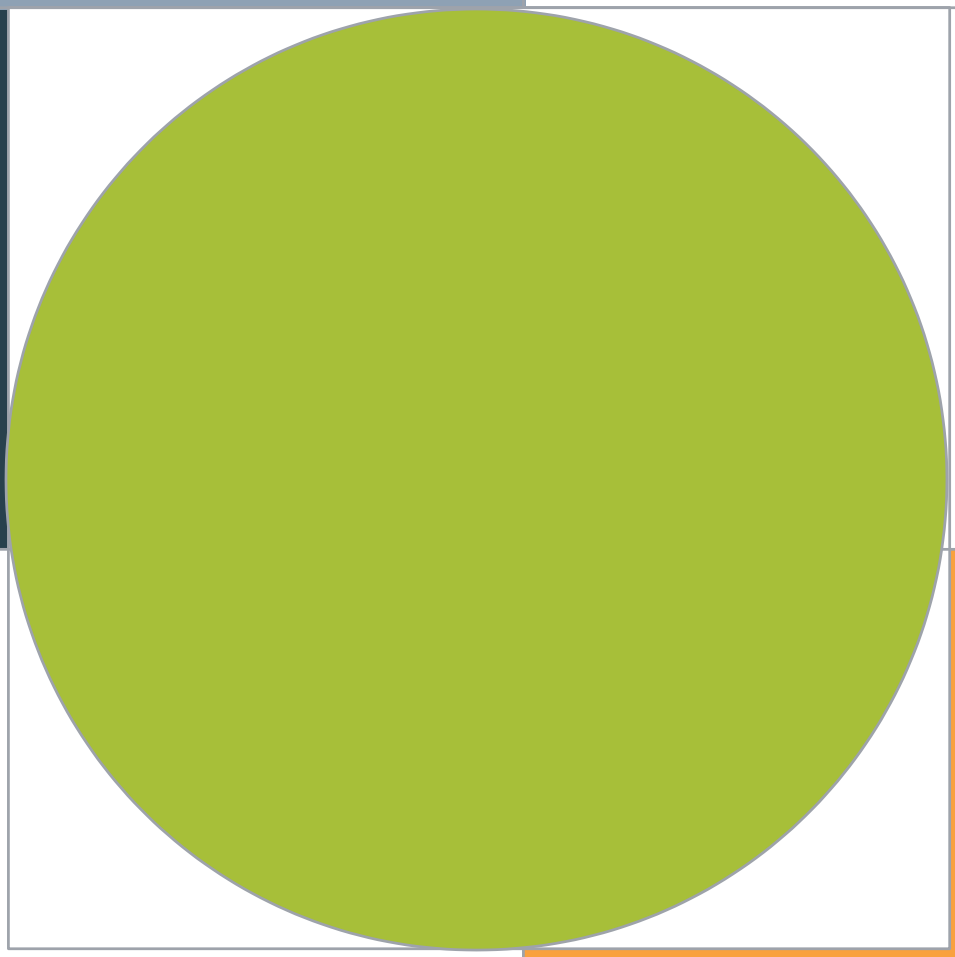
Assessment of the Medical Equipment Information System in USAID IHP-Supported Provinces in the Democratic Republic of Congo



June 2023

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Assessment of the Medical Equipment Information System in USAID IHP-Supported Provinces in the Democratic Republic of Congo

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Abbreviations

AG	Administrator-Manager | *Administrateur-Gestionnaire*
ANC	Antenatal Care
ART	Antiretroviral therapy
BCZ	Health zone central office | *Bureau Central de la Zone de Santé*
CDC	Centers for Disease Control
CDR	Regional Distribution Center | *Centre de Distribution Régionale*
CF	Congolese Franc
CODESA	Health Area Development Committee *Committee de Development de l'Aire de Sante*
D4I	Data for Impact
DHIS2	District Health Information System-2
DPS	Provincial Health Division | *Division provinciale de la Santé*
DRC	Democratic Republic of Congo
EPI/PEV	Expanded Program on Immunization | *Programme Élargi de Vaccination*
FEDECAME	Federation of Essential Medicine Procurement Agencies *Fédération des Centrales d'Approvisionnement en Médicaments Essentiels*
HGR	General Reference Hospital | *Hôpital Général de Référence*
HIV/AIDS	Human immunodeficiency virus/acquired immunodeficiency syndrome
IHP	Integrated Health Program
MCZ	Health Zone Chief Physician | *Médecin Chef de Zone*
MSP	Ministry of Public Health | *Ministère de la Santé Publique*
PAO	Annual operational action plan | *Plan d'action opérationnel annuel*
PDSS	Health System Development Project *Le Projet de Développement du Système de Santé*
PMTCT	Prevention of mother-to-child transmission
PNAM	National Program for the Provision of Essential Medicines Programme National d'Approvisionnement en Médicaments Essentiels
RHIS/SNIS	Routine health information system | Système National d'Information Sanitaire
TB	Tuberculosis
USAID	United States Agency for International Development
WHO	World Health Organization

Executive Summary

Efforts to improve health-related supply chains in the Democratic Republic of Congo (DRC) typically focus on medicines and vaccines, while the medical equipment system is either overlooked or considered incidental. This research was conducted to assess the performance of the medical equipment information system in the DRC and make recommendations for its improvement. The study aimed to understand the design and functionality of the medical equipment information system, identify strengths and weaknesses, and examine the impact of the system on health service delivery. The research also explored the role of donor support in the medical equipment information system.

Data for the study came from a desk review of national policies and procedures, as well as key informant interviews conducted at central and provincial levels in three provinces. In-depth interviews were also conducted with health zone chief physicians, hospital heads, and head nurses in selected health zones.

Findings revealed several weaknesses in the medical equipment information system in the DRC. Many health facilities, particularly health centers, lacked the minimum required equipment, which adversely affected the quality of services provided. Responsibility for equipment maintenance and procurement was not clearly defined, leading to a lack of accountability and coordination. We also identified a disconnect between data availability, resource mobilization, and decision making within the health system.

Several suggestions for strengthening the medical equipment information system, focusing on data flow, quality, demand, and use, were offered. These included the development and dissemination of comprehensive guidelines for medical equipment, particularly equipment specifications and amortization, the establishment for an audit mechanism to ensure adherence to national standards, and the need to create administrative positions at the provincial level to disseminate standards and monitor compliance.

Regarding equipment procurement, the study revealed an unclear and fragmented process. Recommendations included establishing a formalized process for keeping facilities informed of equipment requests and exploring regular planning and budgeting exercises for equipment procurement. We also highlighted the potential benefits of subsidies for equipment purchase in certain cases.

Overall, the medical equipment information system in the DRC is not functioning as designed, leading to inadequate availability and maintenance of equipment in health facilities. The Ministry of Public Health should consider investing in strengthening this system as a means of improving overall health service delivery. The findings of this study can serve as an example methodology for assessing medical equipment systems in other low-income countries, highlighting the importance of this often-overlooked component of quality health services.

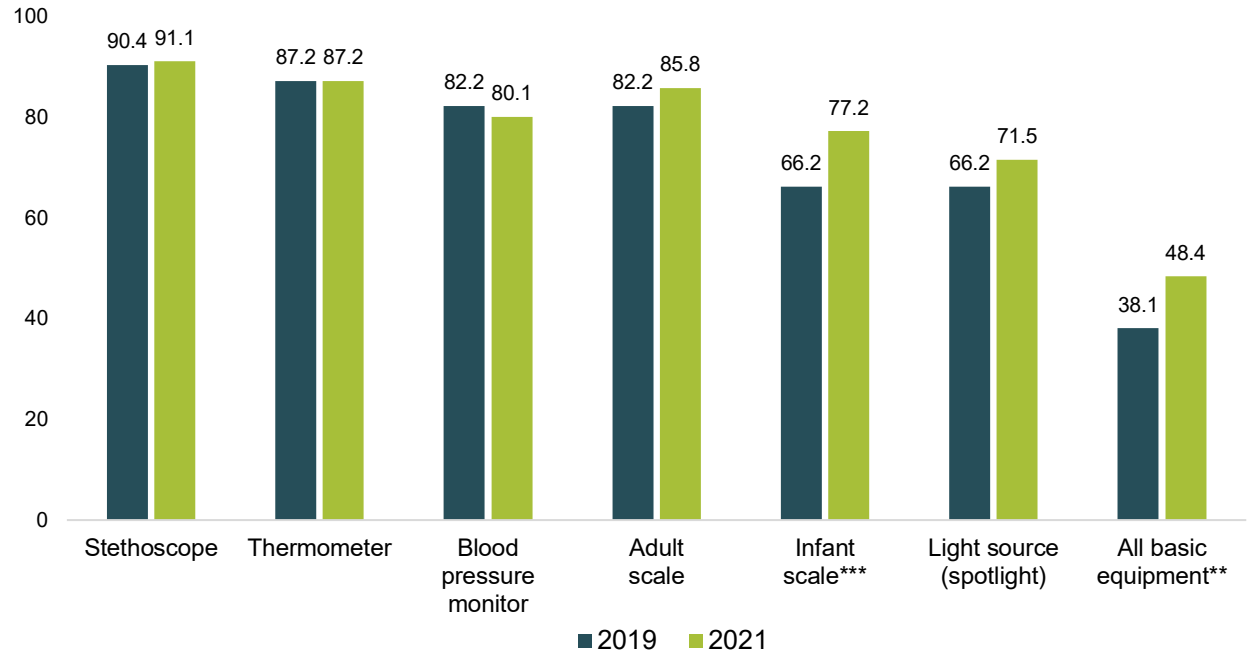
Background

Medical equipment and supplies are essential for health service delivery. According to the World Health Organization (WHO), a well-functioning health system should "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" (WHO, 2007).

Scope and impact of insufficient medical equipment in the DRC

As part of the performance evaluation of the USAID Integrated Health Program (IHP), Data for Impact (D4I) assessed the presence of six basic pieces of equipment—stethoscopes, thermometers, blood pressure monitors, adult scales, infant scales, and light sources—in 281 health centers and 101 hospitals at two points in time. Overall, in 2019, 38.1 percent of health centers had all six pieces of equipment; this percentage rose to 48.4 percent in 2021 (Figure 1). This increase was driven by an increase in the presence of infant scales, which rose from 66.2 percent in 2019 to 77.2 percent in 2021.[1] None of the other pieces of equipment significantly increased in presence between surveys. None of the six pieces of equipment were available in all facilities; the most common were stethoscopes, which in 2021 were found at 91.1 percent of health centers.

Figure 1. Percentage of health centers with selected basic equipment on the day of the survey, by survey round (n=281)

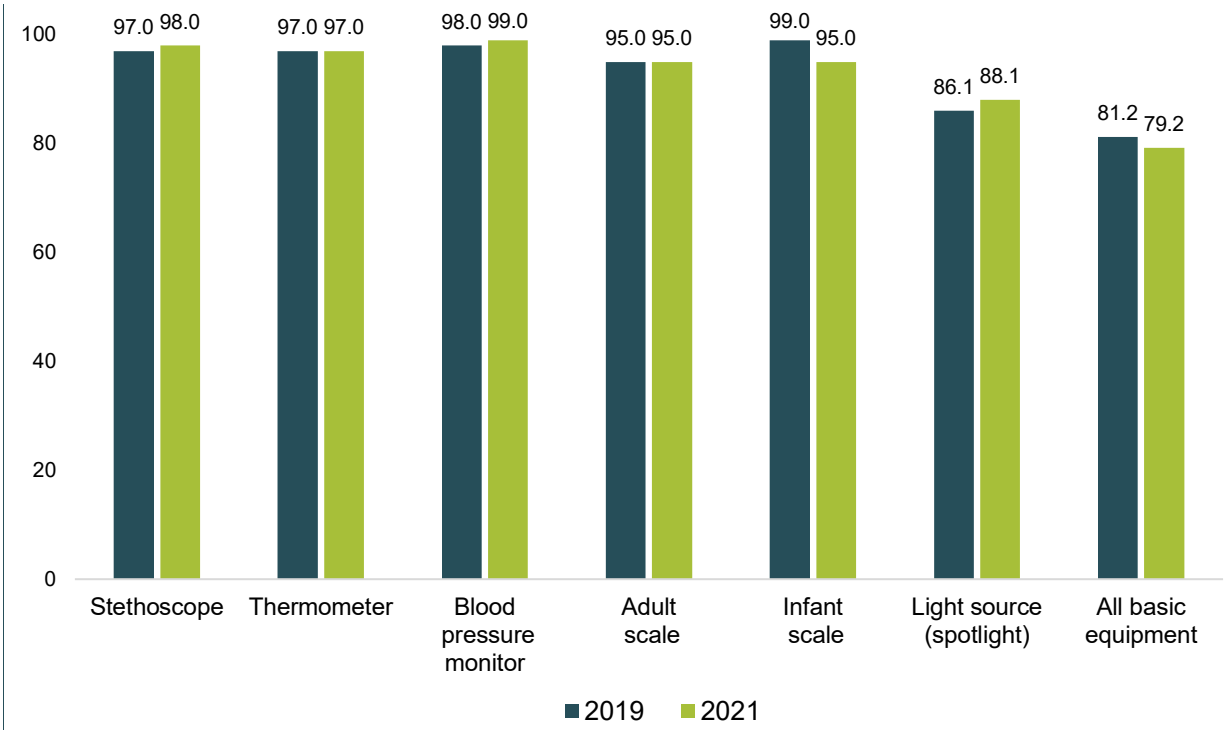


Notes: Limited to health centers surveyed in both rounds in six provinces: Sud Kivu, Tanganyika, Haut Katanga, Lualaba, Sankuru, and Kasai Oriental. Statistical significance is considered at *p<0.1, **p<0.05, and ***p<0.01.
Source: Data for Impact Midline Evaluation Report (2022)

[1] This may be attributable to nutrition programs operating in the region. Other results (not shown) indicate that the availability of oral rehydration salts also increased significantly between 2019 and 2021.

