this involved provision of less treatment medication than standard guidelines recommend, such as only being provided ART for one month rather than three months at a time. In other instances, treatment medications were being provided for longer durations, a practice undertaken because of the uncertainty of public lockdown/facility closures. There was also concern of an increase in TB due to interruptions in the supply chain at provincial level.

The impact of supply- and service-related shortages and stockouts of treatment medications was significant. For example, one participant described the devastating effect a lack of ART was having on some patients, seeing a difference in the health of HIV positive clients because of a lack of treatment. One community support worker in East New Britain Province described having to make decisions to prioritise who to provide treatment for. In another setting, Morobe Province, one informant spoke of infants not being commenced on ART until they were two months old because of a disruption to supplies due to the COVID-19 pandemic. However, this was not a universal experience, with some participants describing receiving guidelines approved delivery of treatment medications – and in some cases being supplied with extra due to health care workers' understanding the impact that the COVID-19 pandemic, service closures and movements, and public lockdowns had on clients' ability to access services for treatment (See Section – Health Service Delivery).

> *There are many people who come just for…. just because we are running short of the ART treatment, I normally give them enough for a month or two and later they come back. If they have other problems or sick apart from HIV then they will come so I usually tell the people over there. If they come like that then that is fine, I accept them and treat them by myself … We are still running short of supplies. So, I would go and just get limited stock so I don't feel good when I come here, because imagine, you are distributing these 90 tablets amongst three clients for one month's supply but also consider the distance that these poor ones will have to walk. If they don't come, they have to walk, and I am not happy with that.*
>
> Tania, F58, Community member & HIV treatment support
> Rural area, East New Britain Province

> *Okay, concerning the drugs, yes, it is true that we have faced a big crisis with the drugs. The drugs supply for us did not come and we faced huge challenges. With regards to children, especially about the paediatric, it is true that many of them did not receive their medicines. They were at home for maybe almost two months or one month. The children didn't receive their drugs because the drugs didn't arrive during this time because of COVID-19 which had affected the transportation of*

drugs. For adults, some drugs didn't come as well. Okay, let's say you are on a drug and if that drug did not come then they will try to put you to another drug again and this becomes a problem for us at the clinic. So, in saying that they have done that to many adult patients. Besides that, there was nothing wrong with us adults as we were fine with our medications. Yet, it is only the children that we had a big concern for them in this time. The issue of COVID-19 has affected the children very much.

Kia, M47, Peer counsellor & Client engaged in HIV & TB services
Provincial Urban Hospital, Morobe Province

3.4 Health financing

Well, one thing I saw about COVID-19 concerning our work was funding. The government was concentrating only on COVID-19 but other major [infectious] diseases that were here before like Tuberculosis, Leprosy and HIV are now creeping [reappearing] up again. They are still here but they [government] were concentrating more on Covid-19, which we saw was not really fair. Like COVID-19, it just arrived, and it came to stay, but there are other infectious diseases such as TB, and Leprosy are on the rise. With regard to funding, we saw that the funding from the government and the NGOs spent big amount of money into Covid-19 and we see the other sicknesses are still remaining.

Lola, F34, HCW/Nursing OIC, TB & HIV services
District Rural Hospital, East New Britain Province

In this section, we examine how health financing was impacted by COVID-19 across the country and to what extent this was the same or different across the sites and the different health programs. Key informants and health care workers engaged in this study described increasing challenges due to the COVID-19 pandemic. Adaptations to funding sources were experienced, re-direction of funding for other health related issues remained a challenge and resource

allocation to respond to COVID-19 was initiated across the country. The following will examine the impact on health financing during COVID-19 as well as sources and use of funding relating to COVID-19.

3.4.1 Health financing during COVID-19

Key informants and health care workers indicated a desire for health finance planning to strengthen sustainability and support consistent funding flows through to health activities, including transportation support, essential medicines and health service delivery (see Section - Health Workforce, Essential Medicines and Health Service Delivery).

> *The one thing I have observed is that the funding must be constant [consistent]. And if it comes and stops and comes, then the service would go up and down [fluctuate]. Under this funding, then it would cover everything like transportation, cars, medicines, equipment, or anything or like these things it would run smoothly. But the funding goes up and down [fluctuates] so everything goes up and down.*
>
> Ainna, F52, HCW/Nurse, MCH services
> Urban Day Clinic, Eastern Highlands Province

> *So, once it again comes back to us Papua New Guineans as the recipients of the funding as well, the assistance that we are receiving. It also comes back to us on how we really manage and provide report to the donor partners is another problem again. Sometimes the donor partners are willing to continue in supporting us; however, it is our failure on how we manage the funds, where we spend the funds and how we report it back. That is one of the situations that make the donors to pull out. So, we got like - for those of us receiving the donor funds has to be very mindful of how we spend the money, where we spend the money and how we report it back is another big issue.*
>
> Regina, F (age not reported), Key Informant
> National HIV Key Populations, Eastern Highlands Province

Several health care workers also described concerns of funding allocations being redirected from existing infectious disease programs and primary health care to COVID-19 (see Annex 1 – Table 13). In addition, healthcare workers experienced the increased burden of responsibility to respond to COVID-19 without additional funding support for specific treatment and response activities. Donor funding was described as an additional source of support for COVID-19 in PNG. Funding cuts were noted against existing infectious disease programs, impacting routine operations – including provision of treatment – across health facilities and hospitals. Adverse outcomes of this were that the gains made in response to other diseases like TB and HIV were now being lost.

> *Those other routine programs we need to continue while these other groups need to help COVID-19 or other pandemic issues. Then to just divert everything to that pandemic and forget the rest … A lot of women were actually not getting like tetanus toxoid or getting iron tables, or anti-malarial's all this, we had a long period of three or four months no Fansidar.*
>
> Albert, M44, Key Informant
> MCH services & Provincial Health, Madang Province

Whilst key informants and health care workers described challenges associated with resource allocation and redirection of funding, COVID-19 provided opportunities for some sub-national healthcare providers to leverage funding allocated for COVID-19 to share resources across programs and support additional activities within the province to operate efficiently.

> *There's not really a barrier but when you see that we talk about funding that came down from the different sectors and the support from the province itself, you will see that you can piggyback on that and that's how I see it. And I use that opportunity to 'piggyback on it to do my other programs, and that's what I see it and I saw that going. COVID-19, there is a lot of resources. Why not use COVID-19 so you can do other things?*
>
> Trevor, M52, Key Informant
> Provincial Public Health, East New Britain Province

3.4.2 Health care worker and primary health care payments

Throughout the interviews, healthcare workers described differences relating to payment and additional allowances for COVID-19 activities. Some respondents indicated that there was no additional funding for COVID-19 activities provided to healthcare workers, compared to others who received risk allowances, allowances to vaccinate and specific funding for frontline staff treating COVID-19 patients. This caused tensions within the health workforce. Issues were raised around delays in routine payment of salary and limited remuneration of additional days or overtime worked, with some healthcare workers describing months of delays to payments, resulting in closure of health services or the use of volunteer contribution to maintain service delivery for their community.

> *Okay, one big problem we currently have is that all the [specific health facility] staff in PNG, we weren't getting paid. We didn't have any funding, so we weren't paid, [but] we just bear with it and volunteer and help the patients. But you know sometimes, today life depends [heavily] on money, so we should have left work and go when we weren't paid, and treat patients properly, but we saw that isn't a thing that affected us the most. Even though we weren't getting paid, but we have the heart to help serve the patients and provide them with the best [services].*
>
> Annie, F41, HCW/Nurse, MCH services
> Urban Clinic, Western Highlands Province

Despite free primary health care policies, the majority of health facilities described payments being required for health services and drugs. These payments are then used to support facilities – in paying wages of ancillary and healthcare staff, facility operations and maintenance, and transport and logistics for care of patients. Throughout the interviews, facility staff described the impact COVID-19 has had on these funding structures due to lockdowns that resulted in a reduced number of patients visiting the facility and subsequent funding loss.

> *When COVID-19 came it did affect the cash collection because there were not many patients. Because we get money from the patients and from the drugs. Like when they pay, they pay for their drugs in the*

dispensary so that time when covid came and there was lockdown, there was no transport, so the patients didn't come.

Clarise, F43, HCW/Clinical HEO, General & COVID-19 services
District Rural Hospital, East New Britain Province

3.4.3 Use of COVID-19 funding support

Additional COVID-19 funding support was provided to government and Catholic health services to support infrastructure development, COVID-19 awareness and health promotion activities, safeguard the workforce against infection with additional PPE support, and establish testing, treatment and isolation facilities for health facilities and hospitals. Health facility staff also described the additional water sanitation infrastructure that was invested in to improve Water Sanitation and Hygiene (WASH) practises of healthcare workers during the pandemic.

Before it wasn't but we had tanks and our own water, we had toilets, we have shower also down there, but the sink put for washing hands is because of the COVID-19.

Fran, F39, HCW/Community Health Worker, MCH & Outpatient services,
Rural Day Clinic, Western Province

However, throughout health care workers described challenges with delays of funding reaching facilities to implement adequate triaging procedures, re-emphasising the funding flow challenges experienced within the health system prior to COVID-19.

We were waiting for funds to come into our area, the Sumkar District to buy all our things so we were already set up when the third wave of COVID-19 came, we were available. We were already setup so we could attend to cases, perform sampling, swabbing and such. However, nothing happened. We put tapes around the area, set up our screening points down there; we did all these things. However, just because didn't

have any funding coming into us, we tried until we gave up and the shelter collapsed, and we forgot about it and stayed until just recently.

Lance, M36, HCW/Nurse & Lab technician, TB services
Rural Day Clinic, Madang Province

In addition to PNG government funding for COVID-19, respondents also referred to several external funding sources that provided support to both routine and COVID-19 activities throughout this period. These funding sources included Australian Government Aid, New Zealand Government Aid, the World Health Organization (WHO), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), Australian Department of Foreign Affairs and Trade (DFAT), particularly the Health System Strengthening Program (HHISP), and charity donations. These funding sources were used to support infrastructure and hospital development, semi-permanent triaging stations such as tents, testing and treatment supplies and consumables, as well as PPE and communication materials such as pamphlets, brochures and information documents.

3.5 Health information systems

The challenges that we are facing that is affecting our work. It's like the manpower is down. We need manpower and then space too, and then like maybe due to our reporting, if we had more staff, we could do our reporting on time. The data is everything so it can go in time, the medicine too will come on time. And we don't have time to do the reports [attending to] all our patients are one challenge. It's like it makes us to do our reporting late, and the medicine to comes in late and such … What support do we need? We need a [dedicated] data clerk.

Annie, F49, HCW/Nurse, HIV/PPTCT services
Urban Day Clinic, Eastern Highlands Province

In this section, we examine how health information systems were impacted by COVID-19 across the country and to what extent this was the same or different across the sites and the different health programs. This section will also pay particular attention to the adaptations made to the COVID-19 surveillance program in PNG, particularly focussing on the flow of data from the health facility or hospital through to the national government agencies.

3.5.1 Adaptations to surveillance during COVID-19

In this study many healthcare workers referred to the ongoing adaptations of the surveillance and reporting requirements for COVID-19 throughout the pandemic (see Annex 1 – Table 12). They also discussed the introduction of additional human resources to specifically support surveillance activities within the province. At the national level, the surveillance team within the National Control Centre comprised of 30 individuals and within the provinces, healthcare workers referred to surveillance officers, responsible for swabbing patients and reporting critical information through to a health information system that separately to the national health information system.

> *COVID-19 surveillance. As for that, we just started doing the testing and such things. But in the past with other normal surveillance reporting, we are doing it to get in.*
>
> Daphne, F54, HCW/Nurse, HIV services
> Rural Day Clinic, Madang Province

Contact tracing teams were established during surge periods of transmission; however, difficulties were expressed with the volume of follow up contacts that required processing each day, increasing the stress on the heath workforce and therefore the health information system to accurately report COVID-19 case numbers and infections.

When we had some of the funding from DFAT [Department of Foreign Affairs and Trade] we recruited a team for the contact tracing. Contact tracing but then when there was surge, I tell you we had to do like 100 contacts in a day and it's very difficult.

Kerapeng, M (age not reported), Key Informant
Provincial Public Health, Western Highlands Province

Re-direction of human resources were noted by several respondents as staff were required to join the COVID-19 surveillance team within the province. Respondents noted that additional diagnostic tests such as the PCR and RDTs for COVID-19 enabled decision-makers to use diagnostic data reported into the system. However, study participants indicated the strengthened molecular diagnostic capacity for COVID-19 also had benefits for other diseases such as TB and malaria as infrastructure and resources could be used for alternative testing in the future.

