

**How Process Maps Can Inform Clinical Decision-making:  
A Time-Driven Activity-based Costing Case Series on HIV Services in Tanzania**

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## INTRODUCTION

While low- and middle-income countries account for roughly three-quarters (75%) of the global burden of HIV/AIDS, they account for only slightly more than one-third of all HIV/AIDS spending (37%).<sup>1</sup> Countries with a particularly high burden of HIV/AIDS, such as Tanzania, Botswana, and Lesotho—where more than 1 in every 21 adults are infected<sup>2</sup>—are confronted with pressing decisions about how to best serve their population health needs with the limited resources available.

Against this backdrop, it is essential that policymakers and health system administrators in low-resource settings have accurate and timely information on the flow of their financial resources as well as information on what their financial investments *buy* them.<sup>3</sup> Progress towards achieving the UNAIDS 95-95-95 targets is, at least in part, predicated on the ability of the governments of high-burden countries to finetune and optimize these investments—both in terms of the configuration of health systems' infrastructure and the way patient outcomes are supported, such as viral suppression.<sup>4</sup> Nevertheless, these relationships are often opaque, partially due to poor visibility into the actual resources being allocated to patients at health facilities.

Activity-based costing and management (ABC/M), a new and multi-country initiative to track resource allocation and funding for HIV services throughout sub-Saharan Africa, has sought to directly tackle this problem.<sup>5</sup> It does so by applying a method employed as part of the ABCM/approach—known as time-driven activity-based costing (TDABC)<sup>6</sup>—to directly observe the resources allocated to thousands of patients seeking HIV services across more than a hundred facilities in half-a-dozen countries (Tanzania, Uganda, Kenya, Mozambique, Namibia, Zambia<sup>1</sup>). The resources expended include personnel, equipment, and infrastructure, each of which can be expressed as a function of time (in minutes) utilized. Coupled with consumables expended, policymakers will have high-resolution information on where patients go, who they see, for how long, what services are provided, what tests are ordered, and what medicines are prescribed.

A fundamental building block of TDABC, and by extension the ABC/M initiative, is process mapping. *Process mapping* can be defined as the exercise of creating a visual representation of the care pathways involved in service delivery, including depicting the 'where', 'what', 'when', 'who', and 'how often'.<sup>7</sup> Process maps are created using either normative or observed inputs. Normative process maps provide a representation of what *should* occur during service delivery or the standard care pathways. This is often elicited by interviewing health care providers or other members of a clinical leadership team with expert knowledge. By contrast, observed process maps provide a representation of what is occurring *in practice* during health care delivery. This is most commonly deduced by directly observing patients as they move through the healthcare system.

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<sup>1</sup> In Kenya and Namibia, the ABC/M approach has been expanded to capture essential health services in addition to HIV services, but this report focuses solely on key HIV services.

Both the normative and observed process maps serve at least three functions. First, they provide a clear and concise depiction of what is (observed) or should happen (normative) during the care delivery cycle—including the frequencies of clinical and non-clinical activities.<sup>6</sup> This should allow administrators to examine whether appropriate activities are (or are not) happening, and how often. Second, the observed process maps identify important departures from standard care pathways, when compared to the normative process maps, as denoted by ‘branches’ and corresponding decision nodes.<sup>6</sup> These departures may indicate key junctures in clinical decision-making (i.e. purposeful departures), or else may indicate arbitrariness within the system (i.e. purposeless departures). Third, observed process maps provide a dynamic representation of patients as they move through space and time within a health system. Administrators can use this information to consider alternative arrangements that would be more efficient and cost saving, or else pinpoint areas for greater investment where resources are currently lacking.<sup>7</sup>

In this report we provide a series of process map case vignettes on delivery of antiretroviral therapy (ART). The purpose is to provide a real-world demonstration of the development, interpretation, and functions of process maps for improving HIV service delivery in a high-HIV burden, low-resource context. We are hopeful that other countries engaging in ABC/M can look to this as a reference tool for undertaking similar exercises.