Hospitals were better equipped with basic equipment, although none of the six pieces of equipment were available in all hospitals, and only 79.2 percent of hospitals had all six pieces of equipment in 2021 (Figure 2). There were no significant changes in hospital-based equipment between 2019–2021.

Figure 2. Hospitals with selected basic equipment on the day of the survey, by survey round (n=101)



Notes: Limited to hospitals surveyed in both rounds in six provinces: Sud Kivu, Tanganyika, Haut Katanga, Lualaba, Sankuru, and Kasai Oriental. Statistical significance is considered at *p<0.1, **p<0.05, and ***p<0.01.
Source: Data for Impact Midline Evaluation Report (2022)

In Tanganyika, there were 27 health centers for which both service volume data[2] and D4I's 2021 survey data on the availability of medical equipment were available. In order to quantify the impact of missing equipment on patients, we calculated the numbers and percentages of patients who should have benefited from a piece of equipment but did not because it was not available at the facility during the month of their visit. This analysis assumed that the piece of equipment was stocked-out for the entire month. It also assumed that, if a health center had a piece of equipment, it would be used for all patients who needed it.

[2] Reported in the DRC's routine health information system (District Health Information System-2, abbreviated as DHIS2)

In Tanganyika, in March 2021, we estimate that:

- **43% of antenatal care-4 patients** (n=158) visited a facility at which their blood pressure could not be measured because there was no blood pressure monitor.
- **14% of patients with suspected malaria** (n=731) visited a facility at which their temperature could not be measured because there was no thermometer.
- **3% of children** who came for their under-two well-child visit[3] (n=103) could not be measured because the facility did not have a height measurer.

Efforts to strengthen the system

Efforts to improve health-related supply chains in the DRC have tended to focus on medicines and vaccines, while the medical equipment system is either overlooked or considered incidental.. Supply chains in the DRC are siloed, with commodities such as essential medications, vaccines, bed nets, and family planning distributed through parallel systems operated by different health programs.4 Evidence from these supply chains and the limited assessments of the medical equipment system suggest that it is fragmented in terms of funding sources, procurement processes, and administration (République Démocratique du Congo Ministère de la Santé et Secrétaire Général de la Santé, 2010; Kalambay Ntembwa & Van Lerberghe, 2015; Defawe et al., 2015; Motomoke & Defawe, 2018). Responsibility for equipping health facilities and performing maintenance on existing equipment appears to rest at multiple levels, with limited accountability throughout. While medicine stocks and service delivery data are reported in the DHIS2, there does not appear to be a centralized system for detailed tracking of equipment and supplies.

The government of the DRC has recognized the importance of medical equipment. The National Plan for Health Development for 2019–2022 prioritizes "strengthening the maintenance of infrastructure and equipment acquired." Specifically, it states that "standards relating to the management of equipment and materials will be updated and popularized." Maintenance centers will be organized in the 26 provincial health departments. They will be equipped with the collective and individual tools necessary for monitoring infrastructure and the functionality of equipment. A policy of depreciation and regular maintenance of Ministry of Public Health equipment, materials and infrastructure at all levels will be instituted. Awarding contracts with centers of expertise will be considered, as well as a capacity building plan for the maintenance centers of the Ministry of Public Health" (République Démocratique du Congo Ministère de la Santé, 2018).

USAID IHP, which is operating from 2019–2025, is providing support to all health zones in nine provinces: Sud Kivu, Tanganyika, Haut Katanga, Lualaba, Sankuru, Kasai Oriental, Kasai Central, Haut Lomami, and Lomami. While USAID IHP provides limited assistance to health facilities in terms of equipment procurement and building infrastructure, it is not responsible for providing technical support to improve the medical equipment information system. The program's potential to improve the medical equipment system mainly

[3] Consultation préscolaire (CPS)

[4] Programme National d'Approvisionement en Médicaments Essentiels (National Program for the Provision of Essential Medicines); Programme Élargi de Vaccination (Expanded Program on Vaccination); Programme Nationale de Lutte Contre le Paludisme (National Malaria Control Program); Programme National de Santé de la Reproduction (National Reproductive Health Program)

comes from its efforts to strengthen the health system broadly through improved oversight, planning, coordination, information gathering and use. In alignment with the government's priorities, USAID IHP emphasizes the need to improve medical equipment in health facilities. At least three of the program's intermediate results relate to medical equipment:

- IR 1.7: Increased availability of essential commodities at provincial, health zone, facility, and community levels
- IR 2.1: Increased availability of quality, integrated facility-based health services
- IR 2.6: Improved basic facility infrastructure and equipment to ensure quality services

The government's performance-based financing program that receives support from the World Bank (PDSS – Le Projet de Développement du Système de Santé/Health System Development Project) is operating in a subset of USAID IHP's supported health zones. The program was launched in 2015 and supports a total of 165 health zones. Facilities in these health zones receive quarterly payments based on the achievement of performance targets using service volume and quality indicators, which include the availability of equipment. Facilities develop annual business plans that include a budget for medical equipment. An impact evaluation of PDSS found that it positively impacts availability of basic equipment at supported facilities (Fink & Shapira, 2022).

USAID and other international health partners in the DRC tend not to cover the whole country, supporting instead a subset of geographic areas which may be entire provinces or selected health zones. Partners may implement broad health system strengthening initiatives or focus on specific health issues such as malaria, nutrition, or reproductive health.

Research Objectives

This study will assist the government of DRC and USAID IHP in improving the medical equipment information system. For the purposes of this study, the medical equipment information system is defined as the processes by which data on the volumes, ages, and state of medical equipment in public health facilities is generated, communicated, and used. Researchers map the current medical equipment information system, both in design and in practice, and offer recommendations for strengthening the system with a focus on governance and the ways in which information is generated and used.

Further, the need to assess and strengthen the medical equipment information system is not unique to the DRC. There are few published in-depth assessments of medical equipment systems in low-income countries, despite it being an important component of quality of care. This study can highlight this often-overlooked system and provide an example methodology that other countries may use when assessing their own medical equipment systems.

The study has two objectives:

1. Assess the performance of the DRC's medical equipment information system, with a focus on data flow, quality, demand, and use.
2. Make recommendations for strengthening the medical equipment information system, with a focus on data flow, quality, demand, and use.

The research questions investigated are:

1. How is the DRC's public sector medical equipment information system designed, and to what extent is it functioning as designed?
2. What are the strengths and weaknesses of the DRC's public sector medical equipment information system?
3. How do the medical equipment information system's strengths and weaknesses impact health service delivery?
4. How does donor support impact the medical equipment information system?

Methods

Desk review: National policies, procedures, and standard operating procedures related to the medical equipment information system were compiled, reviewed, and summarized.

Interviews: Key informant interviews were conducted in the provinces Haut Katanga, Kasai Oriental, and Tanganyika, and in the capital city Kinshasa. We conducted key informant interviews with central level officials, including one from the Ministry of Public Health and one working in procurement, and with officials responsible for medical equipment management at the provincial health offices. All of the interview subjects were male, as the positions selected were all occupied by men. We asked these informants to "ground truth" what is stated in national and provincial policies and fill in any gaps in information regarding the medical equipment information system's design and operation.

In each of the three provinces, we selected two health zones. We also conducted in-depth interviews with their health zone chief physicians or their designees (2 per health zone; 6 total), heads of general reference hospitals or their designees (1 per health zone; 6 total), and head nurses at health centers/posts or their designees (2 per health zone; 24 total).

We asked how equipment is requested, tracked, and maintained. We also discussed whether and how donor support impacts equipment procurement and maintenance. During the in-depth interviews, we used facility-specific data from the facility surveys to conduct mini-case studies on particular pieces of equipment, documenting the process by which it was obtained and the schedule for its maintenance and replacement. Further, we asked about equipment that the facility is missing and explored why the facility is not adequately equipped.

Interviews were recorded, with the subjects' consent, and transcribed. Data were coded using ATLAS.ti software and subsequently analyzed inductively and deductively. Based on the interviews and our review of national policy documents, we mapped how the medical equipment information system is designed and how it functions in practice.

Limitations: While efforts were made to conduct a comprehensive assessment of government policies and procedures related to the medical equipment information system, the decentralized nature of the DRC's health system means that some such documents may have been missed. Further, qualitative observations were only collected from government staff, and other stakeholders such as non-governmental implementing partners may have different perspectives.

Results

Desk review: System design

National policies, procedures, and standard operating procedures related to the medical equipment information system were reviewed (Appendix A) and synthesized. In the public health sector, the medical equipment information system is designed to operate through two main channels. One channel is used to report equipment that has become inoperable, and the other is used for ordering new equipment.

Channel 1: Inoperable equipment

The system for reporting inoperable medical equipment is embedded within the overall national health information system (*Système National d'Information Sanitaire* [SNIS]) which operates at the level of health center (peripheral level), general reference hospital (health district hospital), health zone office (Bureau *Central de la Zone de Santé* [BCZ]) and provincial health office (*Direction Provinciale de la Santé* [DPS]). At all these levels, data is supposed to be compiled monthly and forwarded to the next level upwards using SNIS data collection forms. DPS's supervise general reference hospitals, and BCZ's supervise health centers.

The specific forms used are:

- **Health centers**
  - Form 4.3 lists six items related to equipment and requires the facility to report the number of days each specific item was not functional during the previous month at the health center. The six items are electricity, refrigerator, microscope, glucometer, spectrometer, and centrifuge (Appendix B).
- **General reference hospitals**
  - Form 4.3 lists six items related to equipment and requires the facility to report the number of days each specific item was not functional during the previous month at the hospital. The six items are electricity, refrigerator, microscope, glucometer, spectrometer, and centrifuge (Appendix B).
  - Form 4.12 lists 12 pieces of equipment and requires the facility to report on the number of each piece of equipment at the hospital and the number of days each material/specific equipment was not functional during the previous month at the hospital. The 12 pieces of equipment are computer, photocopier, motorcycle, vehicle, internet, incubators for pre-term and full-term neonates (*incubateur et couveuse*), electrophoresis chain, resuscitation device, echograph, radiograph, and electrocardiogram (Appendix C).

Channel 2: Equipment procurement

The category to which the health facility belongs (public, private, non-governmental organization) determines how medical equipment is provided/replaced. Also important is the source of funding (government, private, bilateral, or multilateral assistance).

Public funds: When public funds are used, health facilities are expected to follow government procedures for acquiring or replacing equipment. These procedures are not specific to the health sector but are standard for all government sectors and services. They are described in official documents (Appendix A, documents 2–6.)

The process for ordering equipment from the government supply depots (*Centre de Distribution Régionales* [CDR]) is designed as follows: CDRs are public, not-for-profit institutions, supplying health facilities with medicines, equipment and supplies through direct payment or payment through credit lines. CDRs follow the guidelines and procedures issued by the National Program for the Provision of Essential Medicines (*Programme National d'Approvisionnement en Médicaments Essentiels* [PNAM]) (Appendix A, document 9).

CDRs should maintain a database of all the health zones in their service area and their respective BCZs. Typically, a health facility (health center or general reference hospital) fills out an ordering form (*bon de commande*) indicating the designation, specificities, and quantities of the needed item, and forwards it to the BCZ. In turn, the BCZ checks the order for conformity and checks credit balance before forwarding it to the CDR. At the CDR, similar checks are performed, as well as a verification whether the facility qualifies for supply by that CDR. Then the order is executed, and delivery is organized through the CDR's system in case the quantities are large, or the order is directly picked up by the BCZ or the facility.

CDRs operate in an open market system and face competition from other private suppliers, meaning that although public facilities are supposed to purchase through CDRs, in practice they may select to purchase equipment from non-government sources if they are more available or less expensive than what the CDR offers.

Private or donor funds: Very often, medical equipment for public health facilities is purchased with funds from donors of international organizations. In this case, facilities or the organization purchasing equipment for them follow the procedures of the donors when ordering medical equipment. Private health facilities follow the procedures of the owners, although if they are a "designated" facility5 they are theoretically subject to government requirements as well. Currently, several commercial providers operate in DRC and sell medical equipment.

Information system design and operation

Data generation

In general, health facilities track more detailed information about medical equipment than is reported in the DHIS2. Facilities report on a small number of equipment types through paper reports that are submitted monthly (or at times, less frequently) and move up the levels of the health system until the provincial health office enters them into the DHIS2.