Okay so we do have enough whether it's RDT, what's the other one, Gene Expert Cartridges that were sent out to the provinces. So those two can be done at the provinces and then we have of course the support of PNGIMR for PCR testing both here and up at Goroka, but we are also looking and rolling out really, original PCR labs. So, this one will be set up in Morobe for the Momase [Morobe, Madang and Sepik Province] region. Another one will be set up in Goroka and Hagen for the highland's region, then we have another one that's I think set up in East New Britain. So, slowly again, it's about strengthening the system in the long run, not only PCR for covid, but other diseases as well. So that's the capacity that this pandemic is able to - this response is able to build.

Graclyn, F43, Key Informant
National Public Health & COVID-19 response, National Capital District

3.5.2 COVID-19 reporting

Several different data management systems were referred to by study participants across the provinces and facilities. Facility and hospital staff indicated internal systems that were established which allowed data clerks to

manually enter and register samples sent to the laboratories and that would enable the attachment of results following processing. Within the laboratories, respondents indicated updated guidelines from the National Control Centre (NCC) or the Central Public Health Laboratory (CPHL) that streamlined sample records and results.

> *So, clerk actually they have excel there where they enter all these and then manually enter [and] are registered and the samples are sent with the actual form to the lab and then they are brought back there so they registered on the status of the results.*

Sylvia, F46, HCW/Nursing OIC, Infection Control
Provincial Urban Hospital, Western Province

Barriers to reporting were raised by health facility and hospital staff, such as limited resources for procurement of stationery, printing and logistics support that impacted their ability to print updated reporting forms and transport samples in a timely manner. Laboratory staff expressed a strong need for laboratory and data management systems linked to computers and integrated across the country's laboratory network.

> *I asked them if somebody should come and help me, but nobody did. So, in the near future, I need some lab guys to come and work with me to set up things with COVID-19, with the laboratory and the data system. If the administration gets the computer, then, I need a proper data system*

Bob, M54, HCW/Pathology
District Urban Hospital, Western Province

3.5.3 Enablers and barriers to COVID-19 information systems

Throughout the interviews, health care workers and key informants described human resourcing systems that supported information flow through dedicated COVID-19 workers or flexible staffing systems that enabled adaptability as surges in cases numbers proceeded. In addition, senior facility staff (officers in

charge, sisters in charge or monitoring and evaluation officers) or hospital managers were tasked with COVID-19 reporting, aiding clarity in role responsibility and streamlining efficiency in reporting. Whilst respondents indicated clear reporting pathways through from the facility or hospital straight to provincial and national systems, national healthcare workers described difficulties with the balance of daily reporting requirements placing increased pressure on provincial health information systems that were under-resourced and used to monthly reporting needs. However, emphasis was placed on the benefit of electronic reporting minimising paperwork and timeliness of data.

> *We get our own data and information, and we report straight to the Provincial and to the National and since the e-system been introduced everything goes into one system and they do one report at the same time.*
>
> Vyv, F49, HCW/Nursing OIC, HIV/STI/TB services
> Catholic Urban Hospital, East New Britain Province

The value placed on data for decision making was echoed by most health care workers and key stakeholders, particularly in leadership roles within the provincial or national health team, however technical capacity to use and interpret data for decision-making purposes was difficult, with resource constraints and at times limited experience. Bottlenecks with entering daily reporting data into the system resulted in roadblocks to responsive action, resource allocation and support. In addition, further training and support to provincial health teams to drive effective information systems is required to translate data collected and displayed into decision-making opportunities.

> *What we [are] contributing towards is actually going to be put into a system that gets the response that we can use to stop the transmission or lower transmission, you know some way of getting a response that's effective. See, when you don't have that data, I mean there are provinces right now who are reporting - who are calling and telling me that they have six deaths in the last three weeks, but they are not sending in the information's so that it can be updated, and then, when it's updated then the clinical team sees that, 'oh, so we have information that has more people dying here, we need to be there, we need see you know what's the cause of this, is it because of lack of oxygen, is it*

because there's no doctor'. So, when you don't get that information, you're not able to react quickly and make sure that you stop-you know stop the disease in its track. So that's one of the challenges that we continue to face.

Graclyn, F43, Key Informant
National Public Health & COVID-19 Response, National Capital District

3.6 Leadership and governance

[COVID-19] has gone from bad to worse or you know it's kind of hanging in that balance, and it really depends on how we move forward as a country. But also, that leadership you know whatever that maybe either at NCC [National Control Centre – COVID-19] or at NDoH [National Department of Health] but that leadership is very crucial and very decisive actions need to be taken you know if you want to see us surviving through these times, I must say.

Graclyn, F43, Key Informant
National Public Health & COVID-19 Response, National Capital District

In this section, we examine how leadership and governance were impacted by COVID-19 across the country and to what extent this was the same or different across the sites and the different health programs. The following examines leadership and governance and explores enablers, barriers and lessons learnt in the pandemic response from national, provincial and health care worker informants in PNG.

3.6.1 National level leadership

During the COVID-19 pandemic the country initiated several new structures to support the response efforts at the national and provincial levels. The COVID-19

National Control Centre (NCC) was established within the NDoH to lead the coordination and advocacy to provinces on the COVID-19 response which provincial governments were responsible for implementing. Within the NCC was the development of an Incident Management Team which was replicated at the provincial government level with provincial coordination leads. The NCC provided expert advice to provinces on infrastructure requirements, workforce surge capacity, COVID-19 facilities and standard operating procedures and guidelines.

> *And some of those like in terms of the advice that we gave to repurpose you know repurpose if its building, facilities, workforce, cause there was not dedicated you know dedicated ward, or dedicated staff…So we've kind of like when we set up here with PPE distributions, we needed people on the ground to be able to communicate directly with us, and like I said in the beginning, with the structure we had the similar structure that was advice for each province to have a similar structure set up. So each province has an incident manage and has those seven key pillar leads and clusters within the province to respond to surveillance, clinical infection prevention and control, risk communication and community engagement, [niupla pasin] or the new normal interventions and there was laboratory point of entry, quarantine and monitoring.*
>
> Graclyn, F43, Key Informant
> National Public Health & COVID-19 Response, National Capital District

National level respondents indicated the importance of sustainability planning and integration of new COVID-19 response activities back into routine health responses. Emphasis was placed on strengthening the response mechanisms within the health system and finding ways to balance systems constraints such as workforce capacity and resource availability with holistic, integrated system approaches.

> *And I think that's how the pandemic is playing out and eventually we have to have an integrated system to strengthen the health system that can respond both to the covid 19 as well as other programs and there's greater benefit in that as well in terms of resourcing. We are using the same manpower, so getting that back into our one system would be more effective.*
>
> Graclyn, F43, Key Informant
> National Public Health & COVID-19 Response, National Capital District

The COVID-19 pandemic also raised political governance concerns, with respondents reporting challenges with ministerial leaders overseeing areas of work outside their area of expertise leading to decision-making implications on resource allocation which delayed routine infectious disease programs such as HIV, TB and malaria. Pertinently, national health providers emphasised that through this pandemic many lessons have been learnt, capacity has been significantly strengthened and gaps have been identified which have enabled the government to better map out next steps for addressing health systems barriers systematically.

> *As such, we have to give due consideration to this Health Minister's portfolio and even the other portfolios as well. Should this portfolio be given to someone [an MP] whose knowledge and expertise goes in line with the portfolio then he would know what to say or do instead of us degrading ourselves.*
>
> Flora, F39, Client engaged in MCH services & Support worker PLWD
> Catholic Urban Hospital, East New Britain Province

3.6.2 Provincial government implementation

Throughout the pandemic, the Provincial Health Authority workforce experienced several changes, including additional programs or committees to support the COVID-19 response, provincial health leadership changes, workforce responsibility adjustments, additional human resourcing requirements and changes to communication structures for routine meetings and feedback of information.

> *And then we have the Provincial Control Center or PEOC available that we meet on every Mondays, Wednesdays, and Fridays. It's a routine thing. It already became part of normal to us … where we meet every Mondays, Wednesdays and Fridays and discuss about COVID-19 cases.*
>
> Kerapeng, M (age not reported), Key Informant
> Provincial Public Health, Western Highlands Province

Internal systems have been strengthened to support planning, reporting and funding streams for the implementation of activities and responses to COVID-19. However, key informants and health care workers also indicated that contractual arrangements, such as Memorandums of Understandings or Partnering Agreements, with private sector companies to support the supply chain of medical consumables and logistics would have been advantageous and prevented the closure of health centres or hospital operations. Multi-sectoral partnering arrangements were also described by respondents since the establishment of the PHA model, noting close liaisons with relevant government partners such as Department of Planning, Department of Health, and other central agencies.

> *So, when they come in, these committee and the team leaders they must ensure that the activities are actually happening and then they will come and give us report plus their budget and all that. So that committee is responsible to ensure, getting the report on a regular basis and making the funds available so that they can go back and do the activities.*
>
> Beetrus, F57, Key Informant
> Provincial Public Health, Eastern Highlands Province

Provincial government respondents emphasised the lessons learnt and benefit of collaboration, coordination and working towards a shared common goal. Strengthened leadership skills were described by respondents that referred to improved micro planning skills, leading to subsequent lobbying opportunities for funding. However, challenges were also raised by respondents around ineffective management of COVID-19 funding to support PPE procurement and activities, lack of skillsets to understand and respond to complex health systems issues such as COVID-19 and a strong desire to invest in opportunities to plan, budget and strategize about future response to public health issues.

> *Well, I learnt about collaboration, coordination, coordinating different stakeholders collaborating with them, working together to achieve a common goal. I learnt about micro planning, making sure that there is good micro planning so that the funding can be given as per the micro plan but it's not always so.*
>
> Peter M (age not reported), Key Informant
> Provincial Public Health, Western Province

Key informants and health care workers interviewed described difficulties with implementation of response activities due to resourcing constraints. Despite recommendations from the national level government, realities within provinces such as funding constraints led to reduced access of PPE and WASH facilities, difficulties balancing the needs of multi-disease management, and increased burden of responsibility to PHAs that prior to COVID-19 were already under resourced.

> *And you know, going into the future and these are already lessons that we are learning, but how can you improve a system if you don't have the resources, you don't have the leadership you know. And it always goes back to that- it always goes back to having you know a good leadership in place to achieve most of what- you know strategies are strategies, but how yeah how you resource that, how you fund that can*
>
> Graclyn, F43, Key Informant
> National Public Health & COVID-19 Response, National Capital District

3.6.3 Hospital management

Many hospitals across the country experienced changes in leadership and management during the COVID-19 pandemic. Health care workers described changes that resulted in strengthened communication structures and transparency over leadership actions, whereas other interviewees noted difficulties in performing in leadership positions as well as disapproval from frontline health care workers in management decision making. Participants also

noted there were, at times, no changes in hospital management or leadership during COVID-19 or that they were unaware of any internal changes that may have occurred.

> *I think everything is just still the same; no changes from the high authority, from the administration down to the unit level where the staff are working, things never changed, and things stay the same, yeah.*
>
> Andre, M42, HCW/Nurse, HIV/STI services
> Catholic Urban Hospital, East New Britain Province

Several health care workers indicated push back from front-line workforce due to health worker conditions, particularly the risk to front-line staff of contracting COVID-19 as well as unpaid work and allowances due to financing challenges. Discrepancies were also experienced within hospitals, with allowances being received by some of the workforce and not by others. However, other hospital staff described positive changes to governance arrangements that resulted in transparent decision-making processes and clarity around hospital activities.

> *Okay before COVID-19, uh like we were more at our level; I would say at the administration level, we were more at our level like we were dealing more at our own little departments. Uh, basically they [Hospital administration] were not barking at our backs and say 'No, you come and help me with this administration thing…' But after let's say when COVID-19 came in, it was a whole different picture. Everyone was involved in decision making. Everyone's views were very important at the time, so that we had to come up with a good decision in doing something right for everyone and so and so.*
>
> Jenni, F38, HCW/ Nursing OIC, Outpatient & COVID-19 services
> Catholic Urban Hospital, East New Britain Province

3.6.4 Health facility management

At the health facility level, respondents indicated resistance to change felt within health facilities, resulting in difficulties with human resourcing and role

responsibility. Interviewed health care workers also commented on challenges with implementation of new systems such as reporting forms for COVID-19 and finance, triaging structures and information sharing systems due to new leadership within their facility or recurrent turnover of management staff.