## **APPROACH**

### *Setting & Population*

Six regions of Tanzania—Dodoma, Kagera, Mbeya, Tabora, Mwanza, Njombe—were selected from four geographic zones of the country, each with an adult HIV prevalence ranging from 4.2% to 11.6%.<sup>8</sup> Across these regions, 22 facilities were purposively selected to balance a set of characteristics that included: urbanicity (urban v. rural), facility type (district hospital, health center, dispensary), primary funder (PEPFAR, Government of Tanzania), sector (public v. private/NGO), and ART treatment patient volume (low [20-249 patients], medium [250-1,249 patients], high [1,250+ patients]). All facilities were reviewed to ensure that they provided a comprehensive array of HIV services such as routine antiretroviral therapy (ART), which is the focus of this paper, as well as HIV testing and counseling (HTC), prevention of mother-to-child transmission (PMTCT) services, voluntary medical male circumcision (VMMC), and pre-exposure prophylaxis (PrEP).

Individuals were eligible to participate in the TDABC process if they were aged 18+, were seeking HIV services, and were accessing ART services at one of the 22 participating facilities between September 2 and October 16, 2020. Eligible participants were identified when they arrived for registration at facilities, at which point the prospective participant was informed about the study objectives and presented with a consent form. Those who verbally consented were assigned a unique identifier to safeguard confidentiality. All study procedures were approved by the National Institute for Medical Research and Muhimbili University of Health and Allied Sciences in Tanzania, along with the Health Media Lab in the United States.

## *Procedures*

Process mapping occurred in two steps. First, normative process maps were constructed through key informant interviews with senior clinical leadership at each facility. Specifically, members of the research team identified a clinician with expertise on the particular service line of inquiry (e.g. HIV care and treatment, HIV testing etc.) and asked a series of questions, including:

1. What steps should be performed during the care delivery cycle and how frequently?
2. Which staff are engaged at each step?
3. What is the estimated duration of provider-patient engagement at each step?
4. What consumables are expended at each step?
5. Are there important departures in the care delivery cycle that should be documented? If so, what are these?

Based on these interviews, the interviewer generated a visual process map depicting the *normative* care delivery cycle. The second step of process mapping involved direct observation of patients as they proceeded to receive care through each facility. Trained data collectors shadowed patients and documented all relevant information on the care delivery process, including where patients went, who they saw (and for how long), what services they received, and what consumables were expended. This direct observation process occurred over a 1–2-week period at each facility, yielding an average of 10-15 direct observations per service line.