Health centers: Health center-based respondents reported that only a few types of equipment are listed in the SNIS, meaning that many common pieces of equipment are not tracked through the routine information system. The equipment data that is mandated to be collected is reported monthly.

> *"Bon, en rapport avec les équipements médicaux conformément au canevas SNIS, bon le canevas SNIS ne répertorie pas tous les équipements médicaux, mais néanmoins il y a seulement quelques peu d'équipements qu'on a demandé qu'il faut toujours remplir dans le SNIS. Mais il n'y a pas un rapport détaillé des équipements en ce qui concerne le rapport mensuel. C'est un peu ça. Donc sur les équipements là on demande seulement combien de jours vous avez fonctionné avec frigo, avec électricité, avec*

[5] Each health zone in the DRC has one "designated" health center through which the Ministry of Public Health works, and which reports data into the government system. Designated health centers may be publicly or privately owned and operated.

centrifugeuse manuel, microscope. C'est un peu ces équipements-là qui entrent en ligne dans le rapportage mensuel." (Centre de santé – Kasai Oriental)

> *"Well, the SNIS framework does not list all the medical equipment, nevertheless there are a few items of equipment that have been requested to always be filled out in the SNIS. But there is not a detailed report of the equipment in the monthly report. It's a bit like that. So, on the equipment, there it only asks how many days you worked with fridge, with electricity, with manual centrifuge, microscope. It's only that bit of equipment that gets entered online in the monthly report."* (Health center – Kasai Oriental)

"Avec le canevas nous le faisons mensuellement. Donc à chaque fin du mois on recherche ces informations-là sur les équipements." (Centre de santé – Kasai Oriental)

> *"With the report, we do it monthly. So, at the end of each month we look for this information about the equipment."* (Health center – Kasai Oriental)

Hospitals: Respondents at general reference hospitals reported that data related to the equipment are collected, but that the data reported via the SNIS hospital collection framework are limited in terms of presence/non-presence and functionality/non-functionality for a few types of equipment. Again, this means that much of the equipment present in the hospitals is not tracked at higher levels of the health system.

"… On demande le nombre des matériels et le nombre de la non fonctionnalité. C'est juste les deux renseignements là qu'on cherche dans le SNIS. Mais compte tenu peut-être de la durée des matériels, vétusté des matériels, tous ces renseignements là n'y sont plus." (Hôpital – Kasaï Oriental)

> *"… It asks the equipment quantity and the number (of days) of non-functionality. It is the only two pieces of information sought in the SNIS. But perhaps considering the duration of the equipment, obsolescence of the equipment, all this information is no longer there."* (Hospital – Kasaï Oriental)

"Par rapport aux équipements médicaux, ça dépend. Il y a des informations en rapport avec l'échographie, les informations en rapport avec la radio, les informations en rapport avec certains Kiné, les informations en rapport avec certains examens que nous faisons par au laboratoire là où il y a un certain bon nombre de matériels, il y a les informations en rapport avec certains matériels que nous utilisons dans la salle d'opération ou en salle d'accouchement de façon générale." (Hôpital – Kasaï Oriental)

> *"With medical equipment, it depends. There is information about the ultrasound, information about the X-ray, information about certain physiotherapy [equipment], information about certain tests that we perform in the laboratory where there is a fair amount of material, there is information related to certain materials that we use in the operating room or in the delivery room in general."* (Hospital – Kasaï Oriental)

Health zone offices: Respondents at the BCZs level reiterated that only a small amount of information related to facilities' equipment is included in the DHIS2 tool.

“Mais pour ce que je vais vous dire par rapport à ça, ce ne sont pas tous les matériels qui y sont mentionnés. Ce ne sont que certains matériels sur lesquels un accent a été mis, mais dans le registre d’inventaire il y a plusieurs matériels qui ne sont pas répertoriés dans le canevas SNIS.” (BCZ – Tanganyika)

> *“But for what I'm going to tell you about that, it's not all the hardware that's mentioned there. It's just some of the hardware that's been highlighted, but in the inventory log there's several materials that are not listed in the SNIS framework”* (BCZ – Tanganyika)

Provincial health office: The DPS, which is supposed to aggregate all the data from the health zones via the DHS2, receives the data related to the equipment in paper format. This presents a point of vulnerability for the information system as challenging transportation within the DRC can make it difficult to move paper registers from remote facilities to the provincial health office.

“Ils font maintenant la saisie des informations qui sont dans les canevas en dur vers le DHS2 que nous nous voyons maintenant à partir de la DPS ici.” (DPS)

> *“They now input the information in the hard-copy reports into DHS2 which we can now see from here in the DPS.”* (DPS)

Data related to the equipment is generally more comprehensive in the facility’s inventory book compared to the SNIS. Health centers track the presence of the equipment, its functionality, its origin (purchased with the institution’s own funds, allocation from the State or a partner), and the year of acquisition.

“Bon, l'information c'est par rapport à la quantité, l'état, l'origine même du matériel. C'est ce qui est demandé. L'année même de dotation de ce matériel-là. Donc qui a doté ce matériel, c'est un partenaire c'est l'État, c'est vous-mêmes qui avez acheté sur le marché, ce sont un peu les rubriques-là qui entrent en compte.” (Centre de santé – Kasai Oriental)

> *“Well, the information is about the quantity, the condition, even the origin of the material. This is what is asked [of us]. Even the donation year of the material. So, who provided the equipment, is it a partner, is it the State, is it you yourself who bought on the market? It is those headings that are considered.”* (Health center – Kasaï Oriental).

*“Dans les types d’informations que nous collectons nous voyons d'abord le nombre d'équipements ou des matériels selon la catégorie, nous collectons aussi l'information sur l'état du matériel si ça fonctionne ou pas, et puis nous apprécions aussi l'efficacité qu'a ce matériel.” (*Centre de santé – Kasai Oriental)

> *“Within the kinds of information we collect, we begin with the number of equipment or materials according to their type, we also collect information on the state of the material, if it works or not, and then we also evaluate the effectiveness of the material.”* (Health center – Kasaï Oriental).

“Oui, nous mettons le nombre, nous mettons l'âge. L'âge c'est-à-dire la date et le mois qu'on avait réceptionné ce matériel, c'est ça l'âge. Et nous mettons aussi la provenance. La provenance c'est-à-dire que nous pouvons avoir des matériels provenant d'un partenaire quelconque, nous pouvons avoir des matériels que la structure s'est approvisionné. Et la date même de péremption.” (Centre de santé – Kasai Oriental)

> *“Yes, we record the quantity, we record the age. The age, that is to say, the date and the month that we received this material - that is the age. And we also put the source. The source, that is to say, we can obtain the materials from a partner, we can have materials that the institution has sourced. And the expiration date.”* (Health center – Kasaï Oriental).

Almost all structures record this more extensive equipment data in their inventory. Respondents at public facilities report that in practice, they transmit the required data to the BCZs on the frequency requested by the health zone authorities (monthly, quarterly, biannually, or annually).

"À la fin du mois nous avons un registre de l'inventaire, on inventorie tous les matériels qu'il y a ici, on envoie un papier au BCZ. Parce que dans ce canevas là il y a même une colonne qui montre si le matériel qui est là est bon état, on envoie ça." (Centre de santé – Kasai Oriental)

> *"At the end of the month, we have an inventory logbook. We inventory all the materials that are here, we send a paper to the BCZ. Because in this report, there is even a column which shows if the material here is in good condition, we send that."* (Health center – Kasaï Oriental).

"Non il n'y a pas une autre information en rapport surtout avec les équipements. Les équipements on les demande seulement manuellement avec le rapport inventaire équipements. On peut vous le demander une fois l'an ou deux fois, là ça dépend du bureau central qui peut nous demander ce rapport-là." (Centre de santé – Kasai Oriental)

> *"No, there is no other information in relation specifically to the equipment. For equipment, it is only requested manually with the equipment inventory report. You may be asked for it once a year or twice, it depends on the central office [BCZ] which can ask us for this report."* (Health center – Kasaï Oriental).

"En rapport avec les données collectées pour les équipements médicaux nous avons ici dans notre structure l'habitude d'inventorier les matériels à un rythme de 3 mois après, donc chaque trimestre on fait l'inventaire de nos matériels." (Centre de santé – Kasai Oriental)

> *"Concerning the data collected for medical equipment, we have here in our institution the habit of inventorying the equipment at intervals of 3 months, so each quarter we take inventory of our equipment."* (Health center – Kasaï Oriental).

Hospitals: Hospitals generally provide information on their equipment in their inventory report. Each department produces a report for management, and management compiles all the information and sends it to the BCZs when the latter requests it (often quarterly).

"Non, là dès qu'on fait le rapport comme ce sont des inventaires de chaque service ce sont des informations ou des rapports à chaud avec les services, pour pouvoir voir ce qu'il y a. Donc ce qu'il y a à arranger, à améliorer, s'il y a un matériel qui est déclaré hors usage, on le prend on le met peut-être au dépôt et on peut faire encore une réquisition pour qu'on puisse remplacer." (Hôpital – Kasai Oriental)

> *"No, as soon as we report, as this is each services' inventory, the information or report is immediately used by the service, to be able to see what is there. So, if there is something to fix, to improve, if there is a piece of equipment that is declared out of use, we take it, we may put it in the depot and we can make another requisition so that we can replace it."* (Hospital – Kasaï-Oriental)

"Avec notre politique ici, c'est juste si le bureau central peut-être demande, et là facilement on peut les donner, mais la fréquence vraiment c'est peut-être c'est trimestriel, pas même mensuel." (Hôpital – Tanganyika)

> *"With our policy here, it's only if the central office asks, and in that case, we can easily give them [the inventory], but the frequency really is perhaps quarterly, not even monthly."* (Hospital – Tanganyika)

Health zone offices: An inventory is created either monthly or quarterly for all equipment belonging to the BCZs. They also report on health facilities' equipment, assuming they have submitted their inventory reports.

"Mais je vous ai dit tantôt que chaque mois on fait les inventaires. Par exemple un matériel qui était en bonne état ce mois ici le mois prochain peut tomber en panne. Parce que c'est un matériel qu'on est en train d'utiliser. Peut-être un matériel qui se retrouvait dans la rubrique bon état peut se retrouver dans la rubrique en mauvais état le mois suivant." (Zone de santé – Kasai Oriental)

> *"But I told you earlier that every month, we perform an inventory. For example, equipment that was in good condition this month by next month may break down. Because it is a material that we are using. Perhaps equipment that was classified as being in good condition can be found as in poor condition the following month."* (Health zone- Kasaï –Oriental)

"Les données sont stockées dans des registres ; il y a des registres d'inventaire des matériels, il y a aussi les fiches des inventaires, on les fait de façon trimestrielle après chaque trois mois on essaie d'actualiser, il y a aussi les bons de livraison des matériels." (Zone de santé – Tanganyika)

> *"Data is stored in registers; there are equipment inventory registers, there are also inventory sheets. We perform them quarterly. After every three months, we try to keep them up to date. There are also delivery notes for equipment."* (Health zone – Tanganyika)

Provincial health office: At the provincial level, equipment data is only transmitted in the form of equipment inventories, in paper format (without going through the DHIS2) and they are compiled annually.

"Ce sont des inventaires en papier que nous avons ici. Ici, nous les analysons, nous voyons ce qu'on peut réparer, on descend on répare; ce qu'il faut déclasser, on les déclasse et celles qu'il faut peut-être désaffecter, la direction s'organise pour désaffecter pour un autre site." (DPS)

> *"We have paper-based inventories here. Here, we analyze them, we see what can be repaired, we descend [to the institution], we repair; what needs to be downgraded, we downgrade them and those that may need to be decommissioned, management organizes to decommission for another site."* (DPS)

"Ils les envoient sous forme les inventaires. Par exemple il dit: l'Etat m'a donné 10 appareils tel, tel, tel… pendant une période donnée et j'ai les appareils donnés mais chacun avec son état actuel, l'état présent. Et cela, là où il fait son rapport. Par exemple, Il a reçu un microscope, il a fonctionné pendant un temps. Il arrive un moment où il doit faire le rapport de l'inventaire, généralement chez nous c'est annuel. Il donne le rapport des équipements qu'il a reçus (le microscope), il dit à l'heure actuelle ou je fais mon rapport ici, cette machine-là a perdu telle ou telle autre fonction." (DPS)

> *"They send them as inventory report. For example, he says: the state gave me 10 devices such as, such as, such as… during a given period, and I have those devices but each with its current state, the present state. And that is where he makes his report. For example, he received a microscope, it worked for a while. There comes a time when he must report on the inventory, generally with us it is annually. He gives the report of the equipment he received (the microscopes), he says at the moment in which I am making my report here, this machine has lost such and such other function." (DPS)*

Data access

Informants reiterated many of the findings from the desk review concerning data access. Policies on data availability and accessibility vis-à-vis medical equipment are not explicitly defined for each level of the health system. Rather, policies concerning the collection and dissemination of RHIS data carry over to medical equipment.