> *We had a change in the OIC position from one person to another, to another in this short period of time maybe because of the management issues or not because of the disease but most because of the management issues.*
>
> Daphne, F54, HCW/Nurse, HIV services
> Rural Day Clinic, Madang Province

Other health care workers shared success stories from their facility management experience, describing the ability of the facility to still perform normal duties and lead vaccination efforts in the country, drawing parallels between health outcomes, strong teamwork and tireless efforts towards the COVID-19 pandemic.

> *And despite this COVID-19 pandemic, we are still operating and performing our normal duties. Currently, I think [the] clinic is the leading vaccination site in the country in reference to a report that I received. We were the second highest vaccination site in the country. It shows our work output that we had a strong team that work tirelessly to help fight this COVID-19 pandemic.*
>
> Morris, M37, HCW/Nurse, MCH & COVID-19 services
> Urban Day Clinic, Morobe Province

3.6.5 Partnerships

Most participants also referred to the role partnerships played in their COVID-19 response. These involved community, implementation, multi-sectoral and research partnerships. Advocacy, health promotion and community mobilisation were described through partnerships with trusted representatives from within the community.

The community needs to be organized. When they organize themselves and then if we have such outbreaks occur again then the community needs to take the responsibility. You talk about health workers; health workers are not many. Health worker are very few and then if the community takes the responsibility of [their own health] also and then it goes back to the provincial leadership also.

Kerapeng, M (age not reported), Key Informant
Provincial Public Health, Western Highlands Province

Implementation partnerships between PHA teams and central government agencies were deemed critical to combat the disease and minimise the spread. Respondents emphasised that good governance at the implementation level was important to align programs to the national health plan and improve indicators for the health of the population. Additionally, there was a strong need for multi-sectoral partnerships, for example, involving ports, policy, air transport, public health teams and primary healthcare taskforces. Lastly, respondents described the role research partners played in supporting training activities, advocacy and awareness.

Yes, unlike the district itself it set up a Covid response [team]. So, it includes the doctors and even the people in the district are also in there and we met, and we have agriculture sector, social welfare sector is there, and all the other government sectors are also present at our Covid meeting, the response team and the health people we were also there.

Daphne, F54, HCW/Nurse, HIV services
Rural Day Clinic, Madang Province

3.7 People and community

> *But the other primary health problems, people could take care of their health. So, I see a lot of like we spend a lot of time trying to cure, cure the problems, giving medicine, and they went back. The problem is right at the community level. A lot should be focused more on the preventive measure in [in the community] … More should be in the concept of the Healthy Island Concept. The government or the arm of the health [Department] should send more health workers or trained volunteers at the community levels to be as advocators, so that they are responsible in each of their communities … There should be trainers to train them and then so that it lessens some burdens from like doctors or nurses or educators or they wanted to come and get it (training) but you go and do the health education, no! Use people in the community so that they'll be responsible.*
>
> Andre, M42, HCW/Nurse, HIV/STI services
> Catholic Urban Hospital, East New Britain Province

In this section, we examine the additional building block of people and community, and how this block was impacted by COVID-19 across the country and to what extent this was the same or different across the sites and the different health programs. This section will focus on those community-based health delivery and social mobilisation activities that couldn't occur in a community environment that was significantly impacted due to COVID-19 mitigation and prevention measures, particularly those measures that limited the gathering of people.

3.7.1 Community-based health delivery

Community health, in the form of outreach by health care workers, community health workers, peer workers and treatment supporters, is identified as a critical component of health service delivery, particularly community health that is delivery by community health workers.

It's very effective strategy for us at the community level. I mean we at the community level we look after the patients, we know who the patients is, his life or their lifestyle, so [at the] clinic they don't kind of, when the patients are out there in the community, the clinic people they find it hard to go down to the community level so they kind of appreciate us the TB Treatment Supporters inside the community level. So we are the ones that bring in the patients, we find new cases-new TB cases, we find the patients at the community and we refer them to the clinic

Clinton, M47, Community member & TB Treatment Supporter
Urban Day Clinic, National Capital District

Whilst acknowledging its importance, health care workers, community health workers and treatment and peer support across all provinces and health service types also described the devastating impact that COVID-19 had on these community health and outreach programs. Although a small number of health care workers reports little to no impact, with the exception of public lockdowns, where community outreach stopped completely, more commonly reported across all provinces was the suspension of these community health programs – an outcome that was reported to be influenced by COVID-19 lockdowns, unstable or no funding due to the prioritisation of COVID-19 (see Section – Health Service Delivery and Health Financing), a lack of transport and an absence of facility support for their delivery in communities (see Section – Health Service Delivery).

COVID-19 had a lot of impact. So, we didn't push through with the program and that also contributed to—these TB Watch Committees they lost interest, especially these. We use these TB Watch Committees to help us to do Contact Tracing especially in TB work. They also do lost-to-follow-up tracing for us. In our catchment … area, we have a TB watch Committee in that catchment, so whenever we find that the patient is not—is becoming non … compliant to his or her treatment, we call those TB Watch Committees and we use them to go out and tell them to come back, to encourage them … Yeah, we supposed to have done it first last year, [it wasn't] up until now that we did. We see that

[COVID-19] has disturbed many of our annual plans up there. We see that it has affected many of our programs especially the mobile clinics, the outreach programs, it has affected [them].

Lola, F34, HCW/Nursing OIC, TB & HIV services
District Rural Hospital, East New Britain Province

When COVID-19 came in, it made us not to do our programs, to do outreach programs to go out to the communities. Or take the, uh like to help people out in the community we have to go there and track down how they are doing. By doing community mobile clinics and VCT, blood testing and all these at their doorsteps, you will find a lot of cases. But really this thing did not happen last year till now because there was no funding. All the funding was pumped back into COVID-19, I think. So, really HIV money for the district and the province was given to COVID-19, so this program was ignored. So really, we did not do any programs until now

Chimera, F54, HCW/Nurse, HIV services
District Urban Hospital, Western Province

We don't do, we don't go mobile, the outreach was, it's not – I don't know why. Maybe [the] government has no money to fund them so mobile clinic and outreach and this entire are now; looks like it's dying out.

Gladys, F44, HCW/Nursing OIC, MCH services
Urban Day Clinic, National Capital District

3.7.2 Social mobilisation activities

Information and awareness

An absence of detailed COVID-19 information delivered in the community was prominently reported by health care workers, clients and community members from formal health services. Routine community awareness activities were limited

due to lockdowns, health service delivery scale back, shutdowns to normal operations and shortages within the health workforce (see Section – Health Service Delivery and Health Workforce). This absence of formal health information delivered in the community created an information vacuum where alternative channels and types of information about COVID-19 thrived which influenced the way that people understood and then responded to COVID-19. Social media, particularly, and the sharing of information from social media through community gossip, made these conspiracy theories, misinformation and cultural beliefs widely disseminated and accepted. An absence, or suspension, of community health awareness compounded the spread of this misinformation, as in its absence, information that impacted negatively on COVID-19 understandings and information that directly and negatively impacted client engagement with health could not be attended to.

Only certain members of the community – particularly community leaders, but only reported in a small number of instances across the provinces – were provided with COVID-19 information and tasked with the responsibility to share this information. Non-government organizations tasked with particular health initiatives (HIV, TB, malaria) were reported to facilitate some integrated COVID-19 community awareness activities in areas where their operations extended. Family and friend networks and churches were also reported as sources of COVID-19 information, as well misinformation; some of the Church messages took on moral tones and also spread misinformation. Whilst at a surface level, these issues surrounding COVID-19 related information do not appear to impact health service delivery, by their very nature this information and misinformation directly influenced people's perceptions of COVID-19, which also directly influenced people's willingness to engage with health service.

Social mobilisation and coordination with community stakeholders

Social mobilisation was reported in a few instances across the provinces, but particularly highlighted in examples of coordinated mobilisation in East New Britain Province. When reported, these instances of formal coordination with community stakeholders were most likely to describe mobilisation for development of community mitigation strategies to prevent COVID-19 and the dissemination of information and awareness during COVID-19. Formal co-

ordination of these social mobilisation activities was described in terms of a COVID-19 committee forming or where health services engaged with already established community committees and leaders. In East New Britain Province, this formal community stakeholder coordination was managed through a multi-sectoral approach.

> *We have everybody tied together. In that committee we had all the public servants coming in and we have the community leaders as ward members coming in. We had education people representing education. We have police representing police. We have the youth leaders representing the youth. We have the women leaders representing the women. We have all our government people, our Governor and all our Presidents of the Local Level Governments. All of them all involved … That committee was the one that led us with, everything! Putting up the isolation centres and quarantine centres and taking the quarantine team checking the [sea] ports and due for awareness which we Local Level Government we take on board and do the community awareness to the communities. We had roadblocks to stop people, to continue to wear masks and hand washing and we had, and we have the Local Level Governments town urban centres that you know we put signs and strict laws uh the shops have to abide and all that.*
>
> Gloria, F53, Community Leader & District Health Services Urban Area, East New Britain Province

Allowances were particularly important for the engagement of community in coordinated social mobilisation and activities. In Morobe Province, a health care worker described engaging with community volunteers and key sporting players in their COVID-19 vaccination roll-out – an engagement strategy that also included allowances and catering. Conversely, in Madang Province, formal coordination between health services and the community to work together for COVID-19 testing and awareness began but was disbanded because community members believed that they should be provided with an allowance, which they were not.

> *I was attached with the COVID-19 team for vaccination … I did a two-week program doing awareness and advocacy regarding COVID-19. I*

took some [rugby] players with me, and we did vaccination in the communities. World Vision and the WHO funded the program, so we bought lunch and stationaries and paid allowances for the volunteers or the staffs that were involved with the program.

Morris, M37, HCW/Nurse, MCH & COVID-19 services
Urban Day Clinic, Morobe Province

The community came and helped a bit during the time when they were doing the testings and, but we did not continue to do that. They came asked if they can do awareness or such things, but we were saying in case they might want allowance, which we do not have the allowance to give so they did not come in.

Talita, F42, HCW/Nurse, TB/HIV services
Rural Day Clinic, Madang Province

Whilst formal coordination with civil society organisations and community leaders and representatives was described, so too was an absence of coordination and communication between communities and government representatives and health service personnel. For example, representatives of people with disability living in Morobe Province – and more specifically women with disability in this province – spoke of being left out of formal community coordination and engagement. The men with disability were able to form a committee, source funding and continue their social mobilisation work during COVID-19; however, the women were not. For these women, mainstreaming and inclusion were critical for any future social mobilisation.

So, we were left out of that picture, for them to come and share information of COVID-19 with us. So, we talked with Lutheran Church, ELC PNG and they have this program, Church Partnership Program, so they were interested in this idea, they thought it was a great idea. So, we sat down and tried to discuss on how [best] we can address this. It's because all of us were, had such thought that we will catch this sick [COVID-19], there was absolute fear in the community … So that's what we did, we formed that committee and our purpose at that time was to

secure some funds and we will go out [and] give hygiene kits [to disabled]. The hygiene kits contain [things] such as alcohols or sanitizers, we got soap, bleach, tissue; things which can help the [disabled] people to help themselves. When we go and talk to the disabled [then] they will use these kits to keep themselves clean or such when they are at their homes.

Alex, M62, Community Leader & PLWD
Urban area, Morobe Province

Just for this one since this COVID-19 awareness team went around, they didn't include us the Women with Disability … Like the men went but not the Women with Disability … [When we are included, there is] great impact like many things we have talked, it's like I have said, to include us the persons with disability into mainstreams or whatever service we will access it. One point I said is accessibility, and these are the things that is causing the barriers to our lives.

Anion, F31, Community leader & PLWD
Urban area, Morobe Province

Discussion

This study explored the impact of COVID-19 on primary health and public health infectious disease programs in seven provinces in PNG using an amended WHO building blocks framework. The frameworks included seven key building blocks: health service delivery, health workforce, essential medicines, health financing, health information systems, leadership and governance and people and community. We set out to explore the impact across provincial location, different types of health facilities and services, and across MCH, TB, HIV and malaria. The findings showed many similar impacts and experiences within diverse geographies, varied health services and facilities, and across primary health and infectious disease programs. Some of the impacts were uniquely experienced in PNG, whilst other factors were reported globally, even among the well-developed health systems of Europe, North America and the Pacific [79]. On top of an already weakened and fragmented health system, COVID-19 highlighted how PNG was not prepared for a further infectious disease outbreak.

PNG was quick to respond to the initial COVID-19 outbreak through an SOE that prioritised lockdowns at a time where there were very few cases in the country [49, 50]. The focus of the SOE obscured and ignored the health system at the very time where health system preparedness needed to be urgently developed. Over time, COVID-19 cases started to rise across the country, and this stretched the health system beyond its limited capacity. In this discussion we focus on the areas of the building blocks that were most significantly impacted during COVID-19 and conclude with recommendations to be considered to build a resilient and responsive health system that is better prepared to respond to the next pandemic, as well as expected disasters and disease outbreaks.