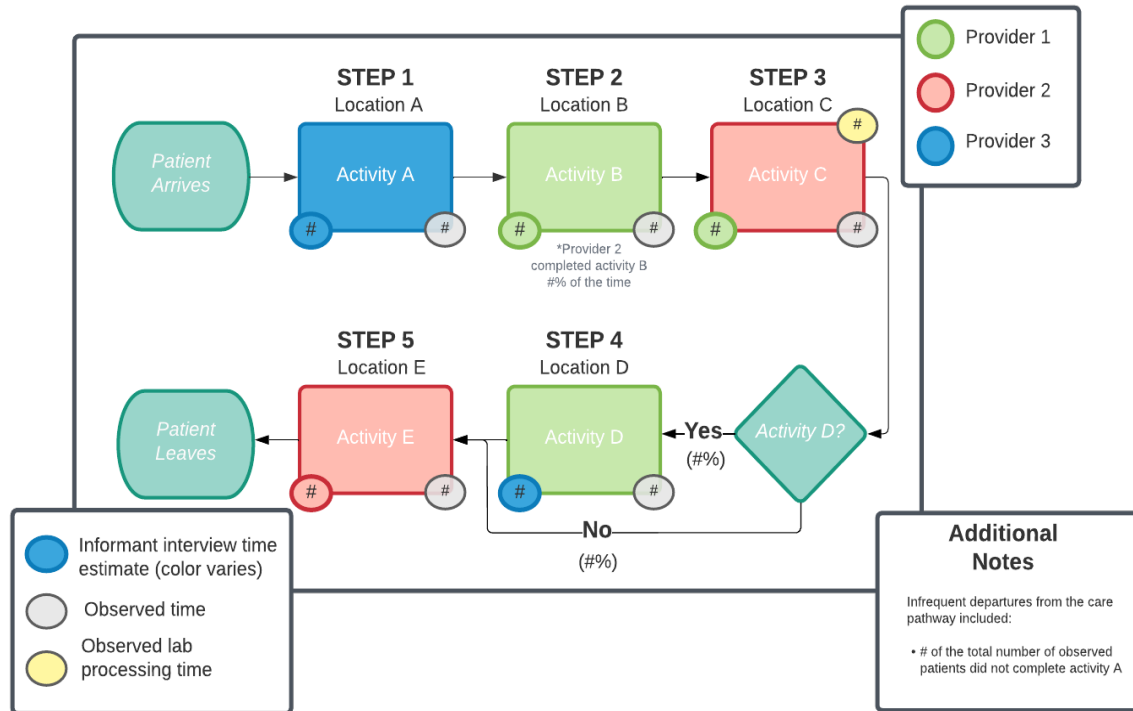
Following this, research team members generated visual process maps depicting the observed care delivery cycle. These process maps were identical to the original process maps, save for the fact that they depicted the observed rather than self-reported array of resources allocated to patients. In the event that ordering of steps or provider types differed across patients, the modal (i.e. most frequent) ordering or provider was selected for inclusion. Timed steps were entered as mean values (in minutes), rounded to the nearest integer.

A template example of an observed process map is shown in Figure 1 below. In this example, we see that each rectangle represents a step, while diamonds represent decision nodes where departures from the care process can be shown (depicted as branches in the process map), and ovals depict entry and exit points for patients. The small gray circles in the bottom right-hand corner of each activity depict the observed duration (in minutes) that providers engage with patients. The small circles in the bottom left-hand corner of each activity depict the expected duration (in minutes) as reported by health care providers, with the color of the circle corresponding to the expected provider performing this step, according to key informants. The small yellow circle depicts the lab processing time, and this would only be shown for the lab services step. The provider type responsible for each activity is connoted by the color of the rectangle. The “Additional Notes” box describes steps that occurred normally with just one patient, so they were not indicated in the shown pathway, or other important information relevant to the process map. If a step is white (not shaded) this indicates that it was a step that



was part of the normative care delivery cycle but was not observed during direct observation (this is not illustrated in the template).

**Figure 1. Process Map Template**



### Analysis

Each case vignette sought to compare clinical care pathways between two or three facilities, based on one of five main factors on which facilities were first selected: urbanicity (urban v. rural), facility type (district hospital, health center or dispensary), funder (PEPFAR v. Government of Tanzania), region of the country (Dodoma, Kagera, Mbeya, Tabora, Mwanza, or Njombe), and HIV treatment patient volume (low [20-249 patients], medium [250-1,249 patients], or high [1,250+ patients]). **Table 1** provides an overview of the facilities selected to represent each of these vantage points for comparison. Areas that are different for comparison are denoted in red in the table and in process map figure titles.

To identify main points of comparison between facilities within each case vignette, we focused on the following categories: whether activities comprising the care delivery pathway were similar or different (both whether they occurred and frequency of occurrence), whether duration of activities was similar or different, and whether providers engaged in each activity were similar or different. This information was reviewed for accuracy and reporting consistency.