At a health center, both the staff and representatives of the Committee de Development de l'Aire de Sante (CODESA) who play a role in monitoring, evaluation, and community resource mobilization, have access to information on medical equipment in the health facility. The national standards describe six reports and documents used for managing materials and medical equipment at the health facilities and zones described in Table 1.

Table 1. National reports and documents used for managing materials and medical equipment

Centre de santé (Health center)	HGR (General reference hospital)	BCZ (Health zone office)
Fiche technique (Technical sheet)	Fiche des stocks (Stock sheet)	Fiche des stocks (Stock sheet)
Fiche de maintenance preventive (Preventive maintenance sheet)	Fiche de movement (Movement sheet)	Fiche de movement (Movement sheet)
Cahier d'inventaire (Inventory book)	Registre d'entrée (Entry register)	Registre d'entrée (Entry register)
Fiche de réquisition /facturation (Registration/billing sheet)	Fiche de réquisition /facturation (Registration/billing sheet)	Fiche de réquisition /facturation (Registration/billing sheet)
Bordereau de livraison (Delivery slip)	Bordereau de livraison (Delivery slip)	Bordereau de livraison (Delivery slip)
Bon de commande (Purchase order)	Bon de commande (Purchase order)	Bon de commande (Purchase order)

In health facilities, equipment is monitored using the same procedures as pharmaceutical control: comparison of stock sheets, inventory reports, and calculation of monthly average consumption. All these documents are subject to inspection by supervisors from the health zone office.

At health zone bureau, national standards name an administrator-manager (AG) to oversee the equipment of the zone, both assets and medicines. The AG reports to the chief doctor of the zone (MCZ) who in turn oversees a team of nurses who function as zone supervisors. The zone team is responsible for receiving the SNIS reports from institutions in the zone and encoding them into the online DHIS2 platform. The SNIS tracks six pieces of equipment from the health center[6], and twelve from the reference hospital.[7] For each equipment, the quantity and number of days the item was non-functional are supposed to be collected (Appendices B and C). Not all tracked equipment is strictly clinical as the hospital form contains computers, electricity, and other administrative items and resources. The data collection form is unclear about how to

[6] Electricity, refrigerator, microscope, glucometer, spectrometer, and centrifuge.

[7] Computer, photocopier, motorcycle, vehicle, internet, incubators for premature and full-term neonates (*incubateur et couveuse*), electrophoresis chain, resuscitation device, echograph, radiograph, and electrocardiogram

enter data for multiple pieces of equipment of the same type, or how to determine whether equipment is non-functional or retired (and therefore, no longer subject to reporting).

Once uploaded into the DHIS2 platform, users at each level (health zone, provincial, national) can create custom dashboards featuring data collected from the SNIS.

Interviews with actors in the health system reveal that data management practices vary widely across health facilities. In general, health centers feature a policy of data transparency among staff, partners, and the community, whilst hospitals impose greater restrictions on data access, often restricting the data access to key staff members or committees.

Health Centers

All health centers collect and store data on medical equipment on paper in physical archives. Most respondents cited the use of *Fiche d'Inventaire* issued by the health zone, though some health centers produced their own registries using pen and paper. These reports are made in duplicate or triplicate, with one copy remaining in the archives of the health center and the others sent to the health zone office and partners. All sites reported that this data was easily accessible.

In interviews with the representatives from health centers, many respondents describe the liberal sharing of data on medical equipment among the health center staff and the local community. The community is represented by the president and members of the CODESA. Among respondents, the community is widely viewed as a partner in management of the health facility, both as a facilitator and auditor.

> *"Et aussi, par rapport à la politique d'aujourd'hui, rien ne peut marcher dans la santé s'il n'y a pas la participation communautaire." (*Centre de santé - Tanganyika)

> *"With respect to today's policies, nothing works in health without community participation."* (Health center – Tanganyika)

The participation of the community is formalized in a few of the health centers that were interviewed by the explicit inclusion of the CODESA during equipment inventory, as well as providing copies of inventory reports sent to the health zone office to the president of the CODESA.

> *"Je vous ai dit que ce sont les données que nous avons avec un soubassement. 1. Ça se trouve au centre; 2. Ça y est dans la communauté auprès du président du CODESA et 3. Ça y est au bureau central."* (Centre de santé – Kasai Oriental)

> *"I told you that it is the data we have with supporting documentation. 1. It is found at the [health] center. 2. It is [found] in the community with the president of CODESA and 3. It is at the central office."* (Health center – Kasai Oriental)

Similarly, when asked whether partner organizations or other actors in the health system could request access to equipment information, many responded affirmatively.

> *"Tout le monde a accès à ces données. Tout le monde pourquoi, pour l'amélioration du travail il faut impliquer tout le monde."* (Centre de santé – Kasai Oriental)

> *"Everyone has access to this data. Why everyone? For the improvement of the work, it is necessary to involve everyone."* (Health center – Kasai Oriental)

However, not all health centers interviewees explicitly invoked the community. In a few instances, the respondents explained that restrictions were necessary to protect the confidentiality of the data; only if approved and necessary would facility operations data be shared.

> *"Non, c'est une information sanitaire qui ne peut pas être livré à n'importe qui. C'est un secret administratif, c'est seulement quand il y a une nécessité qu'on peut livrer cette information."* (Centre de santé – Kasai Oriental)

> *"No, it is health information that cannot be given to just anyone. It is an administrative secret, it is only when it is necessary that we provide this information."* (Health center – Kasai Oriental)

All respondents reported submitting their equipment reports by physical letter to the health zone. Several respondents also reported that their health centers share data by phone call, WhatsApp, and in person interview. All respondents were aware that data shared with the health zone would be transcribed into the SNIS and therefore be widely available.

Reference Hospitals (HGRs)

In the hospitals surveyed, all institutions used paper-based inventory systems as their primary means of data collection. Some HGRs additionally transcribe equipment data into a computerized system. No respondent mentioned the participation of the community in hospital administrative activities. Rather, data is presented and analyzed during internal meetings, notably the *Comité Directeur* (CODI). In most cases, the administrator (AG) of the institution collects and archives equipment data but may also share the role with the director of nursing.

Health zone office (BCZ)

Representatives from the health zone are responsible for translating data from the health facilities from paper reports into the National Health Information System. Respondents did not report any major difficulties entering data into the web-based national health information system; however, they report a paucity of information available via the DHIS2 system. As one informant described:

> *"Pour l'instant, il n'y a presque pas les données que nous collectons en rapport avec les équipements médicaux. Les quelques données limitées qui sont dans le canevas SNIS, parce que le canevas SNIS ne reprend pas toute la liste des équipements médicaux nécessaire que ça soit pour l'hôpital ou pour le centre de santé."* (Zone de santé – Kasai Oriental)

> *"At the moment, there is almost no data that we collect in relation to medical equipment. The few limited data that are in the SNIS canvas, because the SNIS canvas does not include the entire list of medical equipment necessary for either the hospital or the health center."* (Health zone – Kasai-Oriental)

Datasets delivered to the health zone are archived in the zone office and available to the entire health zone staff (ECZ). One respondent described maintaining a registry of all items donated to the health zone, including those donated directly to facilities, the donor, as well as other information related to medical

equipment. This information was available in files on their computer as the national health information system did not have relevant fields for this information.

Respondents also reported that data was accessible at the health zone, citing as clients of the data the Expanded Program on Immunization (EPI), visiting dignitaries, partner organizations, and the provincial Ministry of Public Health (DPS). Access to data often requires authorization from the DPS, but once obtained, is straightforward.

> *"Tout celui qui a besoin de savoir plus sur les données il a l'accès d'entrer, de poser des questions à celui qui les garde, il brandit le document et enfin il peut accéder facilement aux données données."* (Zone de santé – Tanganyika)
>
> > *"Anyone who needs to know more about the data has the access to enter, to ask questions to the person who keeps them, he brandishes the document and finally he can easily access the given data."* (Health zone – Tanganyika)

Some health zone representatives mentioned displaying equipment data in tables, though it was unclear if these were kept in the archives or used as a dashboard or tracking mechanism.

Ministry of Public Health

Respondents from both the provincial and national ministries of health reported relying on the national health information system for access to equipment information. However, they expressed frustration that the data was incomplete and did not reflect the reality found in the health facilities.

> *"Parce que le canevas là, c'est par rapport au paquet minimum d'activités de chaque structure. … Mais la réalité sur terrain est autre chose, par exemple vous allez dans centre de santé, vous trouvez qu'ils ont une table d'opération, alors que selon les normes du ministère de la santé, on ne peut pas opérer dans un centre de santé. Vous trouvez qu'il y a une table d'opération et les gens opèrent là-bas. C'est un peu ça."* (Ministère de la Santé Publique)
>
> > *"Because the report concerns the minimum package of activities for each structure. … But the reality on the ground is different, for example you go to a health center, you find that they have an operating table, whereas according to the standards of the Ministry of Public Health, one cannot perform an operation in a health center. You find there is an operating table and people are operating there."* (Ministry of Public Health)

Furthermore, respondents elaborated that there is no national equipment database. Rather, all data collected on medical equipment is found in the SNIS.

System level

From both a design and implementation standpoint, there is a disconnect between the availability of data on medical equipment, the resource mobilization power, and decision-making responsibility among the actors in the DRC health system. Decision makers at the provincial and national levels, who have access to resources, do not have the data necessary to make informed decisions, nor do they understand it to be their role to do so. Similarly, the individual institutions and health zone offices which gather data on medical

equipment do not possess the resources to shore up gaps observed from national standards, although the responsibility for doing so falls at their level. Table 2 summarizes these findings.

Table 2. Resources, data availability and responsibility for equipment at all levels of the health system

Level	Resources Available	Data Available	Frequency	Responsibility for equipment*
National	Donors, National Budget	6 – 12 pieces of equipment	Yearly	Minimal
Provincial	Donors, Provincial Budget	6 – 12 pieces of equipment	Trimesterly	None
Health Zone	None	Full inventory	Monthly	Significant
Facility	Revenue, Community	Full inventory	Continuous	Significant

*Based on authors' assessment.

Data use

While the SNIS provides a uniform set of data collected across all health facilities, data use varies greatly from site to site. In general, health centers appear to collect data for accountability and reporting, hospitals to aid in procurement decision making, health zones for monitoring and evaluation, and higher levels to attract external aid.

Health facilities

In rural health clinics, the distinction between collecting and storing data about equipment and using equipment was often confused during interviews. This is likely due to both the small management team size (usually one or two nurses) and the few pieces of equipment on hand at these facilities. Universally, the management team of the health center had full access to equipment data, and all but one private clinic expressed the ability to respond to ad hoc analyses by decision makers. In addition to the health facility managers, respondents also cited the CODESA, the health zone office, the DPS, and partner organizations as having access to equipment data.

Between facilities, knowledge of norms and standards governing equipment vary greatly, with most respondents either unaware that norms exist or aware but lacking sufficient knowledge to explain how they apply to their health facility. Some sites had mixed knowledge – that is, some staff at the health facility were aware of norms, but not all staff members.

> *"Je peux dire que cette politique est suivie, mais ici pour avoir un peu de clarté parce que l'idéal est d'avoir un cadre normatif c'est-à-dire avoir un outil permanent au centre de santé sur lequel on peut lire et savoir est-ce que ce qu'on fait c'est réellement réel ce qui est prescrit par les normes ou pas, mais nous faisons le minimum."* (Centre de santé – Tanganyika)
>
> > *"I can say that this policy is followed, but, to have a little clarity, because the ideal is to have a normative framework, that is to say to have a permanent document at the health center which one*

> *can read and know whether what we are doing is really what is prescribed by the standards or not, but we are doing the minimum."* (Health center – Tanganyika)

However, a few respondents did affirm their knowledge of and referral to norms on a routine basis. One such respondent had such a document on hand, though this was the exception. Those with knowledge of norms frequently used them in decision-making while creating budgets and plans.

> *"Bon, je peux aussi faire sur base des normes. Par exemple au niveau d centre de santé. Si le centre de santé mérite d'avoir par exemple une centrifugeuse, or au niveau de centre de santé il n'y a pas. A tous les inventaires la centrifugeuse il n'y en a pas. Maintenant, comme les normes l'obligent, je peux aussi me baser sur ça."* (Centre de santé – Tanganyika)

> *"Well, I can also do based on standards. For example, at the health center level. If the health center deserves to have, for example, a centrifuge, but within the health center there is not [one]. During each inventory, there is no centrifuge. Now, as the standards require one, I can also base myself on that."* (Health center – Tanganyika)

It is rare that a facility has the financial ability to directly procure equipment. A few private institutions described direct purchases with the owner's permission, but the majority create budgets and action plans to share with the health zone and DPS as part of the PDSS project. One respondent summarized their creation as follows:

> *"Nous ce qui nous est demandé c'est seulement de faire la micro-planification, budgétiser annuellement les fonctionnalités de la structure, on fait ça et on se limite par-là. Mais les décideurs c'est au niveau de la hiérarchie où on peut s'en occuper."* (Centre de santé – Kasai Oriental)

> *"What is asked of us is only to do the micro planning, budget annually for the functioning of the institution, we do that, and we stop there. But the decision makers, it is within the hierarchy where one can deal with it."* (Health center – Kasai Oriental)

Effectively, these budgets are another form of reporting to higher levels of the health system. When creating the equipment budget, most facilities factor in the state of the equipment on hand for repair or replacement. Some facilities with knowledge of norms also include "gaps" or missing equipment to bring the facility into compliance. Other datapoints cited when budgeting was revenue, community capacity to pay, and the respondent's personal experience

> *"Les informations que nous utilisons c'est beaucoup plus quand les matériel ne fonctionne pas, on a ce qu'on appelle le plan de management avec le projet PDSS ; chaque semestre nous devons élaborer ce plan là et nous passons en revue tous les matériels que nous avons avec les rapports que nous avons de la part des chefs de services."* (Centre de santé – Haut Katanga)

> *"The information we use is really more when the equipment breaks down, we have what is called the management plan with the PDSS project; every semester we have to develop this plan and we go through all the materials that we have in the reports that we obtain from the heads of departments."* (Health center – Haut Katanga)

Hospitals (HGRs)

Hospitals reported storing equipment data in the hospital administration's archives, typically in paper-based formats. Most hospital respondents indicated they regularly analyze equipment data in monthly meetings, while one site reported analyzing the data quarterly. Analysis meetings are headed by the medical director, director of nursing, or hospital administrator (AG) but typically involve staff from each hospital service.