Health service delivery was disrupted during COVID-19. Services were indefinitely closed for lockdowns and services and programs transferred to other locations. Health services were also closed for shorter periods of time due to COVID-19 infection in the health workforce and the need to deep clean facilities. Facilities changed the way health services were delivered. Services were moved to outside spaces, with social distancing and IPC measures. This movement within a facility impacted the way services could be delivered – health care workers in many instances were made to operate out in the open where they did

not have access to equipment routinely used for testing, treatment and care (and which is housed in the clinics), they did not have technology or power to run IT systems and they often went without desks and chairs.

The challenge of health service delivery and infrastructure capacity pre-dates COVID-19, where systemic health infrastructure gaps and maldistribution were reported alongside ongoing calls for a back-to-basics approach to address these infrastructure gaps across the country for improved access to primary health care, particularly in rural and remote areas [7, 80, 81]. Where ageing building infrastructure and space impacted the ways in which health services could be delivered, these infrastructure gaps became more prominent during COVID-19. Whilst the installation of tents and other temporary structures addressed these gaps in some ways, these interventions were not uniformly implemented across the provinces.

Service disruptions directly impacted health care workers' ability to provide health services and clients' experience of care during COVID-19. Health workers were also fearful of COVID-19 infection for themselves and their clients. For health care workers, inadequate training on COVID-19 IPC and working with COVID-19 infected patients, inadequate training and provision of PPE, and significant COVID-19 infection and death among health care workers in PNG, saw some seek deployment to non-client facing roles where they perceived a lower level of risk of infection and death. This health care worker fear, compounded by health care workforce barriers described above, reduced the numbers of staff available to deliver health services. Clients and community also feared COVID-19 in health settings. This fear caused disengagement or delays in seeking health care, contributing to the reduction in client numbers attending health services reported by health care workers during the study.

Challenges in the availability and distribution of the health workforce in PNG is documented extensively, and a challenge that is described as a crisis by the WHO [82], particularly in rural and remote settings where people remain underserved [7, 19]. Systemic health workforce issues become more prominent during times of public health crises. For example, during the cholera outbreak in 2009 which highlighted systemic challenges of workforce availability and distribution, the health workers were able to be redeployed from low prevalence to high prevalence areas [83]. In a similar way, in the polio outbreak in 2018,

hundreds of health care workers were recruited from the NCD to undertake nationwide mass vaccinations programs – a program that was supported by a nationwide information campaign [84]. The outbreak of COVID-19 however was different; it was nationwide and it was an airborne pandemic. Containment and mitigation focused on restrictions of movement and gathering. These factors directly impacted the already overstretched health workforce.

Lockdowns and travel restrictions made it almost impossible to draw on health care workers from elsewhere, and specialised professionals were redeployed to COVID-19 responses without being replaced in their respective operational programs. At times, even when these healthcare workers tried to get to work, they could not as there was no, or limited, transportation to get health care workers to and from work. Health care workers infected with COVID-19 had to undertake a mandatory two-week isolation period and many healthcare workers have died from COVID-19. COVID-19 shone a spotlight on the ageing workforce, as this cohort of workers were perceived to be most at risk of COVID-19 infection morbidity and mortality. These older workers in many instances were furloughed or deployed to non-client facing roles, a practice that reduced their risk of COVID-19 but further depleted the health workforce that health services could draw upon.

Globally, health financing, information systems and leadership and governance needed to respond to COVID-19 in an unprecedent and unplanned way – and PNG was no exception. Papua New Guinea, however, responded to COVID-19 by creating a separate but parallel system for the management, financing and reporting of COVID-19. The new COVID-19 financing, information and leadership system was prioritised over routine primary health and public health infectious diseases programs. The leadership and governance of COVID-19 in PNG was managed through the creation of new national and provincial structures and commands to support the response efforts – primarily through the creation of the COVID-19 National Control Centre (NCC) that was established within the NDoH to lead the COVID-19 response. Implementation of this response occurred at the provincial government and health facility level, where health leadership changes, workforce responsibility adjustments, additional human resourcing requirements and changes to communication structures for routine meetings and feedback of information were commonly reported.

COVID-19 health information systems, surveillance and reporting were separate to the national health information system. COVID-19 reporting, and surveillance created an extra workload to submit facility-level data on a system/notification sheet that was new. This reporting role was being undertaken by health care workers with limited IT and human resource support. Across all provinces, there were requests for dedicated data reporting clerks that were not fulfilled. The provision of this infrastructure and human resources would allow client-facing health workforce to be able to concentrate on delivering services.

Health financing for COVID-19 was dispersed as separate funding streams to operational financing. A lack of transparency related to budget allocations and distributions processes was also evident. Whilst there was a significant allocation of funding to COVID-19 responses, many health care workers spoke of services being underfunded, including new COVID-19 services, but particularly operational funding for routine primary health and public health infectious disease programs. This under financing of operational programs saw the diversion of COVID-19 funding to operational programs. Health care works also described differences relating to payment and additional allowances for COVID-19 activities. Some respondents indicated that there was no additional funding for COVID-19 activities provided to healthcare workers, compared to others who received risk allowances, allowances to vaccinate and specific funding for frontline staff treating COVID-19 patients. There was also a large disconnect between what governments (national and provincial) were saying was allocated and how health care workers experienced this on the ground. This disconnect could be resolved by increased financial management transparency and the participation of key health care workers in the management of pandemic responses at the provincial, district and facility level.

Across the varying health system dimensions and building blocks, people and community were central, and the impact of COVID-19 was most significantly experienced in community-based health. The ceasing and suspension of community-based health services and programs during COVID-19 had a devastating effect on primary health and public health infectious disease programs. COVID-19 disrupted the health workforce, community health workers and peer and treatment supporters who provide essential community-based health. These disruptions, which were described across all study provinces, were

a function of lockdowns or where there are mitigation strategies were implemented to prevent movement and gatherings. Other barriers, such as poor mobile phone network coverage and clients' socio-economic capacity to purchase data packages, as well as an absence of service-based transport and the lack of supply – accompanied by increasing prices – of public forms of transport, impacted these community-based health programs.

COVID-19 also highlighted the need to address community engagement as a critical aspect of preparedness and for effective responses to disease outbreaks [85]. An absence of community engagement directly impacted clients' awareness of where services could be accessed, where services had moved to and where services had closed. This confusion directly impacted people's willingness to travel for health care in the absence of community-based health programs. An absence of health-delivered information on COVID-19 abounded. This absence not only created a vacuum in which misinformation, disinformation and conspiracy theories thrived, it also eroded trust in the health system [86]. This distrust was particularly disruptive as people – particularly mothers and their children – avoided routine immunisation programs. People did not trust COVID-19 immunisation due to misinformation, and they did not trust health care workers to respect their choice to remain unvaccinated. It is therefore unsurprising that those community-based vaccination teams that were able to continue programs were met with verbal insults, exclusion from community and, at times, violence. The erosion of trust also factored into health care workers beliefs – (dis)trust that the health care system would keep them safe at work.

Whilst these study findings provide a deep and contextual understanding of the impact of COVID-19 on primary health and public health infectious disease programs in PNG, several study limitations need to be acknowledged. The first relates to the building blocks conceptual framework used to analyse and explore study data. This framework provided a way to unpack and present study data, but it is critical to acknowledge that the framework boundaries between these building blocks are not so clear cut. In reality, these health system dimensions rarely fall within a specific building block that can be explored in isolation. It is also important to note that study data collection was conducted between July and November 2021 – a time of the third, and largest, wave of COVID-19 in PNG. This data reports on the impact of COVID-19 at a specific time and in

specific places, and therefore this data may not be generalisable to other provinces in PNG or in fact to the same provinces at different time points during and after the time in which study data collection was collected. And finally, the quantitative health facility review (HFR) faced a number of methodological and implementation limitations, the first of which was the small sample size (n=33) which only allowed for the tabulation of descriptive statistics. The administration of the HFR also experienced many barriers. The tool was initially developed to be administered by the researcher with the healthcare worker, however, due to health workforce issues during COVID-19 over two-thirds of HFR were self-administered. This process of self-administration may have led to respondents not understanding the HFR domains and also a significant proportion of HFR that were only partially completed before submission. These limitations we acknowledge, and therefore caution on the use of the HFR findings as a data source to guide understandings and policy and practice development.

The health system of PNG, like many globally, was not prepared for COVID-19 and in many instances the health system was unable to cope with impact of COVID-19. However, this is not a complete story. In many instances across the study provinces, examples of bravery, adaptability and innovation in practice and engagement with health were described. Health workers courageously showed up to work to reduce disruptions to the provision of health services despite, for the most, lacking appropriate training to do so and in some instances not being provided with appropriate PPE to safely do so. They continued to work in a COVID-19 environment characterised by uncertainty and crisis, but also in environments where systemic barriers in workforce shortages, infrastructure and financing existed prior to COVID-19. Health care workers continued to provide health service despite becoming infected, sick and dying from COVID-19. Without the bravery, dedication and persistence of the health workforce in PNG, the impacts of COVID-19 on primary health and public infectious disease programs would have been much worse. The same bravery and persistence were also described by clients. Despite lockdowns, movement restrictions, transport barriers, increasing costs of health care and transport and the fear of being infected with COVID-19 from health settings, most clients who participated in this study activity tried to remain engaged with services for their health.

Many adaptions were made to minimise service-based disruption and the risk of contracting COVID-19 on the way to or within the health service. Health services were moved outside to mitigate the risk of infection. Health care workers, clients, and community came together to build triage and isolation infrastructure in partnership, ensuring that their health service had the COVID-19 infrastructure that it needed. Health care workers changed the way that essential medications were prescribed and, in many instances, where clients required essential medications for treatment, larger amounts were supplied to ensure that any further lockdowns, movement restrictions and client fear of COVID-19 did not interfere with treatment adherence. These partnerships and changes in practice continued to change to respond to COVID-19 after study data collection.

Most participants referred to the role partnerships played in the COVID-19 response. These involved community, implementation, multi-sectoral and research partnerships. Advocacy, health promotion and community mobilisation were described through partnerships with trusted representatives from within the community. Partnerships were critical and were a factor of health system effectiveness that needs to extend beyond the small number of instances that occurred in this study.

These findings have highlighted key areas where the health system in PNG was not prepared for COVID-19, and the inefficiency and barriers in the response. It has also highlighted key areas that can be built upon and developed. From these findings, the authors have developed recommendations that we believe the health system needs to adopt to effectively deal with COVID-19 and for ensuring health system preparedness for primary health and public health infectious disease programs that can be used to plan and prepare for future public health pandemics and disaster responses.

Key recommendations

This study has highlighted several key areas that require attention and action for a more resilient health system in preparation for future pandemics and emergency situations (humanitarian, climate and/or environmental). The following recommendations speak to the actions, based on this research and in-depth knowledge of PNG's health system, that need to be undertaken in accordance with the WHO health system building blocks in the medium- to long-term.

5.1 Health system strengthening

Even the strongest health systems globally have struggled to cope with the COVID-19 pandemic. For under-resourced and fragmented health systems, such as in PNG, it is even harder to respond in a crisis without built-in resilience. This study has highlighted that the health system in PNG was not prepared for the COVID-19 pandemic. A weakened and fragmented health system and a central command and control approach - with a largely generic response at the national level - did not work within the decentralised governance structure at sub-national level. The establishment of quasi parallel systems during COVID-19 overrode established systems of reporting in health and added layers of complexity in terms of accountability, information and the ability to enforce measures, guidelines and reporting.

For PHAs and districts to effectively lead and coordinate outbreak and pandemic responses at the service delivery level, they need to be resourced appropriately (human resources, supplies and financing) to take on that role. All provinces and their communities are different and therefore resourcing PHAs and districts will allow for a more nuanced, tailored and targeted approach across and within provinces.

Whilst there was evidence that there was some ability to shift and redistribute supplies across provinces with support coordinated from the National Control Centre, particularly for PPE, vaccines and emergency medical teams/clinical support, additional support is required. This support must ensure that needs at

a local level are responded to, with responses based on local level data from surveillance and information to inform decisions and budgets. Further strengthening of surveillance at the local level is critical. This needs to be institutionalised during 'non-pandemic times'.

Key Points:

1. Prioritise health system preparedness. The NDoH and PHAs, together with partners and donors should continue to prioritise strengthening, supporting and enabling the health system, including governance, financing, essential commodities and supplies, diagnostic networks, human resources and community engagement. Leverage of existing components of the health system to provide integrated preparedness and response e.g., diagnostic platforms, supply chains, human resources, surveillance, and information systems.
2. Strengthen the underlying structure of the whole health system needs using a bottom-up, and primary health care approach focusing services on the needs of the population within their communities. The NDoH and PHAs together with partners and donors, need to continue to prioritise health system strengthening, supporting, and enabling the health workforce.
3. Establish linkages between the health system and associated policy, funding, and programming needs to disaster and risk reduction KRAs.

5.2 Health workforce

- Invest significantly in the health workforce. PNG needs more health care workers and training of health care workers so that task-shifting and innovation can occur.
    - Training needs to be responsive to emerging health evidence and respond to evolving understandings of the community.
    - All health care workers must be trained in the use of PPE and provided with appropriate supplies for their personal protection and trained in treating and caring for patients with a new or novel infectious disease.
    - Training must include on-the-job training and coaching by senior specialists and peers, focusing on a team approach to patient care,

with close engagement of senior management teams to support service delivery redesign and adapting care pathways to new and emerging infectious diseases.
    - Training must be expanded to all the health workforce, not just those who may be redeployed to areas focusing specifically on the infectious disease. This includes training of administration staff, porters, hygiene officers. (cleaners), mortuary workers and drivers, as well as nursing staff and doctors.
- Human resources for health need to explicitly acknowledge the role and contribution of peer support workers, peer counsellors and treatment supporters, who are essential to treatment adherence and should be included as essential workers during infectious disease outbreaks.
- Effective use of communities of practice should be considered, including improved engagement with professional societies on a regular basis, to build a trusted network of peers and access to continuous learning opportunities for rural health staff.
- Develop a strategy for communication that involves all areas of the health workforce. Providing detailed information not just to identified personnel dealing with the response but uniformity across all areas of the health workforce, to include ancillary and support staff (e.g., security staff tasked with staffing/regulating access to health facilities who are often the first point of contact with community during emergency/health crises).

5.3 Health service delivery

- There need to be clear, concise and location-specific guidelines on the management of disease outbreaks and conditions from the national authorities. These should include outpatient and community care guidelines, including entry criteria to facilities, clinical triage, treatment of clients and referral processes.
- There needs to be an operational definition of essential services, including maternal and child health, HIV, TB, malaria, laboratory and diagnostic services, and recognition that these essential services are not choices, but minimum service standards in an emergency situation (pandemic, humanitarian, climate emergency etc.). This approach needs to be supported by flexible financing to enable service delivery pivoting (e.g., more outreach or stronger implementation of triage and referral

management, and ensuring mild cases can be managed more effectively in the community or at local facilities rather than being referred to Provincial Hospitals). Availability of such services must be clearly communicated to all members of the community.
- Support the roll out of innovative low tech diagnostic products, such as RATs, that are highly beneficial for patient care in lower-income countries at the point of care. Implementation of these products needs to be accompanied by strong training and communication.
- Develop integrated models and delivery systems that are community-based with central stewardship and coordination.

5.4 Essential medicines

- Improve the medical supply chain, including information management and supply chain (from Aid Posts to hospitals): systemic shortages of essential medicines (and other commodities) at the area medical stores need addressing in order to enable facilities to be appropriately provided with essential drugs for the needs of catchment populations of individual health facilities.
- Plan for breakdowns in supply chain management, with a particular focus on essential medicines, in future emergencies.

5.5 Health Financing

- Establish direct facility financing and flexible financing arrangement during emergencies, so that health facilities have access to quick operational budgets to deliver services more effectively, including pivoting and additional financing for outreach and community engagement.
- Improve understanding of how financing works for health care workers. These understandings will reduce some of the concerns that were discussed by health care workers with respect to operational and COVID-19 funding during the pandemic.
- Build greater capacity and support for PHAs to strengthen their processes and ability to effectively and quickly utilise financing that comes through

the HSIP Trust Account and to be able to budget and draw down on resources faster in a more responsive manner. Many flexibilities were provided for PHAs in use of HSIP resources, but capacity to effectively maximise those flexibilities (e.g., contracting short term staff for surges) hampered responses and delayed responsiveness.

5.6 Leadership and governance

- Ensure all members of the health workforce are represented at key decision making tables in emergency situations (this includes nurses and midwives and those working in auxiliary and community-based health roles).
- Utilise and leverage existing health partnerships for effective and timely responses to emergent threats and epidemics.
- Provide clear, centralised and top-down guidance on the management of public health and primary health infectious diseases. This should include special risk mitigation measures for these patients and a minimum standard of care despite service scale-downs.
- Investment in leadership training for emergencies should be prioritised in non-emergency times (i.e., periods outside of major epidemics, pandemics or other major national health threats surges), with additional support for desk-top and scenario operational exercises to practice responses and strengthen coordination and management. This leadership training includes ensuring Senior Executive teams are all well trained in establishment and operationalising incident management teams, delegating functions in times of crisis and empowering incident managers to be making key decisions, rather than having to wait for senior management – which leads to delays in responses.

5.7 Information management

- National health information should reflect needs and experience at the local level and be based on local level data from surveillance and information to inform decisions and budgets.
- Invest in overall eHealth architecture and capacity building during non-emergency periods as the rapid introduction of new technology and tools

during a crisis is difficult to manage in any health system, let alone systems that have poor governance, accessibility to eHealth infrastructure and without user input into design of new tools and technologies.

- Dedicated health information human resources at the health facility-level should be considered a priority. Having a dedicated person in charge of health data would reduce the reporting burden on client-facing roles, improve the timeliness of health information sent to provincial and national departments and improve data validity and reliability.
- Continue to invest in software and/or technologies (smart phone technology, laptops, tablets etc.) to assist in streamlining the collection of health service data to feedback into automated system of health information (eNHIS).
- Ensure that there are multiple channels and modalities of community information, including free hotline – with staff and resourcing to support responding to community fear, concern and confusion at times of health crises.

5.8 People and community

- Build on established partnerships and approaches for engaging with the community, through trusted community leaders and representatives, to support health communication, health promotion, public health intelligence and community engagement in decision making. Coordination and/or utilization of existing civil society is critical, including representatives from key faith-based organizations, local and international NGOs, development agencies working in health partnerships and health administration partnerships at provincial health level, to support the management of emergency response activities and ensure health service availability.
- In future outbreaks, emphasis should be placed on supporting local health workers with financing and logistics to realise locally appropriate care plans. Local health workers often have a thorough understanding of the needs of key populations in their community and the best way to maintain key populations services during health threats.
- Further research to capture community-centred approaches that were initiated after this study could identify other community innovations, outstanding needs and communication that needs to occur at the local level.

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Annex 1 Facility review findings

Description of health facilities

Table 4 presents basic descriptions of the health facilities as reported in the health facility review (HFR). Thirty-three HFR were completed at 16 health facilities in the seven study provinces. Facilities included hospitals, urban clinics and health centres, hospital specialised clinics and stand-alone specialised clinics. Hospital specialised services included facilities or services that are part of the hospital providing specific health services such HIV/STI, TB. Specialised clinics included health clinics providing a specific service, usually as part of a larger health facility, such as an antenatal clinic within a sexual and reproductive health service.

Of the 33 HFR, one facility reported no outpatient or inpatient data (Western province), one no outpatient or operations data recorded (Western province) and one had no outpatient, inpatient or operations response data completed (Eastern Highlands Province). All 33 surveys were included in the analysis. The majority of surveys (91%) were conducted in urban centres; hospitals and hospital-based specialised clinics comprised 58% of the surveys. Two thirds of participants who completed the HFR (67%) identified that facilities were government led and 58% were government funded. Over half of all participants (58%) reported that outpatient services were provided at their facility and 49% reported inpatient services. Half of the participants (52%) reported that COVID-19 services were available in their facility.

COVID-19 functions and services

Table 5 presents COVID-19 functions and services at these 16 health facilities. The availability of COVID-19 PCR testing was only reported in hospital facilities and one health centre, while RDT (Ag POC) COVID-19 was available in all hospitals and in 44% of health centres. Most of the health facilities (82%) did not charge patients for COVID-19 tests. COVID-19 treatment support was more

likely to be available at hospitals (56%), than a health centre (22%). The proportion of participants that reported availability of oxygen supply was greater for those working at hospital facilities compared to health centre facilities (67% and 22% respectively). Inpatient beds for patients with COVID-19 were only reported in six HFR. Although the proportion of participants attached to health centre facilities reported lower occurrence of COVID-19 infection among health care workers, their reports of health facility closure due to COVID-19 was higher for health centres compared to hospital facilities. Of the 33 HFR responses, 33% reported having information systems to report COVID-19 cases to an established authority

Outpatient services

Table 6 presents clinics and outpatient services reported to be provided by participants. Of the 33 HFR completed, eight reported availabilities of well women's clinics and 14 reported well baby clinics. A higher proportion of common outpatient services, including family planning, antenatal care, childhood immunisation, malaria testing and treatment and general outpatient services, were reported compared to those attached to hospital facilities. In contrast to the qualitative data presented in this report, most services across the different health facilities reported few, or no, major change during the COVID-19 pandemic (Table 7).

Inpatient capacity of services and facilities

Table 8 presents inpatient wards and services reported by participants from 16 health facilities. Of the 16 health facilities included in the review most reported key inpatient beds and services were available and operating during the COVID-19 pandemic. General medical wards, labour and post-natal wards were reported to be available by 63% of all facilities. COVID-19 isolation wards were available in 25% of the facilities. There were no changes reported to the availability of inpatient beds for 50-75% of all 16 facilities.

Operating hours, other services, and resources

Table 9 presents operating hours resources available at the health facilities reported by participants. The majority of outpatient services were operating throughout the day, with only a quarter mentioning 24 hours operation. The availability of electricity and water supplies was mentioned in most HFR responses. Electricity and water supplies for the health facilities were available (73% and 94%, respectively), with both being delivered from the main town supply. The availability of ambulance services at health facilities was reported in 48.5% of HFR, and 18.2% reported the ceasing of ambulance services.

The four frequently used standard treatment books, which include obstetrics and gynaecology, paediatrics, STIs, and adult care, were mentioned as available by 50% of the participants.

Access to personal protective equipment (PPE), including surgical masks, latex gloves, gowns, face shields and hand sanitiser, were reported as available by up to two thirds of participants, but this declined to 30-50% when reporting access to PPE during COVID-19. No access to PPE was reported by 10-20% of the participants.

Availability of health care workers and other workforce across the health facilities

In Table 10 we report the availability of administrative and support staff, along with clinical staff. An administration manager was the most frequently reported member of the administration team, reported by 30% of participants. Availability of ancillary staff was reported by 45% of the participants. While there was little change in availability of the administration-related staff during the COVID-19 pandemic, the availability of ancillary staff was reported as increasing by 21% during COVID-19.

Among clinical staff, community health workers (70%) and nurses (80%) were the most frequently reported clinical members of the health workforce. Of these

community health workers and nurses, 60% and 70% reported availability of nursing officers and community health workers respectively while midwives were reported in 40% of completed HFR. There was a slight increase in the availability of doctors, nurses, midwives and community health workers, with additional clinic staff members added to the workforce during the pandemic. Of the 33 participants, 24% reported having doctors currently available, with an increase of 21% more doctors during COVID-19. There was a 30% increase in the availability of nurses and community health workers during COVID-19.

One in five (20%) reported a volunteer workforce at their health facility, including village health volunteers, treatment supporters and councillors – and of those who reported volunteer workforce, most (89%) had no change during COVID-19. These health workforce findings reported in the HFR stand in stark contrast to the qualitative data, where significant health workforce shortages across all healthcare worker roles were reported.

Availability and access to essential resources and medicines

In Table 11 we report the availability of and access to essential medicines and consumables and resources, including access to essential medicines and rapid diagnostic tests. Common contraceptive methods, including the oral contraceptive oral pills Depo-Provera injection and condoms were reported to be available by 42%-49% of all participants. There was little change in availability of modern contraceptive methods during the COVID-19 pandemic.

Of the 33 participants, up to 40% stated that an extended program of Immunisation (EPI) vaccines was available at the health facility they were working at. In terms of availability of essential medication, including antibiotics and first line treatment for malaria, 35-50% of the participants reported that items were currently in stock. However, antiretrovirals for prophylaxis for newborns and second line treatment for severe malaria were only reported by 24% and 27% respectively. Essential items to support safe childbirth were mentioned to be available by less than 30% of the participants. Availability of rapid tests for HIV, malaria and syphilis was reported by less than 45% of participants. Changes in the availability of essential medicines due to COVID-19 cannot be determined

by this HFR data but was reported as a significant barrier of health service delivery in the qualitative data.