Of the hospitals visited, one half used annual operational action plans (PAO). The PAO contains a budget and procurement plan for the year based on the gaps in equipment availability, the quality or durability of existing equipment, and the national norms and standards for equipment in their institution. In monthly meetings, the PAO, equipment inventory, and financial situation of the institution are considered to inform purchasing or repair decisions. Additionally, if new needs arise, they are discussed and added to the PAO. At the end of the meeting, decisions are made regarding replacement or purchases, as indicated by one respondent:

> *"Il y a toujours une décision que nous prenons pour chaque service et pour chaque matériel. On peut décider aussi de faire la maintenance; tout ça c'est à l'issue de la réunion qu'on le décide*."
> (Hôpital – Haut Katanga)

> *"There's always a decision we make for each service and for each material. You can also decide to do maintenance; all that is decided at the end of the meeting."* (Hospital – Haut Katanga)

In hospitals without annual operational plans, the national norms are either largely ignored or not well known. Only one respondent mentioned the creation of a budget based on national norms, though no item budgeted was procured due to lack of sufficient funding. The other institutions relied solely on the monthly inventory and revenue to make decisions on equipment procurement and repair.

Health zone office (BCZ)

In general, equipment data for the zone is examined every month or three months. One health zone respondent reported irregular analysis of data. Zone to zone, the responsibility of collating and analyzing the data varies, but the entire zone management team appears to have access to equipment data.

When queried if standards for equipment for medical facilities existed, the responses were mixed. Most zones responded affirmatively, but others disagreed. Of those that responded affirmatively, one mentioned that the norms were referenced in discussions with representatives from health facilities. The respondents who disagreed expressed a lack of training and documentation prevented knowledge of norms from being known or understood.

> *"Ces normes-là n'existent pas. Quand on dit exister c'est-à-dire il faut avoir l'outil, que ceci doit être tel part tel part. Mais dire que par exemple l'échographie, la radiologie ça doit se retrouve dans un HGR, ça on connaît, mais il n'y a pas un outil normé comme ça qu'on a disponibilisé dans les structures."* (Zone de santé – Kasai Oriental)

> *"Those standards do not exist. When one says "exist", that is to say, one must have a document, that this must be such and such a way. But to say that, for example, an ultrasound, radiology must be found in an HGR, that we know, but there is no standardized documentation like that which is made available in the structures."* (Health zone – Kasai Oriental)

Of interest is that one zone office felt that their requests for equipment, despite being founded on needs in their zone, were entirely ignored. They felt that any equipment made available was already allocated to individual health facilities regardless of the health zone's input.

> *"On exprime les besoins et quand le niveau national veux doter, c'est lui-même qui spécifie; qui dit tel matériel par exemple en PEV, on dit tel réfrigérateur doit aller à tel endroit même si nous avons un besoin imminent à un autre endroit, mais comme Kinshasa a déjà sélectionné une structure où ira ce matériel nous ne pouvons pas changer cela."* (Zone de santé – Haut Katanga)
>
> > *"We express the needs and when the national level wants to provide, it is them themselves who determine; who says such material for example in PEV, they say such refrigerator must go to such place even if we have an imminent need in another place, but as Kinshasa has already predetermined an institution where this material will go we cannot change that."*
> > (Health zone – Katanga)

This sentiment was later affirmed in interviews with the provincial level.

> *"Ils font des commandes sur base des matériels manquants dans leurs structures. Ce sont des commandes qui sont… qui restent archivées parce que les commandes qui ne sont pas approvisionnées."* (DPS)
>
> > *"They make orders on the basis of missing materials in their institutions. These are orders that are… that remain archived because the orders are not fulfilled."* (Provincial health office)

Health zones that reported knowledge and usage of norms and standards for equipment still expressed reservation that these norms were followed in the practice. Lack of funding was cited for deviations from the national standard, and partner organizations inappropriately equipping institutions with equipment outside of the national guidelines.

Provincial health office (DPS)

At a provincial level, equipment data from the provincial facilities are readily accessible via the national health information system. Provincial offices reported using this data for audit purposes, ensuring that the equipment in facilities throughout the province responds to the national norms.

> *"Notre analyse consiste à vérifier l'existence d'abord de différents matériels médicaux et non médicaux dans les structures, la quantité et la qualité."* (DPS)
>
> > *"Our analysis consists of checking for first the presence of different medical and non-medical materials in the institutions, quantity, and quality."* (Provincial health office)

No integration of additional data sources beyond the indicators available in the national health system was reported by any respondent. Similarly, no respondent indicated having up to date information on equipment available at the CDR to meet any observed needs in provincial facilities.

It is not clear what decisions or tangible actions the provincial office may perform based on medical data available to it. No respondents reported having access to a budget to facilitate procurement or repair of equipment. Several respondents were not aware if medical equipment could be obtained from their regional depot (CDR). In the best case, one respondent reported that, despite having no local technicians on staff, the DPS might intervene to fix an x-ray machine.

According to respondents at the provincial level, planning and budgeting decisions would be made based on the source of financing, rather than analysis of needs of the health facilities. Answers varied on how decisions were made about budgeting. One respondent felt outside donors were the key decision makers, another indicated that each health institution would procure based on their revenue, and a third thought that the province may create a budget based on a fixed percentage of spending.

Notably, the Kinshasa DPS behaves differently from other provincial offices, likely due to the province's urbanization, developed infrastructure, access to suppliers, and proximity to political resources. The DPS respondents reported a close working relationship with facilities under their jurisdiction, functioning as technical assistants in addition to auditors or supervisors.

> *"J'arrive la bas je travaille s'il faut des pièces de rechange je fais un état de besoins. Et j'attends qu'on m'emmène des pièces car je n'ai pas le droit d'aller acheter les pièces pour l'Etat parce que je n'en ai pas l'autorisation."* (DPS)
>
> > *"I arrive there I work if spare parts are needed, I make a statement of needs. And I'm waiting for parts to be taken to me because I'm not allowed to go and buy parts for the state because I don't have permission."* (Provincial health office)

The ease of movement about the provinces affords agents of the DPS the ability to regularly collect paper-based inventories from facilities, as well as be on-site for equipment repair. However, despite this close partnership, the respondents did not indicate that they facilitate procurement or make budgeting decisions.

> *"Ça c'est la hiérarchie. Ce n'est pas nous. Nous en tant qu'agents de l'Etat nous ne pouvons pas engager l'Etat c'est l'Etat qui me donne le pouvoir de 'engager. Nous nous sommes juste techniques."* (DPS)
>
> > *"That's [the responsibility of] the hierarchy. It's not us. We as state agents cannot obligate the state, it is the state that gives me the right to engage. We are purely technical."* (Provincial health office)

When asked about budgeting, the respondent only reaffirmed that the budget was controlled by the State, and their role was purely technical, they did not have the power to procure new items or replacement parts.

CDR

From a data use perspective, the CDR appears to function as an independent entity from the rest of the health system. Data generated at the CDR is reported back to the national program for medicine supply (PNAM), and purchasing decisions are made internally based on national recommendations by the Federation of Essential Medicine Procurement Agencies (FEDECAME), rather than observed need through the national health information system. Respondents further replied that the CDR did not play any role in evaluating data on equipment availability in the province.

Health Centers

With few exceptions, health centers interact principally with two parties: the health zone office and the community. Correspondence is conducted with the health zone office through reports, letters, phone calls, and supervision visits, and whilst community interaction is through the CODESA and village chief.

Respondents reported that communication regarding equipment replacement or loss was primarily done in writing, either by submitting monthly SNIS reports containing the number of days of equipment failure or through written letters addressed to the health zone office. If the equipment failure required urgent treatment, several interviewees mentioned they would additionally make a phone call. However, all verbal correspondence was buttressed by written correspondence to the zone office.

> *"Souvent on appelle même au téléphone et par après on donne le rapport écrit."* (Centre de santé – Kasai Oriental)
>
> > *"Often, we even call on the phone and afterwards we send the written report."* (Health center – Kasai Oriental)

Private institutions also reported keeping the health zone office abreast of equipment needs in addition to the owners of the institution. The recipient of equipment information in the zone office varies from zone to zone. Most often, reports are addressed to the MCZ, though if the equipment was for a particular program such as nutrition or vaccination, the zone supervisor responsible for that program might be the first point of contact.

Respondents rarely made requests directly to third parties or partner organizations, and never self-initiated and without the knowledge of the health zone office. Most interviewees reported that the proper channel to inform partner organizations of existing needs was through the health zone office. A few respondents indicated that equipment needs might be expressed during partner visits face to face.

> *"Sauf d'autres personnes de bonne volonté, il y a des députés et d'autres personnes, en ce moment dès qu'ils viennent je leur donne mon état de besoin. Je vais aussi informer à mon chef le jour qu'on viendra m'appuyer, je ne peux pas l'informer que j'ai fait un plaidoyer, aussi longtemps peut-être que le plaidoyer que j'ai fait on ne viendra pas m'appuyer."* (Centre de santé – Kasai Oriental)
>
> > *"Besides other people of goodwill, there are politicians and others, as soon as they come, I present them my needs. I will inform my boss on the day that they come to support me. I do not inform him that I asked for help, as the request I made may not result in their assistance."* (Health center – Kasai Oriental)

Equipment donations by third parties likewise are reported in writing back to the health zone, sometimes accompanied by a phone call. One respondent explained that the same process for receiving any other equipment would be followed: a goods received note would be sent to the health zone with a duplicate archived at the health facility. Another indicated that if a goods received note was not provided with the donation, a report would be issued to the zone.

“Oui, il faut que le bureau soit au courant parce que c'est le bureau qui nous couvre. La personne qui nous amène un don peut-être à la longue elle peut nous créer des problèmes. Alors si le bureau n'est pas au courant qui va nous couvrir et qui va nous défendre. ” (Centre de santé – Kasai Oriental)

> *“Yes, the office needs to know because the office has our backs. The person who brings us a gift may in the long run create problems for us. So, if the office doesn't know who is going to cover us and who is going to defend us.”* (Health center – Kasai Oriental)

Messaging on equipment changes and status are relayed from health centers to the community through the CODESA. In some cases, meetings are called in which the community is invited to observe new equipment received. Respondents additionally suggested that information on equipment would be communicated during patient consultations, likely as part of community ownership. For example, one respondent indicated that thefts of equipment would be pointed out to patients.

“l'IT doit être en communication, en collaboration avec la communauté. Chaque équipement que nous allons faire entrer il faut que j'invite la communauté pour l'information, pourquoi, parce que nous travaillons avec la communauté.” (Centre de santé – Kasai Oriental)

> *“The health center nurse must be in communication, in collaboration with the community. Every piece of equipment that we're going to receive, I must invite the community for their knowledge, why, because we work with the community.”* (Health center – Kasai Oriental)

Hospitals (HGRs)

In general, hospitals communicate similarly to health facilities by following the health pyramid structure, albeit with greater autonomy and less community involvement.

The first reaction to equipment needs for several institutions interviewed is to gather institution resources to meet the need, either by mobilizing local technicians or procuring replacements. Over half the institutions interviewed mentioned specifically contacting the health zone office regarding equipment needs, while the remaining institutions appeared to indicate the routine reports submitted by the institution to provide enough detail.

“Nous soumettons les états des besoins au bureau central. C’est maintenant le BCZ qui compile les besoins des structures de premier échelon, de deuxième échelon et il le transmet comme un plaidoyer.” (Hôpital – Tanganyika)

> *“We submit our needs to the central office. It is now the BCZ that compiles the needs of the institutions of first level [and] second level and it transmits them as a plea*.” (Hospital – Tanganyika)

Responses to the appropriateness of reaching out to third parties outside the health system were mixed. One respondent felt strongly that the health zone office was the only representative able to advocate for donor support to health facilities. Another hospital had a long-term partnership with a donor organization and felt it was normal to make equipment requests to both the health zone and the donor simultaneously.