Finance, governance, and information systems of the different levels of health facilities

In Tables 12 and 13 we report governance structures, health information systems and finance as reported by the 33 participants. Among the 33 participants, 73% reported collecting outpatient information on a daily basis; 33% collected inpatient information daily. The sister in charge of the department or the officer in charge of the health centre were primarily responsible for collection of information; 57% of participants reported to the provincial health authority (PHA) on a quarterly basis. Participants from hospital-based specialised services showed a higher proportion of COVID-19 affecting reporting process to PHAs compared to other level of services. The use of paper-based reporting to the provincial health authorities was reported to be higher for hospital specialised services, the health centres and specialised clinics health, while electronic forms were used more by hospitals.

Infection prevention and control committees were reported to be established in most hospitals (77%). In the health centres and specialised clinics this was around 50%; infection control and policy and the establishment of a provincial COVID-19 taskforce were similar. Triage measures for COVID-19 were reported by more than 50% of participants.

Almost two thirds (60%) of all participants reported that their facility was government funded. The proportion of change in finances as a result of COVID-19 was higher for those working at health centres, specialised and hospital specialised clinics, compared to hospitals. Of all 33 participants, not enough financial support either pre-COVID-19 or during COVID-19 was reported by 70%.

Table 4. Overview of health facilities and services by province

	EHP (n=8)	WP- SF (n=3)	WP- NF (n=5)	NCD (n=2)	ENB (n=4)	Madang (n=3)	Morobe (n=3)	WHP (n=5)	Total (N=33)
Location of Facility % (n)									
Urban	100.0(8)	100.0(3)	100.0(5)	100.0(2)	50.0(2)	66.7(2)	100.0(3)	100.0(5)	90.9(30)
Rural	0.0(0)	0.0(0)	0.0(0)	0.0(0)	50.0(2)	33.3(1)	0.0(0)	0.0(0)	9.1(3)
Type of Facility % (n)									
Hospital	25.0(2)	66.7(2)	60.0(2)	0.0(0)	25.0(1)	33.3 (1)	33.3(1)	0.0(0)	27.2(9)
Hospital specialised clinics	25.0(2)	0.0(0)	0.0(0)	0.0(0)	75.0(3)	33.3 (1)	66.7(2)	40(2)	30.4(10)
Health centres	50.0(4)	0.0(0)	40.0(3)	50.0(1)	0.0(0)	33.3 (1)	0.0(0)	0.0(0)	27.2(9)
Specialised clinics	0.0(0)	33.3(1)	0.0(0)	50.0(1)	0.0(0)	0.0(0)	0.0(0)	60(3)	15.2(5)
Managing Authority % (n)									
Government/Public	100(8)	66.7(2)	40.0(2)	50(1)	50(2)	66.7(2)	100.0(3)	40.0(2)	66.7(22)
NGO/Not for profit	0.0(0)	33.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	60.0(3)	12.1(4)
Mission/Faith based	0.0(0)	0.0(0)	60.0(3)	50(1)	50(2)	33.3(1)	0.0(0)	0.0(0)	21.2(7)
Main Funding Source % (n)									
Government	75.0(6)	33.3(1)	60.0(3)	50.0(1)	75.0(3)	100.0(3)	0.0(0)	40.0(2)	57.6(19)
Donor	0.0(0)	0.0(0)	40.0(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	60.0(3)	15.1(5)
No response	25.0 (2)	66.7(2)	0.0(0)	50.0(1)	25.0 (1)	0.0(0)	100.0(3)	0.0(0)	27.3(9)
Main Services: Outpatient %(n)									
Yes	37.5(3)	0.0(0)	80.0(4)	50.0(1)	75.0(3)	66.7(2)	66.7(2)	80.0(4)	57.6(19)
No	50.0(4)	33.3(1)	20.0(1)	50.0(1)	25.0(1)	33.3(1)	33.3(1)	20.0(1)	33.3(11)
No response	12.5(1)	66.7(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	9.1(3)
Main services: Inpatient % (n)									
Yes	37.5(3)	66.7(2)	40.0(2)	0.0(0)	75.0(3)	66.7(2)	100.0(3)	20.0(1)	48.5(16)
No	62.5(5)	33.3(1)	60.0(3)	100.0(2)	25.0(1)	33.3(1)	0.0(0)	80.0(4)	51.5(17)
COVID-19 Services % (n)									
Yes	50.0(4)	66.7(2)	60.0(3)	50.0(1)	75.0(3)	66.7(2)	33.3(1)	20.0(1)	51.5(17)
No	50.0(4)	0.0(0)	40.0(2)	50.0(1)	0.0(0)	33.3(1)	66.7(2)	60.0(3)	39.4(13)
No response	0.0(0)	33.3(1)	0.0(0)	0.0(0)	25.0(1)	0.0(0)	0.0(0)	20.0(1)	9.1(3)

Abbreviations: EHP-Eastern Highlands Province, WP-SF - Western Province South Fly, WP-NF-Western Province North Fly, NCD-National Capital District, ENB-East New Britain, Madang-Madang Province, Morobe - Morobe Province and WHP-Western Highlands Province. Hospital specialised clinics - Clinics managed by hospitals that provide specific service e.g., Maternal and Child Health/HIV clinics. Specialised clinics - Clinics that operate alone providing specific services e.g., sexual reproductive health services, TB management.

Table 5. COVID-19 related services and resources at health facilities

Services and resources		Hospitals (n=9)	Hospital specialised clinics (n=10)	Health centres (n=9)	Specialised clinics (n=5)	Total (N=33)
COVID-19 Testing: PCR %(n)	Yes	100.0(9)	0.0(0)	11.1(1)	0.0(0)	30.3(10)
	No	0.0(0)	90.0(9)	88.9(8)	60.0(3)	60.6(20)
	NR	0.0(0)	10.0(1)	0.0(0)	40.0(2)	9.1(3)
COVID-19 Testing: RDT (POC) %(n)	Yes	100.0(9)	20.0(2)	44.4(4)	0.0(0)	45.4(15)
	No	0.0(0)	70.0(7)	55.6(5)	60.0(3)	45.4(15)
	NR	0.0(0)	10.0(1)	0.0(0)	40.0(2)	9.2(3)
COVID-19 cases are reported to established authority %(n)	Yes	44.4(4)	30.0(3)	44.4(4)	0.0(0)	33.3(11)
	No	55.6(5)	60.0(6)	55.6(5)	60.0(3)	57.6(19)
	NR	0.0(0)	10.0(1)	0.0(0)	40.0(2)	9.1(3)
Testing charges %(n)	Yes	22.2(2)	10.0(1)	0.0(0)	0.0(0)	9.1(3)
	No	77.8(7)	80.0(8)	100.0(9)	60.0(3)	81.8(27)
	NR	0.0(0)	10.0(1)	0.0(0)	40.0(2)	9.1(3)
Referral facility for testing %(n)	Yes	11.1(1)	40.0(4)	77.8(7)	0.0(0)	36.4(12)
	No	88.9(8)	0.0(0)	0.0(0)	0.0(0)	24.2(8)
	NR	0.0(0)	60.0(6)	22.2(2)	100.0(5)	39.4(13)
Treatment support %(n)	Yes	55.6(5)	20.0(2)	22.2(2)	0.0(0)	27.3(9)
	No	44.4(4)	70.0(7)	77.8(7)	60.0(3)	63.6(21)
	NR	0.0(0)	10.0(1)	0.0(0)	40.0(2)	9.1(3)
Inpatient beds %(n)	0	55.6(5)	80.0(8)	88.9(8)	60.0(3)	72.7(24)
	≤20	33.4(3)	10.0(1)	0.0(0)	0.0(0)	12.1(4)
	>20	11.1(1)	0.0(0)	11.1(1)	0.0(0)	6.1(2)
	NR	0.0(0)	10.0(1)	0.0(0)	40.0(2)	9.1(3)
Referral facility for treatment/ Inpatients %(n)	Yes	11.2(1)	40.0(4)	66.7(6)	40.0(2)	39.4(13)
	No	44.4(4)	10.0(1)	11.1(1)	0.0(0)	18.2(6)
	NR	44.4(4)	50.0(5)	22.2(2)	60.0(3)	42.4(14)
Resources						
Oxygen cylinders %(n)	Yes	66.7(6)	10.0(1)	22.2(2)	0.0(0)	27.3(9)
	No	33.3(3)	80.0(8)	77.8(7)	60.0(3)	63.6(21)
	NR	0.0(0)	10.0(1)	0.0(0)	40.0(2)	9.1(3)
COVID-19 treatment - medicine %(n)	Yes	55.6(5)	10.0(1)	44.4(4)	20.0(1)	33.3(11)
	No	44.4(4)	80.0(8)	55.6(5)	40.0(2)	57.6(19)
	NR	0.0(0)	10.0(1)	0.0(0)	40.0(2)	9.1(3)
Service disruption on due to COVID-19						
Closure of facility due to COVID-19 %(n)	Yes	11.1(1)	20.0(2)	66.7(6)	20.0(1)	30.3(10)
	No	88.9(8)	70.0(7)	33.3(3)	40.0(2)	60.6(20)
	NR	0.0(0)	10.0(1)	0.0(0)	40.0(2)	90.1(3)
Occurrence of HCW COVID-19 Infection %(n)	Yes	55.6(5)	40.0(4)	22.2(2)	20.0(1)	36.4(12)
	No	44.4(4)	50.0(5)	77.8(7)	40.0(2)	54.5(18)
	NR	0.0(0)	10.0(1)	0.0(0)	40.0(2)	9.1(3)

Abbreviations and descriptions: NR-No response, NN-Not needed
Hospital specialised clinics - Clinics managed by hospitals that provide specific service e.g., Maternal and Child Health/HIV clinics Specialised clinics - Clinics that operate alone providing specific services e.g., sexual reproductive health services, TB management.

Table 6. Clinics and outpatient services reported to be provided during the time of survey

Clinics/Outpatients services		Hospitals (n=9)	Hospital specialised clinics (n=10)	Health centres (n=9)	Specialised clinics (n=5)	Total (N=33)
Clinics reported						
Well baby clinic %(n)	Yes	44.4(4)	30.0(3)	55.6(5)	40.0(2)	42.4(14)
	No	44.4(4)	60.0(6)	44.4(4)	40.0(2)	48.5(16)
	NR	11.2(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
Well women clinic %(n)	Yes	44.4(4)	20.0(2)	22.(2)	0.0(0)	24.2(8)
	No	44.4(4)	70.0(7)	77.8(7)	80.0(4)	66.7(22)
	NR	11.2(1)	10.0(1)	0.0(0)	10.0(1)	9.1(3)
Outpatient services reported						
General outpatients %(n)	Yes	55.6(5)	40.0(4)	77.8(7)	60.0(3)	57.6(19)
	No	33.3(3)	50.0(5)	22.2(2)	20.0(1)	33.3(11)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(1)
Family planning %(n)	Yes	33.3(3)	30.0(3)	44.4(4)	40.0(2)	36.3 (12)
	No	55.6(5)	60.0(6)	55.6(5)	40.0(2)	54.6(18)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
Antenatal care %(n)	Yes	55.6(5)	20.0(2)	44.4(4)	40.0(2)	39.4(13)
	No	33.3(3)	70.0(7)	55.6(5)	40.0(2)	51.5(17)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
Childhood immunisation %(n)	Yes	44.4(4)	20.0(2)	55.6(5)	40.0(2)	39.4(13)
	No	44.4(4)	70.0(7)	44.4(4)	40.0(2)	51.5(17)
	NR	11.2(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
Cervical cancer screening %(n)	Yes	33.3(3)	10.0(1)	0.0(0)	0.0(0)	12.1(4)
	No	55.6(5)	80.0(8)	100.0(9)	80.0(4)	78.8(26)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
HPV testing %(n)	Yes	44.4(4)	10.0(1)	11.1(1)	0.0(0)	18.2(6)
	No	44.4(4)	80.0(8)	88.9(8)	80.0(4)	72.7(24)
	NR	11.2(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
STI management %(n)	Yes	66.7(6)	40.0(4)	88.9(8)	60.0(3)	63.6(21)
	No	22.2(2)	50.0(5)	11.1(1)	20.0(1)	27.3(9)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
TB Testing %(n)	Yes	66.7(6)	30.0(3)	44.4(4)	40.0(2)	45.4(15)
	No	22.2(2)	60.0(6)	55.6(5)	40.0(2)	45.4(15)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.2(3)
TB Treatment %(n)	Yes	66.7(6)	40.0(4)	44.4(4)	20.0(1)	45.4(15)
	No	22.2(2)	50.0(5)	55.6(5)	60.0(3)	45.4(15)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.2(3)
Malaria Testing %(n)	Yes	66.7(6)	30.0(3)	88.9(8)	40.0(2)	57.6(19)
	No	22.2(2)	60.0(6)	11.1(1)	40.0(2)	33.3(11)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
Malaria Treatment %(n)	Yes	66.7(6)	30.0(3)	77.8(7)	40.0(2)	54.5(18)
	No	22.2(2)	60.0(6)	22.2(2)	40.0(2)	36.4(12)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
Prevention of mother to child transmission of HIV %(n)	Yes	77.8(7)	50.0(5)	66.7(6)	40.0(2)	60.6(20)
	No	11.1(1)	40.0(4)	33.3(3)	40.0(2)	30.3(10)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
HIV counselling and testing %(n)	Yes	77.8(7)	60.0(6)	55.6(5)	60.0(3)	63.6(21)
	No	11.1(1)	30.0(3)	44.4(4)	20.0(1)	27.3(9)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)
HIV care, support, and treatment %(n)	Yes	66.7(6)	50.0(5)	66.7(6)	40.0(2)	57.6(19)
	No	22.2(2)	40.0(4)	33.3(3)	40.0(2)	33.3(11)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(1)
Syphilis testing %(n)	Yes	66.7(6)	50.0(5)	55.6(5)	60.0(3)	57.6(19)
	No	22.2(2)	40.0(4)	44.4(4)	20.0(1)	33.3(11)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(1)
Syphilis treatment %(n)	Yes	77.8(7)	50.0(5)	77.8(7)	60.0(3)	66.7(22)
	No	11.1(1)	40.0(4)	22.2(2)	20.0(1)	24.2(8)
	NR	11.1(1)	10.0(1)	0.0(0)	20.0(1)	9.1(3)

Abbreviations: NR-No response. Hospital specialised clinics - Clinics managed by hospitals that provide specific service e.g., Maternal and Child Health/HIV clinics. Specialised clinics - Clinics that operate alone providing specific services e.g., sexual reproductive health services, TB management.

Table 7. Changes in availability of outpatient services at time of survey (n=33 respondents).

	Change in availability		
	No changes	**Services added**	**Services ceased**
Clinics			
Well baby clinic %(n)	48.5(16)	30.3(10)	21.2(7)
Well woman clinic %(n)	75.8(25)	18.2(6)	6.0(2)
Outpatient services			
General outpatients %(n)	54.6(18)	33.3(11)	12.1(4)
Family planning %(n)	60.6(20)	21.2(7)	18.2(6)
Antenatal care %(n)	63.6(21)	21.2(7)	15.2(5)
Childhood immunisation %(n)	57.6(19)	24.2(8)	18.2(6)
Cervical cancer screening %(n)	81.8(27)	12.2(4)	6.0(2)
HPV testing %(n)	75.8(25)	18.2(6)	6.0(2)
STI management %(n)	54.6(18)	39.4(13)	6.0(2)
TB Testing %(n)	60.6(20)	27.3(9)	12.1(4)
TB Treatment %(n)	60.6(20)	33.4(11)	6.0(2)
Malaria Testing %(n)	54.6(18)	33.3(11)	12.1(4)
Malaria Treatment %(n)	51.5(17)	33.3(11)	15.2(5)
Prevention to mother to child transmission of HIV %(n)	42.4(14)	45.5(15)	12.1(4)
HIV counselling and testing %(n)	42.4(14)	45.5(15)	12.1(4)
HIV care, support, and treatment %(n)	51.5(17)	39.4(13)	9.1(3)
Syphilis testing %(n)	54.6(18)	39..4(13)	6.0(2)
Syphilis treatment %(n)	42.4(14)	48.5(16)	9.1(3)

No changes: Refers to testing, treatment care activities and resources for various diseases did not change during the time of survey.
Services added: Refers that during the time of survey testing, treatment care activities including resources for the various diseases were made available.
Services ceased: Refers that during the time of survey testing, treatment care activities including resources for the various diseases were no longer available.

Table 8. Inpatient wards and inpatient services (treatment and care) available at the 16 health facilities.

	Current availability		Change in availability		
	Yes	No	No Change	Added	Ceased
Services %(n)					
Labour and childbirth	62.5(10)	37.5(6)	50.0(8)	37.5(6)	12.5(2)
Nursery (special care)	43.7(7)	56.3(9)	50.0(8)	31.2(5)	18.8(3)
Postnatal care	62.5(10)	37.5(6)	56.3(9)	37.5(6)	6.2(1)
General medical ward	62.5(10)	37.5(6)	56.3(9)	37.5(6)	6.2(1)
TB isolation ward	43.7(7)	56.3(9)	50.0(8)	31.2(5)	18.8(3)
TB Drug Sensitive ward	37.5(6)	62.5(10)	68.8(11)	25.0(4)	6.2(1)
TB Multi-Drug Resistant ward	31.2(5)	68.8(11)	62.5(10)	25.0(4)	12.5(2)
General surgical ward	37.5(6)	62.5(10)	68.8(11)	25.0(4)	6.2(1)
Paediatric medical ward	43.7(7)	56.3(9)	62.5(10)	31.3(5)	6.2(1)
Isolation ward	25.0(4)	75.0(12)	75.0(12)	25.0(4)	0.0(0)
Intensive care unit	31.2(5)	68.8(11)	68.8(11)	25.0(4)	6.2(1)
Accident and Emergency	50.0 (8)	50.0 (8)	62.5(10)	31.3(5)	6.2(1)
Inter-ward	18.8(3)	81.2(13)	75.0(12)	18.8(3)	6.2(1)
Morgue facility	37.5(6)	62.5(10)	68.8(11)	25.0(4)	6.2(1)

Currently available: were in operation during the survey; no changes: did not change during the time of survey.
Services added: services/resource changed during the time of survey
Services ceased: during the time of survey these were no longer available

Table 9. Operating hours and key resources available at facilities (n=33).

	Currently availability		Change in availability		
	Yes	No	No Change	Added	Ceased
Operation and resources %(n)					
Ambulance transfer	48.5(16)	51.5(17)	48.5(16)	33.3(11)	18.2(6)
Operating time: Full day	81.8(27)	18.2(6)	48.5(16)	51.5(17)	0.0(0)
Operating time: 24 hours	24.2(8)	75.8(25)	15.2(5)	81.8(27)	3.0(1)
Electricity - main supply	72.7(24)	27.3(9)	45.5(15)	42.4(14)	12.1(4)
Water source: main supply	93.9(31)	6.1(2)	45.5(15)	54.5(18)	0.0(0)
Water source: tank	6.1(2)	93.9(31)	96.9 (32)	3.1(1)	0.0(0)
Access to standard treatment books %(n)					
Obstetrics & Gynaecology (red)	48.5(16)	51.5(17)	66.7(22)	18.2 (6)	15.1(5)
Paediatric (blue)	57.6(19)	42.4(14)	63.6(22)	27.3(9)	9.1(3)
STIs (green/white)	48.5(16)	51.5(17)	57.6(19)	30.3(10)	12.1 (4)
Adult (green)	51.5(17)	48.5(16)	66.6(22)	27.3(9)	6.1(2)
Public health manual (yellow)	9.1(3)	90.9(30)	78.8(26)	6.1(2)	15.1(5)
Outpatient Manual for PNG	6.1(2)	93.9(31)	87.9(29)	3.0(1)	9.1(3)
Malaria treatment protocol	24.2(8)	75.8(25)	72.7(24)	9.1(3)	18.2(6)
TB (treatment/care handbook)	18.2(6)	81.8(27)	72.7(24)	12.2 (4)	15.1(5)
Access to PPE %(n)					
Surgical masks	69.7(23)	30.3(10)	36.3(12)	45.5(15)	18.2(6)
N95 masks	48.5(16)	51.5(17)	48.5(16)	33.3(11)	18.2(6)
N95 masks testing	39.4(13)	60.6(20)	60.6(20)	27.3(9)	12.1(4)
Latex gloves	69.7(23)	30.3(10)	33.3(11)	48.5(16)	18.2(6)
Gowns	63.6(21)	36.4(12)	39.4(13)	51.5(17)	9.1(3)
Face shields	57.6(19)	42.4(14)	42.4(14)	42.4(14)	15.2(5)
Hand sanitiser/wipes	60.6(20)	39.4(13)	51.5(17)	33.3(11)	15.2(5)
Utilisation of PPE %(n)					
Surgical masks	60.6(20)	39.4(13)	39.4(13)	39.4(13)	21.2(7)
N95 masks	42.4(14)	57.6(19)	51.5(17)	30.3(10)	18.2(6)
N95 masks testing	33.3(11)	66.7(22)	57.5(19)	27.3(9)	15.2(5)
Latex gloves	72.7(24)	27.3(9)	33.3(11)	48.5(16)	18.2(6)
Gowns	69.7(23)	30.3(10)	33.3(11)	57.6(19)	9.1(3)
Face shields	57.6(19)	42.4(14)	39.3(13)	45.5(15)	15.2(5)
Hand sanitiser/wipes	66.7(22)	33.3(11)	39.3(13)	45.5(15)	15.2(5)

Currently available: were in operation during the survey; no changes: did not change during the time of survey; services added: services/ resource changed during the time of survey; services ceased: during the time of survey these were no longer available

Table 10. Availability of health care workers and support personnel at the health facilities during the survey (N=33).

	Currently availability		Change in availability		
	Yes	No	No Change	Yes	No
Administration %(n)					
Executive management	15.1(5)	84.9(28)	84.8(28)	9.1(3)	6.1(2)
Administrative/managerial	30.3(10)	69.7(23)	78.8(26)	15.1(5)	6.1(2)
Provincial malaria officer/supervisor	9.1(3)	90.9(30)	84.8(28)	9.1(3)	6.1(2)
Provincial information/data officer	12.1(4)	87.9(29)	81.8(27)	9.1(3)	9.1(3)
Clinical staff %(n)					
Doctors	24.2(8)	75.8(25)	69.7(23)	21.2(7)	9.1(3)
Doctors-specialised	12.1(4)	87.9(29)	87.9(29)	9.1(3)	3.0(1)
Health Extension Officers	30.3(10)	69.7(23)	69.7(23)	18.2(6)	12.1(4)
Nurses	57.6(19)	42.4(14)	54.6(18)	30.3(10)	15.1(5)
Midwives	39.4(13)	60.6(20)	69.7(23)	21.2(7)	9.1(3)
Community Health Workers	69.7(23)	30.3(10)	57.6(19)	33.3(11)	9.1(3)
Laboratory Technicians	18.2(6)	81.8(27)	78.8(26)	12.1(4)	9.1(3)
Trainees (medical/clinical/lab)	15.1(5)	84.9(28)	87.9(29)	9.1(3)	3.0(1)
Educators/trainers	6.1(2)	93.9(31)	90.9(30)	6.1(2)	3.0(1)
Nurses in charge	15.1(5)	84.9(28)	87.9(29)	12.1(4)	0.0(0)
Support staff-Clinical care %(n)					
Village health volunteers	18.2(6)	81.8(27)	87.9(29)	9.1(3)	3.0(1)
Peer educator/ counsellor/advocate	21.2(7)	78.8(26)	84.9(28)	15.1(5)	0.0(0)
Treatment supporters	18.2(6)	81.8(27)	84.9(28)	12.1(4)	3.0(1)
Health facility volunteer	21.2(7)	78.8(26)	84.9(28)	15.1(5)	0.0(0)
Porters	6.1(2)	93.9(31)	90.9(30)	6.1(2)	3.0(1)
Councillors	18.2(6)	81.8(27)	87.9(29)	9.1(3)	3.0(1)
Support staff-Administration %(n)					
Ancillary staff (clerks/cooks/cleaners)	45.5(15)	54.5(18)	72.7(24)	21.2(7)	6.1(2)
Ambulance drivers	30.3(10)	69.7(23)	72.7(24)	18.2(6)	9.1(3)
Security personnel	27.3(9)	72.7(24)	75.8(25)	15.1(5)	9.1(3)

Currently available: were in operation during the survey; no changes: did not change during the time of survey; services added: services/ resource changed during the time of survey; services ceased: during the time of survey these were no longer available

Table 11. Availability of essential medicine and rapid tests at the health facilities at time of survey (N=33).