"Oui, le partenaire c'est quoi, c'est une collaboration, il est avec nous, il vit avec nous, il connait les réalités sur terrain. La communication c'est au quotidien, soit à travers une lettre que nous communiquons au bureau central et au partenaire." (Hôpital- Tanganyika)

> *"Yes, what is the partner, it is a collaboration. They are with us, they live with us, they know the realities on the ground. Communication is daily, either through a letter that we communicate to the central office and to the partner."* (Hospital – Tanganyika)

Two institutions felt that help should be obtained wherever possible, advocating to seek support from even the governor's office.

"On ne s'arrête pas seulement à ces circuits là, on peut sortir et faire des plaidoyers ; on informe par exemple le gouvernement provincial où il y a le ministre ; on les tient informé si nous avons un problème." (Hôpital – Haut Katanga)

> *"We don't just stop at those channels; we can go out and advocate; we inform for example the provincial government where there is the minister [of health]; we keep them informed if we have a problem."* (Hospital – Haut Katanga)

If equipment was donated, the health zone office may or may not be informed. Most respondents expressed that donor organizations often worked in partnership with the health zone to donate material. However, one institution reported that if a government official may donate an item, no special action would be taken to inform the health zone. Rather, the monthly reports would simply reflect the addition of the new equipment.

Communication on equipment decisions follows a similar mechanism as health centers – the health zone offices may provide guidance or notices about equipment decisions by letter and phone call. In contrast to the health facilities, community participation was less frequently mentioned. One respondent cited community absence from hospital activities as a challenge for the institution. Most responses simply reflected that the community was kept abreast of hospital news by word of mouth, without any specific mechanisms in place to facilitate community dialogue.

Health zone office (BCZ)

Despite the role of the health zone as the primary information artery being understood and embraced by all, the mechanisms through which health zones obtained and shared information on equipment are not standardized. No health zone respondent communicated that the zone played a role in the equipment management other than consolidating, sharing, and communicating information.

The most cited mechanism for facilities to express equipment needs was through writing, understood to be through letters to the health zone office. Every respondent indicated that some form of written document – either a letter, a report, or, in one case, a purchase order from a facility received by the health zone. This mirrored the responses gleaned from the health facilities.

Curiously, despite agreement from health facilities on the role of the zone in advocacy towards partner/donor organizations, there is no standardized interaction between health zones and partner organizations. One health zone reported that partners regularly attended zone meetings, providing platform for requests to be made and needs shared. Contrarily, a different zone felt that donors came with predetermined agendas and would not listen to advocacy by the zone. A further respondent indicated that

partnerships were signed at the DPS level and therefore simply passed equipment needs up to the reporting hierarchy. And a fourth respondent suggested that the zone had records of donor organizations and was able to directly contact them in case equipment needed to be repaired. In aggregate, it appears that where relationships between zones and donor organizations exist, they are bespoke partnerships negotiated without adhering to a norm or standard.

Health zone respondents cited two main mechanisms for communicating decisions on equipment: "circular notes" and supervision trips. Circular notes are open letters emitted by the health zone to health facilities and users of equipment. Supervision trips are performed by the health zone to individual facilities where hands-on training could be provided.

> *"La plupart de temps c'est lors des supervisions, si nous trouvons qu'il y a des problèmes en rapport avec les matériels, ce sont les recommandations que nous laissons. Et on fait les suivis par rapport au responsable ; c'est au responsable de partager l'information lors des différentes réunions au niveau de la structure."* (Zone de santé – Haut Katanga)

> > *"Most of the time, it is during the supervision visits. If we find that there are problems related to the materials, these are the recommendations that we leave. And we follow up with the manager; it is up to the manager to share the recommendations during the various meetings within the institution."* (Health zone – Haut Katanga)

About communicating equipment decisions to the community, interviewees echoed the responses of the health facilities by using the CODESA. Additionally, the several respondents also mentioned using *relais communataire* (RECOs) to spread the word to community members throughout the health zone.

Provincial health office (DPS)

In contrast to the channels of communication between the health zones and health facilities, the communication from the provincial level is not well defined. In most cases, respondents from the DPS indicated that some form of written communication could be employed to inform health zone offices of equipment directives.

One member of the DPS indicated that there was no official means of communicating information on equipment availability and suggested that phone calls, meetings, or emails could be used to share the information. Another DPS respondent simply stated that no communication would be made – if requested equipment was unavailable the facility would "notice that there was none" without formal communication. Yet another articulated that the DPS would communicate with the MCZs about any equipment changes, and the MCZ would communicate those changes to the health facilities.

CDR

The CDR likewise did not report official channels of communication with health facilities or the health zone, though there was little mention of carrying equipment in stock. One CDR did indicate using both email and WhatsApp to correspond with health facilities regarding stockouts of equipment.

Central government

There does not seem to be any meaningful communication between national actors and health facilities. When questioned how requisitions that were not able to be filled might be communicated to facilities, the

respondent indicated that all needs would be filled and thus such a mechanism was not required. The respondent further indicated that no mechanism was in place to assess which health facilities had received equipment from partner organizations.

Equipment procurement

Medical equipment is procured by a variety of government and non-government actors in the DRC health system.

Health facilities

There was consensus among informants that health facilities are authorized to directly purchase less expensive equipment such as thermometers and blood pressure cuffs. Health centers had annual spending limits for equipment; the reported amount of the spending limit varied, ranging from 10,000 CF to 100,000 CF, and in some cases, 20 percent of revenue. While many of the informants at the health centers reported that they purchase equipment directly, for a subset, this authorization was theoretical, as they reported having inadequate funds to purchase any equipment. In at least one health center, the informant did not appear to have considered that the health center could purchase equipment directly, and another informant reported having spent two years trying to raise funds for a purchase.

When a health center directly purchases equipment, the process for informing the BCZ varies. Some respondents said that in an emergency they can buy equipment immediately, but for routine purchases, they are supposed to seek authorization from the BCZ. Other health centers reported their acquisitions to the BCZ afterward. One health center reported that large purchases require authorization from the BCZ, even when the health center is using its own funds.

Hospitals reported that they also directly purchase supplies when they can, with more expensive equipment requested from the hospital's senior leadership team (Comité de Direction) or the BCZ. Hospitals tended to make acquisition decisions via management committees. Hospital representatives mentioned that while they may work with partners, they do not feel obligated to wait for a partner to bring them a piece of equipment, particularly when the hospital and partner's priorities may not align.

Some hospitals and health centers create annual operational action plans and six-month management plans, which include new equipment acquisition. The funds for these acquisitions are supposed to be included in the facility's operating budget. Privately-run facilities tend to be more agile in purchasing equipment directly, as they can draw additional support from the facility's owner or sponsoring religious institution. In a few instances, informants mentioned that if a health worker or patient breaks a piece of equipment, they are expected to pay for its repair or replacement.

Health facilities tend to buy medical equipment from local markets, although in one case the health center manager had traveled to Dubai and brought equipment back with him. One health center manager explained that they have ongoing relationships with suppliers in the nearest city, ensuring that their products are of high quality and reasonably priced.

Health zone office (BCZ)

While the BCZ plays a role in the medical equipment procurement system, it does not appear to be the entity that purchases equipment, at least not systematically. One BCZ-level informant mentioned that their annual

operational action plan for the health zone includes consideration of equipment, informed by the national equipment standards, but the informant did not mention the BCZ buying anything directly. A health center-based informant explained that sometimes the needed equipment is in stock at the BCZ, but again, it is not clear that the BCZ purchases anything. Health zone staff explained that, within the government system, purchasing decisions are made at the national level, and that they do not have funding allocated for equipment. If the national level is unresponsive, the BCZ may try less-formal means of acquiring needed equipment. One informant described appealing to the town hall, partners, and even individual benefactors.

Provincial health office (DPS)

In the Plan National de Développement Sanitaire, there is no specific role for provincial health offices related to equipment purchasing. However, DPS's appear to purchase some expensive equipment for health facilities, particularly hospitals. One provincial-level official explained that they solicit input from end-users before purchasing, to ensure that what they buy is appropriate.

Central government

Health zone offices reported that decisions about what equipment to purchase and where it should be sent are made at the national level. The central government is theoretically responsible for buying expensive, specialized equipment that cannot be purchased in the provinces. Additionally, during the COVID-19 pandemic, the central government acquired and sent equipment such as oxygen concentrators and respirators directly to hospitals.

CDR

When asked about the role of the CDR, most facility-based and BCZ-level respondents stated that the CDRs only supplied medicines and did not regularly provide medical equipment, although interviewers did find individual pieces of equipment that informants claimed had been ordered through the CDR. The respondent from the CDR in Kinshasa corroborated this, explaining that, while theoretically they could order medical equipment, they did not have the processes nor the budget to do so at the present time.

Partners

In general, partners sign contracts at the provincial level and operate through the BCZ. They are typically not supposed to coordinate with the health facilities directly; this includes providing them directly with medical equipment. Likewise, the health facility is not supposed to directly solicit partners for support. It is unclear whether this policy comes from the government or from partners, or both. There are some exceptions; in Haut Katanga, an informant explained that a partner had assisted their health center directly with procuring "enormously expensive" equipment. It also appears that hospitals feel freer to go directly to partners compared with health centers.

There was strong consensus among informants that partners do not give funds for the purchase of equipment, but instead purchase it themselves. In addition to providing medical equipment to health centers and hospitals, BCZ-level informants reported having received donations of computers, bicycles, and other equipment for their offices. A single health zone may have multiple partners providing equipment at the same time.

Several BCZ-level informants discussed their expectations that partners would provide medical equipment and expressed disappointment that promised materials had not yet been provided by their current partner.

It appears that, once a partner has committed to providing equipment, options for government procurement are not pursued, even in the face of delays from the partner.

Small donors

Informants reported that occasionally, small charity organizations such as church groups and visiting physicians donate equipment directly to health facilities. Politicians also sometimes visit facilities and bring them equipment. In these cases, the facility may accept the donation, and is supposed to report the donation to the BCZ.

Community

It does not appear that communities or community members purchase medical equipment for their health facilities, except for rare cases in which a patient breaks a piece of equipment, or a wealthy benefactor is asked to assist. However, communities can be quite involved in the procurement of medical equipment. CODESA members are supposed to assist in health centers' annual planning and in making purchasing decisions. Community members may also be kept abreast of the status of equipment at the facility. One health center-based informant mentioned that when the facility receives new equipment, the community is invited to see it be unpacked and inventoried.

Case studies in procurement

Health center-based informants were asked to tell the story of a piece of equipment at their facility.

For a selected piece of equipment…

- How long has this been here?
- Did you request it?
- Who purchased it?
- When did it arrive here?
- Was it used or new?
- What repairs has it been given? Who did the repairs?
- Does it currently need any repairs? Why have they not been done yet?
- If this table were to break beyond repair, how would you go about getting a replacement?

The following are summaries (quotations lightly edited for clarity) that illustrate the range of sources and means of procuring equipment within the DRC's health system.

- A year ago, we had a blood pressure monitor that was not functional. The health center paid to replace it with a new one in November 2021 from a supplier in Lubumbashi. (Health center in Tanganyika)
- A year ago, we did not have a centrifuge. We placed an order with the CDR because 20 percent of our subsidies were withheld and it was in this amount that we placed the order, and we were given a new centrifuge in 2021. CDR staff arrived at the health zone office, and we were given the drugs and equipment we had ordered to bring back to the health center. To pay for it, the equivalent amount of money was cut from PDSS, which is our partner. (Health center in Tanganyika)
- This adult scale was damaged. We acquired it in 2015 when our manager bought it used in Dubai and brought it back. While we were moving, it fell and got damaged. We called some welders (we do not

have a technician) to try and fix it; they didn't succeed, and it got really complicated. We couldn't pay them because they couldn't fix it. Five months ago, we bought a new scale. (Health center in Haut Katanga)

- Our health center purchased this Ambu, which is used to resuscitate children, in the market seven years ago. It has been broken for a long time and we don't know how to fix it or buy another one. (Health center in Kasai Oriental)

Maintenance

National standards for repair technicians

A national maintenance guide has been drafted at the national level but has not been popularized to date. The guide includes information related to the preventive and curative maintenance of laboratory and surgical department equipment. For prevention, three columns are provided: designation, periodicity, and task to be performed. Table 3 outlines this configuration.

Table 3. Excerpt from national equipment preventive maintenance guide (draft)

Designation	Frequency	Task(s)
1. PH meter (Hydrogen potential)	Daily	Clean the window of light emitters and sensors with a small brush Maintenance procedures of a Microplate Washer: 1. Check the delivered volume 2. Test the uniformity of the filling 3. Check the efficiency of the vacuum subsystem 4. Check the cleanliness of the dispensing and extraction needles Note: System maintenance must be performed by a qualified technician.
	Weekly	
	Monthly	
	Quarterly	Use the calibration plate and take readings with the same plate at 30-minute intervals. Compare the results. They must not present any differences - Clean the plate holder drawer. -Check the alignment of each well with the light emitting and detecting systems.