	Current availability		Availability status		
	Yes	No	No Change	Added	Ceased
Family planning %(n)					
Oral contraceptive pill	45.5(15)	54.5(18)	48.4(16)	45.5(15)	6.1(2)
Injectable contraceptive (Depo)	42.4(14)	57.6(19)	51.5(17)	42.4(14)	6.1(2)
Implants	27.3(9)	72.7(24)	63.6(21)	27.3(9)	9.1(3)
Condoms	48.5(16)	51.5(17)	42.4(14)	48.5(16)	9.1(3)
Intra uterine device	24.3(8)	75.7(25)	66.7(22)	24.2(8)	9.1(3)
Antenatal and Child Immunisation %(n)					
Fefol	33.3(11)	66.7(22)	57.6(19)	33.3(11)	9.1(3)
Measles vaccine	39.4(13)	60.6(20)	51.5(17)	39.4(13)	9.1(3)
DTP-Hib-Hep B	42.4(14)	57.6(19)	48.5(16)	42.4(14)	9.1(3)
Polio vaccine	39.4(13)	60.6(20)	51.5(17)	39.4(13)	9.1(3)
BCG	42.4(14)	57.6(19)	51.5(17)	42.4(14)	6.1(2)
Pneumococcal vaccine (PCV)	36.4(12)	63.6(21)	57.6(19)	36.3(12)	6.1(2)
'pik bel' vaccine	21.2(7)	78.8(26)	75.8(25)	21.2(7)	3.0(1)
Infectious diseases %(n)					
Albendazole	55.6(18)	45.4(15)	36.4(12)	54.5(18)	9.1(3)
Tetanus toxoid immunisation	48.5(16)	51.5(17)	42.4(14)	48.5(16)	9.1(3)
Antiretrovirals for antenatal women	33.3(11)	66.7(22)	54.6(18)	33.3(11)	12.1(4)
Antibiotics %(n)					
ARV prophylaxis for newborns	24.2(8)	75.8(25)	63.6(21)	24.2(8)	12.2(4)
Antibiotics	48.5(16)	51.5(17)	39.4(13)	48.4(16)	12.2(4)
Azithromycin	54.5(18)	45.4(15)	33.3(11)	54.5(18)	12.2(4)
Amoxicillin	48.5(16)	51.5(17)	33.3(11)	48.5(16)	18.2(6)
Probenecid	42.4(14)	57.6(19)	36.4(12)	42.4(14)	21.2(7)
Augmentin	48.5(16)	51.5(17)	33.3(11)	48.5(16)	18.2(6)
Metronidazole	48.5(16)	51.5(17)	36.4(12)	48.5(16)	15.1(5)
Benzathine	48.5(16)	51.5(17)	36.4(12)	48.5(16)	15.1(5)
Tinidazole	48.5(16)	51.5(17)	36.4(12)	48.5(16)	15.1(5)
Erythromycin	48.5(16)	51.5(17)	39.4(13)	48.5(16)	12.1(4)
Nystatin Pessaries	39.4(13)	60.6(20)	45.4(15)	39.5(13)	15.1(5)
Clotrimazole	36.4(12)	63.6(21)	45.4(15)	36.4(12)	18.2(6)
Malaria %(n)					
IPTp for malaria	27.3(9)	72.7(24)	66.6(22)	27.3(9)	6.1(2)
Artemether-Lumefantrine Mala-1 (first line)	48.5(16)	51.5(17)	42.4(14)	48.5(16)	9.1(3)
Primaquine tablet (1st line)	48.5(16)	51.5(17)	45.4(15)	48.5(16)	6.1(2)
Dihydroartemisinic-piperaquine (DP) (2nd line)	30.3(10)	69.7(23)	63.6(21)	30.3(10)	6.1(2)
Quinine tablets (Second line)	27.3(9)	72.7(24)	66.6(22)	27.3(9)	6.1(2)

	Current availability		Availability status		
	Yes	No	No Change	Added	Ceased
Pregnancy/childbirth %(n)					
Oxytocin injectable for 3rd stage labour	18.2(6)	81.8(27)	78.8(26)	18.2(6)	3.0(1)
Magnesium sulphate	27.3(9)	72.7(24)	60.6(20)	27.3(9)	12.1(4)
Nifedipine	24.2(8)	75.8(25)	72.8(24)	24.2(8)	3.0(1)
IV antibiotics for sepsis	24.2(8)	75.8(25)	66.7(22)	24.2(8)	9.1(3)
Dexamethasone for preterm labour	12.1(4)	87.9(29)	81.8(27)	12.1(4)	6.1(2)
Injectable antibiotics for newborns	27.3(9)	72.7(24)	63.6(21)	27.3(9)	9.1(3)
Antibiotic eye ointment for newborns	27.3(9)	72.7(24)	63.6(21)	27.3(9)	9.1(3)
Misoprostol	21.2(7)	78.8(26)	66.7(22)	21.2(7)	12.1(4)
Dexamethasone	24.2(8)	75.8(25)	66.7(22)	24.2(8)	9.1(3)
Oxygen	24.2(8)	75.8(25)	63.6(21)	24.3(8)	12.1(4)
Test/Rapid tests %(n)					
Rapid test for HIV	42.4(14)	57.6(19)	39.4(13)	42.4(14)	18.2(6)
Rapid test for malaria	45.5(15)	54.5(18)	42.4(14)	45.4(15)	12.2(4)
Blood slide preparation tools	27.3(9)	72.7(24)	66.6(22)	27.3(9)	6.1(2)
Rapid test for syphilis	39.4(13)	60.6(20)	51.5(17)	39.4(13)	9.1(3)
Urine test (TB)	3.0(1)	97.0(32)	90.9(30)	3.0(1)	6.1(2)
Tuberculin skin test (TB) HIV/TB coinfections	0.0(0)	100.0(33)	97.0(32)	0.0(0)	3.0(1)
GeneXpert/molecular test (TB)	3.0(1)	97.0(32)	87.9(29)	3.0(1)	9.1(3)

Currently available: were in operation during the survey; no changes: did not change during the time of survey; services added: services/ resource changed during the time of survey; services ceased: during the time of survey these were no longer available

Table 12. Availability of management and governance functions/activities by facility type, at the time of survey (n=33).

		Hospitals (n=9)	Hospital Specialised Clinics (n=10)	Health Centres (n=9)	Specialised Clinics (n=5)	Total (N=33)
Function/ activity %(n)						
Frequency of collecting outpatient information	Daily	66.7(6)	60.0(6)	100.0(9)	60.0(3)	72.7(24)
	Weekly	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	Others	11.1(1)	0.0(0)	0.0(0)	0.0(0)	3.0(1)
	NR	22.2(2)	40.0(4)	0.0(0)	40.0(2)	24.3(8)
Frequency of collecting inpatient information	Daily	55.6(5)	50.0(5)	11.1(1)	0.0(0)	33.3(11)
	Weekly	11.1(1)	10.0(1)	0.0(0)	0.0(0)	6.1(2)
	Others	11.1(1)	0.0(0)	11.1(1)	0.0(0)	6.1(2)
	NR	22.2(2)	40.0(4)	77.8(7)	100.0(5)	54.5(18)
Personal responsible for data collection	SIC	55.6(5)	40.0(4)	55.6(5)	20.0(1)	45.5(15)
	OIC	11.1(1)	10.0(1)	44.4(4)	40.0(2)	24.2(8)
	Others	11.1(1)	10.0(1)	0.0(0)	0.0(0)	6.1(2)
	NR	22.2(2)	40.0(4)	0.0(0)	40.0(2)	24.2(8)
Frequency of reporting to the PHA	Weekly	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	Monthly	11.1(1)	10.0(1)	0.0(0)	0.0(0)	6.1(2)
	Quarterly	55.6(5)	50.0(5)	100.0(9)	60.0(3)	66.7(22)
	Others	11.1(1)	0.0(0)	0.0(0)	0.0(0)	3.0(1)
	NR	22.2(2)	40.0(4)	0.0(0)	40.0(2)	24.2(8)
Reporting changed due to COVID-19	Yes	22.2(2)	40.0(4)	22.2(2)	0.0(0)	24.2(8)
	No	55.6(5)	30.0(3)	77.8(7)	80.0(4)	57.6(19)
	NR	22.2(2)	30.0(3)	0.0(0)	20.0(1)	18.2(6)
Paper based monthly reporting^	Yes	33.3(3)	60.0(6)	77.8(7)	60.0(3)	57.6(19)
	No	44.5(4)	10.0(1)	22.2(2)	20.0(1)	24.2(8)
	NR	22.2(2)	30.0(3)	0.0(0)	20.0(1)	18.2(6)
Electronic based monthly reporting^	Yes	44.5(4)	30.0(3)	44.4(4)	80.0(4)	45.4(15)
	No	33.3(3)	40.0(4)	55.6(5)	0.0(0)	36.4(12)
	NR	22.2(2)	30.0(3)	0.0(0)	20.0(1)	18.2(6)
COVID-19 Management Measures %(n)						
IPC Committee Established	Yes	77.8(7)	50.0(5)	44.4(4)	0.0(0)	48.5(16)
	No	22.2(2)	50.0(5)	56.6(5)	100.0(5)	51.5(17)
Provincial COVID-19 Taskforce	Yes	77.8(7)	50.0(5)	33.3(3)	20.0(1)	48.5(16)
	No	22.2(2)	50.0(5)	66.7(6)	80.0(4)	51.5(17)
IPC policy in place	Yes	77.8(7)	50.0(5)	33.3(3)	20.0(1)	48.5(16)
	No	22.2(2)	50.0(5)	66.7(6)	80.0(4)	51.5(17)
Triage measures for COVID-19	Yes	66.7(6)	50.0(5)	55.6(5)	60.0(3)	57.6(19)
	No	33.3(3)	50.0(5)	44.4(4)	40.0(2)	42.4(14)

Abbreviations: IPC: Infection prevention and control; NR-No response, SIC- sister in charge (specific department); OIC- officer in charge (of facility). ^ reporting of National Health Information Systems data. Hospital specialised clinics - Clinics managed by hospitals that provide specific service e.g., Maternal and Child Health/HIV clinics Specialised clinics - Clinics that operate alone providing specific services e.g., sexual reproductive health services, TB management.

Table 13. Proportion availability of finance at the health facilities reported by participants.

		Hospitals (n=9)	Hospital Specialised Clinics (n=10)	Health Centres (n=9)	Specialised Clinics (n=5)	Total (N=33)
Health facility finances: Government %(n)	Yes	77.8(7)	50.0(5)	77.8(7)	20.0(1)	60.6(20)
	No/NR	22.2(2)	50.0(5)	22.2(2)	80.0(4)	39.4(13)
Health facility finances: Donor %(n)	Yes	22.2(2)	20.0(2)	44.4(4)	80.0(4)	36.4(12)
	No/NR	77.8(7)	80.0(8)	55.6(5)	20.0(1)	63.6(21)
Health facility finances: Government/Donor %(n)	Yes	22.2(2)	20.0(2)	33.3(3)	20.0(1)	24.2(8)
	No/NR	77.8(7)	80.0(8)	66.7(6)	80.0(4)	75.8(25)
COVID-19 Finances						
Finances changed due to COVID-19 %(n)	Yes	22.2(2)	50.0(5)	33.3(3)	60.0(3)	39.4(13)
	No	55.6(5)	20.0(2)	66.7(6)	20.0(1)	42.4(14)
	NR	22.2(2)	30.0(3)	0.0(0)	20.0(1)	18.2(6)
Enough financial support pre-COVID-19 %(n)	Yes	11.1(1)	10.0(1)	22.2(2)	0.0(0)	12.1(4)
	No	66.7(6)	60.0(6)	77.8(7)	80.0(4)	69.7(23)
	NR	22.2(2)	30.0(3)	0.0(0)	20.0(1)	18.2(6)
Enough financial support during COVID-19 %(n)	Yes	33.3(3)	0.0(0)	11.1(1)	0.0(0)	12.1(4)
	No	44.5(4)	70.0(7)	88.9(8)	80.0(4)	69.7(23)
	NR	22.2(2)	30.0(3)	0.0(0)	20.0(1)	18.2(6)
Out/inpatients fees changed due to COVID-19 %(n)	Yes	22.2(2)	0.0(0)	0.0(0)	0.0(0)	6.0(2)
	No	55.6(5)	70.0(7)	100.0(9)	80.0(4)	75.8(25)
	NR	22.2(2)	30.0(3)	0.0(0)	20.0(1)	18.2(6)

Abbreviations and descriptions: NR-No response, NN-Not needed.
Hospital specialised clinics - Clinics managed by hospitals that provide specific service e.g., Maternal and Child Health/HIV clinics Specialised clinics - Clinics that operate alone providing specific services e.g., sexual reproductive health services, TB management


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