For corrective maintenance, the document provides the designation, problems, probable causes, and solutions as shown in Table 4.

Table 4. Excerpt from national equipment corrective maintenance guide (draft)

Designation	Problems	Probable causes	Solutions
1. Pulse oximeter	The oximeter does not turn on	The battery is not in place The oximeter is not connected to the mains	Install batteries Check power supply Connect the device to the mains
	The alarm sound is not working	The alarm is not connected to the oximeter The probe is connected to an extension cable	Check that the probe is correctly connected with the oximeter Check that the extension cord is connected correctly with the oximeter
	"No finger" alarm	The sensor is not connected to the patient's finger	Verify that the sensor is correctly connected to the patient's finger

Since the standards are not popularized, each structure acts according to the approach that seems best to it. The national level, which is supposed to regulate equipment standards, complains about this practice in the field of maintenance.

> *"Il n'y a aucune structure qui donne le PV pour dire qu'il y a tel équipement qui est en panne. Il n'y en a pas."* (Niveau national, Division des équipements et Maintenance)
>
> > *"There is no institution that sends a memo to say that there is such and such an equipment that is broken down. There are not any."* (National level, Equipment and Maintenance Division)

At the level of the Provincial Health Divisions, informants did not seem to know the national directives. Emphasis was placed on the manual that accompanies the equipment as a standard to follow.

> *"Chaque équipement a sa fiche de vie appelé fiche de maintenance. Cette fiche est établie dès l'acquisition de la machine, parce que quand la machine arrive il y a d'abord le service après-vente qui doit être assuré. Après ce service l'équipement est doté par exemple au service, et ce dernier commence à l'utiliser. C'est en ce moment depuis le jour où vous l'avez installé, vous avez une fiche sur laquelle vous allez noter la date d'acquisition, la date d'installation et le date de mise en service. Alors, à partir de la date de mise en service, vous pouvez projeter (éventuellement 6 mois après), faire un Check pour voir le comportement de l'équipement par rapport aux contraintes qu'il a subi (son fonctionnement), et donc le premier entretien."* (DPS)
>
> > *"Each equipment has its life sheet called the maintenance sheet. This sheet is drawn up as soon as the equipment is acquired, because when the equipment arrives there is first of all the after-sales service that must be provided. After this service, the equipment is provided, for example, to the service, and the latter begins to use it. It is then, since the day you installed it, you have a sheet on which you will record the date of acquisition, the date of installation and the date of commissioning. Then, from the date of commissioning, you can project (possibly 6 months later), do a check to see the performance of the equipment in relation to the constraints it has undergone (its operation), and therefore the first maintenance."* (Provincial health office)

Prevalence of trained technicians

Data collected at the national level does not show the prescribed numbers of engineers trained in equipment maintenance. The equipment maintenance sector is more or less new, with a single technical institute named ISTA (National Institute of Applied Techniques) serving the entire country. To date, the country has fewer than 80 biomedical engineers who are largely concentrated in the city-province of Kinshasa. Thus, in the other provinces, there are electricians, electronics engineers, or pharmacists responsible for equipment maintenance, many of whom have trained themselves on the job.

Maintenance workers in the DRC often learn through briefings rather than through a well-defined course.

> *"Dire quelqu'un formé spécifiquement pour cette réparation, mais il y a, je me répète, des petits briefings qu'on donne pour la réparation de certains matériels au centre de santé ; en l'occurrence moi-même là j'ai été briefé par le technicien d'ailleurs par le technicien comme quand on nous avait doté des réfrigérateurs, il y a avait le technicien qui avait été envoyé par le partenaire PATH qui nous avait briefés comment*

dégivrer le réfrigérateur, comment nettoyer le système solaire pour éviter que la poussière ne couvrent pas les panneaux solaires." (Centre de santé – Tanganyika)

> *"Concerning having someone specifically trained for this repair, there are instead, I repeat myself, small briefings that we give on the repair of certain materials at the health center; in this case, I myself was briefed by the technician. For example, as when we were provided refrigerators, there was the technician who had been sent by the partner PATH who briefed us on how to defrost the refrigerator, how to clean the solar system to prevent dust from covering the solar panels."* (Health center – Tanganyika).

In everyday practice, there is no maintenance schedule.

> "On ne peut pas faire un calendrier officiel pourquoi, parce que personne n'est formée sur ça, alors comment nous allons faire un calendrier. Nous nous débrouillons, celui qui connait c'est celui qui va s'en occuper." (Centre de santé – Kasai Orientalo)

> *"We can't make an official schedule why, because no one is trained on it, so how are we going to make a schedule. We manage, the one who knows is the one who will take care of it."*
> (Health center – Kasai Oriental)

Recruitment of maintenance technicians

Recruitment for this position should follow the same principles as all other positions, either by competition (for directors) or by title (by presenting a diploma which makes them eligible for the position). In practice, these norms are often not followed.

"Les descriptions de poste ne sont pas définies, cela constitue une grande faiblesse. La description devrait commencer par l'utilisé puis enrichie par l'utilisateur. En pratique, les décisions de recrutement viennent des politiques ou autorités politiques : on ne s'y oppose pas car il a le stylo vert (Mayi ya Pondu) pour dire que le stylo de la décision peut même te révoquer à ton poste."
(Ministère de la Santé Publique)

> *"Job descriptions are not defined, this is a great weakness. The description should start with the used and then enriched by the user. In practice, recruitment decisions come from politicians or political authorities: we do not oppose them because they have the green pen (Mayi ya Pondu) to say that the pen of the decision can even dismiss you from your post."*
> (Ministry of Public Health)

The recruitment standards are as follows:

- Persons holding a high school diploma are hired as AGA2 (administrative officer of 2nd class), those with higher education first degree are hired as AGA1 (administrative officer of 1st class), those with higher education second degree are hired as ATA2 (office attaché 2nd class), doctors and polytechnic engineers are hired as ATA1 (office attaché 1st class).
- For their remuneration, technicians are part of the administrative category. Currently, the salary is based on the grade (in relation to the diplomas obtained), with optional bonuses paid to maintenance technicians by health workers.

Flow of maintenance data

At the level of the health center or the hospital, as soon as the maintenance person or any user of the equipment notices a breakdown, he reports to his hierarchy to decide whether there is a need for external maintenance or not, or whether to remove the equipment. If the equipment is a donation, the information passes from the health facility to the BCZ and from the BCZ to the DPS, but also from the BCZs to the partner who provided the equipment in order to find a technician who can repair it.

"Il va nous signaler pour qu'on puisse vérifier ou bien qu'on puisse remplacer d'autres matériel." (Centre de santé - Kasai Oriental)

> *"He will let us know so that we can check or replace other equipment."*
> (Health center- Kasai oriental)

"Il y a l'AG chargé du patrimoine qui constate que les équipements ne fonctionnent pas, elle le signale à la direction, le Médecin directeur réunit le comité, nous travaillons sur ça et nous allons appeler quelqu'un pour qu'il les répare si c'est encore réparable et tout ça donc c'est la direction qui prend la décision." (Hôpital- Haut Katanga)

> *"There is an administrator in charge of assets who notices that the equipment is not working, she reports it to the management, the Medical Director calls the committee together, we work on it and we are going to call someone to fix it if it's still repairable and all that so it's the management that makes the decision."* (Hospital- Haut Katanga)

"Donc, chaque fois, il est là pour checker aussi le quoi… les histoires… le quoi… les matériels qui sont finis, qui ne fonctionnent pas. Après, il fait le rapport." (DPS)

> *"So each time, there are there to also check the what... the history... the what... the materials that are done, that no longer work. Then he reports."* (Provincial Health Office)

Use of local and foreign maintenance personnel

Generally, for minor breakdowns of small equipment, the health structures can manage repairs. External maintenance is required for major breakdowns, large equipment, with personnel who have the profile of an electrician or electronics engineer or a mechanic. This is obtained locally, if possible, but in some cases requires expertise from abroad.

"Il y a des choses pour lesquelles c'est autorisé de les appeler, ce n'est pas tous les équipements. Comme le réfrigérateur c'est quelque chose que le partenaire nous a donné pour le PEV, c'est le PEV qui nous a doté ça. Pour ça je ne peux pas appeler la maintenance, pour ça j'informe directement le bureau central. C'est le bureau central qui va s'en charger, pour ça ce n'est pas la structure. Pour ceux- là que nous appelons les gens du dehors c'est ce que nous-mêmes nous avons produits. Mais pour ceux des partenaires on ne touche pas, là nous faisons appel au bureau central."
(Centre de santé – Kasai Oriental)

> *"There are things for which it is allowed to call them, [but] it is not all the equipment. As the refrigerator is something that the partner gave us for the PEV, it is the PEV that gave us that. For that I do not call maintenance, for that I inform the central office directly. It is the central office that will take care of it, for that it is not the institution's responsibility. For those for which we call outside technicians, it is what we ourselves have purchased. But for those of the partners we do not touch, there we call on the central office."* (Health center – Kasai Oriental)

Amortization

Several health zone representatives were asked whether there was a schedule for the useful life of equipment (i.e., amortization). In Kasai Oriental, one health zone-level official said generally equipment was generally eligible for retirement after five years, although the respondent did not specify what types of equipment were subject to that timeline. In contrast, another health zone representative in Kasai reported that there was no schedule for equipment amortization. In Tanganyika, a health zone official replied that having an amortization calendar was a good suggestion that the health zone should implement and asked the interviewer for guidance on doing so.

> *"L'amortissement là on n'a pas prévu pour ça. Mais c'est une bonne idée vraiment on va capitaliser, je ne sais pas si vous pouvez nous briefer pour ça."* (Zone de santé – Tanganyika)

> *"The depreciation, we have not planned for that. But it's a really good idea, we're going to capitalize on it, I don't know if you can train us on it."* (Health zone office – Tanganyika)

Discussion

The purpose of this study was to assess the performance of the DRC's medical equipment information system with a focus on data flow, quality, demand, and use. Drawing on these findings, we set out to make suggestions for strengthening the medical equipment information system. In some cases, weaknesses in the information system were intertwined with weaknesses in the overall medical equipment system, so we offer more general suggestions as well.

In gauging the extent to which the system is functioning as designed, we found that the medical equipment system is misunderstood by users in practice, and it does not meet its goals of providing information needed to support the goal of fully supplying facilities. Many facilities, particularly health centers, persistently lack the minimum set of equipment, which impacts the quality of services that these facilities provide. Furthermore, health system actors lack consensus on the responsibility for maintaining and procuring the minimum set of equipment. This was the case across all the provinces visited for the study. While there are a variety of factors that explain problems with the availability and functioning of equipment, a weak medical equipment information system contributes to these shortcomings.

We found that there is a disconnect between the availability of data on medical equipment, the resource mobilization power, and decision-making responsibility among the actors in the DRC health system. The discordance between national standards and functional equipment in health facilities is thus not due to a lack of standards, resources, or data, but rather challenges in execution. **A process should be institutionalized in which information on equipment needs is brought to those who have the resources and decision-making power in order for these needs to be addressed.**

National guidelines

The central government's stated role in the medical equipment information system is to develop and disseminate guidelines. The Ministry of Public Health (MSP) has long defined the minimum package of medical equipment for health facilities. Recently, the MSP developed guidelines for equipment maintenance; these have yet to be disseminated. There do not appear to be guidelines on approved equipment specifications (i.e., make and model), which would promote uniformity of equipment among facilities and enable equipment to be more readily repaired, nor are there guidelines on amortization. **The MSP could consider developing a comprehensive set of guidelines for medical equipment that includes equipment specifications and amortization.**

There does not appear to be an audit mechanism to ensure that national guidelines are fully disseminated and followed, nor does there seem to be any official recourse if a facility is unable to achieve compliance with national standards under their own budget. This situation is common with most of the normative documents which generally are poorly disseminated and are not made available for those expected to apply them. **The provincial health office could consider creating a province-level administrative position charged with disseminating standards to all who are expected to follow them and ensuring adherence to medical equipment guidelines.**

Equipment procurement system

The system through which equipment needs are determined and fulfilled operates very differently to what is described in government documents. While official documents state that the CDRs are responsible for

equipment procurement, in practice the CDRs seem to be almost completely uninvolved. There does not seem to be a clear understanding of who, within the government system, is responsible for procuring equipment, or what the process is for doing so. The decentralized design of the DRC's health system means that the central government is largely uninvolved in medical equipment procurement. Provincial health offices do not appear to play a significant role.

Occasionally, facilities request equipment from the health zone office, which may fill the request from its own stock, obtain it from a partner, or deny the request. In any case, there is no official process by which the facility receives a response. **The Ministry of Public Health could consider institutionalizing a process for keeping facilities informed of the status of equipment requests. This could be done during facility supervision, during regular meetings, or through an electronic system.**

When they have the means and the inventory is available, health facilities may purchase needed equipment from the private market. While this can be a financial hardship for some facilities, several of the facilities visited for this study reported engaging in regular planning and budgeting exercises that include medical equipment procurement. Facilities in these zones appeared to have a better understanding of the equipment procurement process. Additionally, these facilities used their equipment data to inform prospective budgets and management plans. While we did not collect data on how long they had been doing regular planning, this is a component of the USAID IHP. One of these facilities was also in a health zone supported by the World Bank's Performance Based Financing program, which also promotes this type of planning and provides subsidies for equipment procurement. **The MSP and partners could consider expanding this process of regular planning and budgeting, including for medical equipment, to all health facilities. They might also explore whether and in what cases subsidies for the purchase of equipment may be necessary for facilities to achieve the minimum package of equipment.**

Overall, the medical equipment procurement system appears ill-defined, both on paper and in practice. The MSP could consider a full review and revision of the system so that processes and roles are well-documented and feasible under current conditions. This should include all levels of the government public health system (MSP, CDRs, provincial health office, health zone office, health facilities, CODESAs) with an option for donor/partner involvement. A diagram of the current procurement process, as informed by this study's findings, is provided in Appendix D.

Equipment maintenance system

The communication channel for reporting inoperable equipment appears to be functioning as designed, with facilities regularly reporting the numbers of non-functional pieces of equipment through the SNIS (DHIS2). The country has made significant investment in its routine health information system and therefore, facilities are reporting the required equipment data. While the equipment data forms are confusing and limited to just a few types of equipment, and the data that they produce is inadequate for decision making, the fact that the reporting system functions presents an opportunity. **In the short term, rather than tracking the "number of days non-functional" by equipment type, facilities could report the number of functional pieces of each equipment type by month.**

In the longer-term, the DHIS2 platform is not designed to be an equipment inventory management system. Investment in a dedicated system for inventory tracking, maintenance, projection, and budgeting would produce the data necessary for proactively managing medical equipment, both within individual health

centers and hospitals and at higher levels of the health system (health zones and provinces). The World Health Organization has published technical guidance on the design of such a system (World Health Organization, 2011). An electronic equipment procurement system, similar to the one used for medicines, could also be considered.

In general, there does not appear to be a process by which facilities could request and receive maintenance on broken medical equipment. While national guidelines state that each facility should employ a maintenance technician, in practice, facility-based technicians are almost universally absent. This may be, in part, a function of supply, as there is a limited number of training programs for medical equipment maintenance technicians in the country. In the absence of such a system, facilities try to repair equipment themselves, or hire local technicians who may not have the necessary expertise. **The inadequate number of repair technicians in the DRC deserves attention. As a stopgap measure, provincial health offices could consider employing a small number of technicians who could service high-priority equipment throughout the province. National specifications for equipment procurement could also consider the availability of spare parts and trained technicians.**

The role of donors and partners

Official documents do not mention the role of partners or foreign donors in equipment procurement, despite their major roles. While the objective of large integrated health programs is usually health system strengthening, in practice these programs usually provide at least some medical equipment as well. Those interviewed for this study explained that the health zone office is supposed to act as an intermediary between facilities and partners, meaning that facilities are not able to directly request equipment from a partner. Further, the process by which donors and partners make decisions on what equipment is provided and where it is distributed, and whether and how those decisions should be coordinated with the government, does not appear to be documented.

Donors will likely continue to operate in the DRC. The government could improve the medical equipment system by working with partners to clearly delineate roles regarding equipment procurement. If donors are expected to be solely responsible for equipment, this should be made clear, and guidelines with specifications on the type of equipment expected at each level of the health system need to be made available to donors. If donors are not willing to take on that function, the government should make other arrangements so facilities are not left with no support.

In the current development climate, donors tend to be more interested in investing in system strengthening than in buying equipment. However, given the DRC's weak medical equipment system, programs will likely need to support the procurement and repair of equipment while they work to strengthen the system. **To strengthen the system, the government could request funding for training in equipment systems management and maintenance and for a comprehensive medical equipment information system**. This would have sustained impact on health services in the areas directly supported by the donor, and spillover effects to the rest of the country.

In our interviews, government officials could not articulate a plan for maintaining national equipment standards in the absence of external funding and procurement, and at least one health zone official stated that the province does not budget for medical equipment but cedes that responsibility to the donor. While data collection for this study was limited to areas that receive USAID support, informants in the Kinshasa-

based pilot phase described “orphan health zones,” or zones with no donor support, and indicated that there is no functioning equipment procurement system in such zones. **Establishing such a system in the absence of donor support would likely improve health services in those places.** It would create opportunities to pilot and evaluate the effectiveness of different system designs that could be scaled elsewhere, ultimately moving the DRC’s health system closer to donor independence.

Conclusion

This study identifies several weaknesses in the medical equipment information system in the DRC, ultimately impacting the availability and functioning of essential medical equipment in public health facilities. The system's inefficiencies contribute to facilities lacking the minimum required equipment and experiencing challenges in equipment maintenance. Clear guidelines on equipment specifications, maintenance, and procurement are lacking, and there is a lack of coordination and understanding regarding the responsibility for equipment procurement within the government system.

Our findings highlight the need for a comprehensive review and reform of the medical equipment information system, including the involvement of all relevant stakeholders. Further, there is a need to clarify the roles and responsibilities of partners and donors in equipment procurement and make strides toward a functioning system in the absence of donor support. The government should also consider investing in a dedicated equipment inventory management system and training programs for maintenance technicians. By addressing these issues, the DRC can sustainably strengthen its medical equipment system and improve health service delivery throughout the country.

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Appendix A. Documents reviewed

1. Loi n° 18/035 du 13 décembre 2018 fixant les principes fondamentaux relatifs à l'organisation de la Santé publique
2. Loi relative aux marches publics (avril 2010)
3. Décret n° 010/34 du 28 décembre 2010 fixant les seuils de passation, de contrôle et d'approbation des marchés publics
4. Décret n° 10/22 du 02/06/2010 portant manuel de procédures de la loi relative aux marches publics
5. Décret n° 10/21 du 02 juin 2010 portant création, organisation et fonctionnement de l'autorité de régulation des marches publics, en sigle « ARMP »
6. Décret n°10/22 du 02 juin 2010 portant manuel de procédures de la loi relative aux marches publics
7. Rapport d'évaluation du Plan stratégique de Sécurisation des Produits de Santé de la Reproduction 2008-2012 de la République Démocratique du Congo
8. Manuel de procédures de passations de marches applicables aux financements sous gestion de la CAGF (Tome 7)
9. Procédures opérationnelles standards de la CAMESKIN
10. Rapport mensuel Division Provinciale de la Santé
11. Rapport mensuel du BCZ
12. Rapport mensuel du centre de santé
13. Rapport mensuel de l'hôpital

Appendix B. SNIS data entry forms for medical equipment: Health center

Original French

4.3 Matériel et Equipment : Jrs de non Fonctionnalité (Partie 1)

	Valeur
Electricité	
Frigo	
Microscope	
Glucomètre	
Spectrophotomètre	
Centrifugeuse	

English translation

4.3 Material and Equipment: Days of non-functionality (Part 1)

	Value
Electricity	
Refrigerator	
Microscope	
Glucometer	
Spectrophotometer	
Centrifuge	

Appendix C. SNIS data entry forms for medical equipment: Hospital

Original French

4.12 Matériel et Equipment

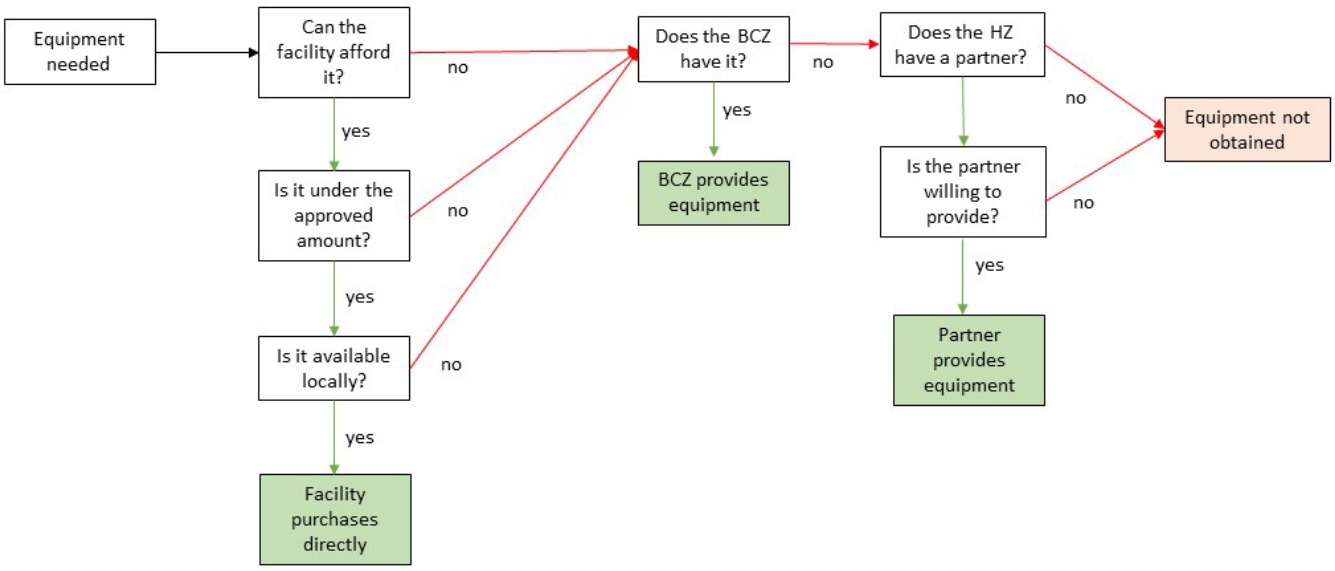
		Nombre Jrs Non Functionelle
Ordinateur		
Photocopieuse		
Moto		
Véhicule		
Internet		
Incubateur		
Chaine pour électrophorèse		
Couveuse		
Appareil de réanimation		
Echographe		
Radiographie		
Electrocardiogramme		

English translation

4.12 Material and Equipment

		Number of Days Non-functional
Computer		
Photocopier		
Motorcycle		
Vehicle		
Internet		
Incubator (pre-term)		
Electrophoresis chain		
Incubator (full-term)		
Resuscitation device		
Ultrasound		
X-ray		
Electrocardiogram		

Appendix D. Current process by which facilities procure basic medical equipment



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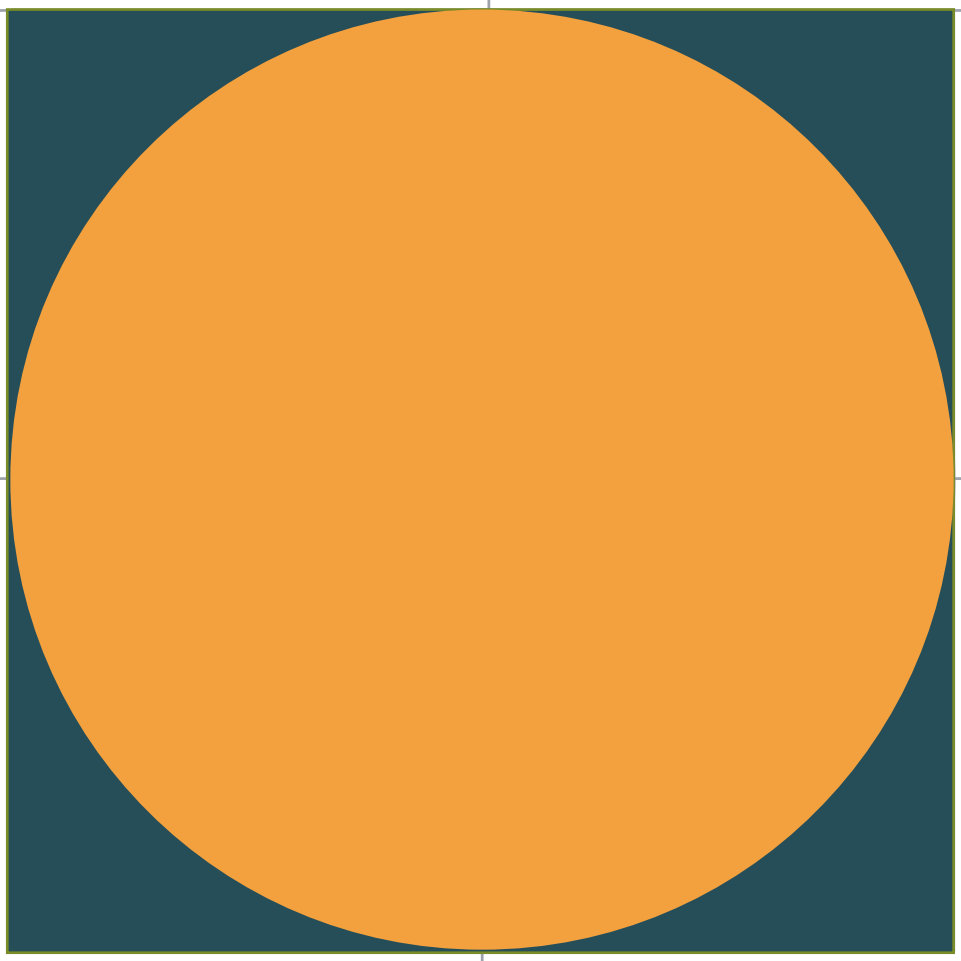

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