**Table 1. Comparative Analysis for Process Maps**

	Comparison	Facility 1	Facility 2	Facility 3
	Region (Urban): <ul style="list-style-type: none"> <li>• Same Urbanicity</li> <li>• Same Level</li> <li>• Same Funder</li> <li>• Different Region</li> <li>• Same HIV Volume</li> </ul>	Luhanga Dispensary <ul style="list-style-type: none"> <li>• Urban</li> <li>• Dispensary</li> <li>• PEPFAR</li> <li>• <b>Mwanza</b></li> <li>• Low</li> </ul>	Boko Dispensary <ul style="list-style-type: none"> <li>• Urban</li> <li>• Dispensary</li> <li>• PEPFAR</li> <li>• <b>Dar Es Salaam</b></li> <li>• Low</li> </ul>	na
	Region (Rural): <ul style="list-style-type: none"> <li>• Same Urbanicity</li> <li>• Same Level</li> <li>• Same Funder</li> <li>• Different Region</li> </ul>	Mwanzugi Dispensary <ul style="list-style-type: none"> <li>• Rural</li> <li>• Dispensary</li> <li>• PEPFAR</li> <li>• <b>Tabora</b></li> </ul>	Mahaha Dispensary <ul style="list-style-type: none"> <li>• Rural</li> <li>• Dispensary</li> <li>• PEPFAR</li> <li>• <b>Mwanza</b></li> </ul>	na
	Rurality: <ul style="list-style-type: none"> <li>• Different Urbanicity</li> <li>• Same Level</li> <li>• Same Funder</li> <li>• Different Region</li> <li>• Same HIV Volume</li> </ul>	Njombe HC <ul style="list-style-type: none"> <li>• <b>Urban</b></li> <li>• Health Center</li> <li>• PEPFAR</li> <li>• <b>Njombe</b></li> <li>• High Prev</li> </ul>	Bunazi HC <ul style="list-style-type: none"> <li>• <b>Rural</b></li> <li>• Health Center</li> <li>• PEPFAR</li> <li>• <b>Kagera</b></li> <li>• High Prev</li> </ul>	na
	Funder (Rural): <ul style="list-style-type: none"> <li>• Same Urbanicity</li> <li>• Same Level</li> <li>• Different Funder</li> <li>• Same Region</li> </ul>	Mwanzugi Dispensary <ul style="list-style-type: none"> <li>• Rural</li> <li>• Dispensary</li> <li>• <b>PEPFAR</b></li> <li>• Tabora</li> </ul>	Mwisole Dispensary <ul style="list-style-type: none"> <li>• Rural</li> <li>• Dispensary</li> <li>• <b>GoT</b></li> <li>• Tabora</li> </ul>	na
	Facility Type (Urban): <ul style="list-style-type: none"> <li>• Same Urbanicity</li> <li>• Different Levels</li> <li>• Same Funder</li> <li>• Same Region</li> </ul>	Boko Dispensary <ul style="list-style-type: none"> <li>• Urban</li> <li>• <b>Dispensary</b></li> <li>• PEPFAR</li> <li>• Dar Es Salaam</li> </ul>	Magomeni HC <ul style="list-style-type: none"> <li>• Urban</li> <li>• <b>Health Center</b></li> <li>• PEPFAR</li> <li>• Dar Es Salaam</li> </ul>	Mbagala District Hospital <ul style="list-style-type: none"> <li>• Urban</li> <li>• <b>Hospital</b></li> <li>• PEPFAR</li> <li>• Dar Es Salaam</li> </ul>
	Facility Type (Rural): <ul style="list-style-type: none"> <li>• Same Urbanicity</li> <li>• Different Levels</li> <li>• Same Funder</li> <li>• Same Region</li> </ul>	Mwanzugi Dispensary <ul style="list-style-type: none"> <li>• Rural</li> <li>• <b>Dispensary</b></li> <li>• PEPFAR</li> <li>• Tabora</li> </ul>	Upuge HC <ul style="list-style-type: none"> <li>• Rural</li> <li>• <b>Health Center</b></li> <li>• PEPFAR</li> <li>• Tabora</li> </ul>	Nzega District Hospital <ul style="list-style-type: none"> <li>• Rural</li> <li>• <b>Hospital</b></li> <li>• PEPFAR</li> <li>• Tabora</li> </ul>

\*The red text indicates the difference across the facilities compared. HC denotes health center; na denotes not applicable

## FINDINGS

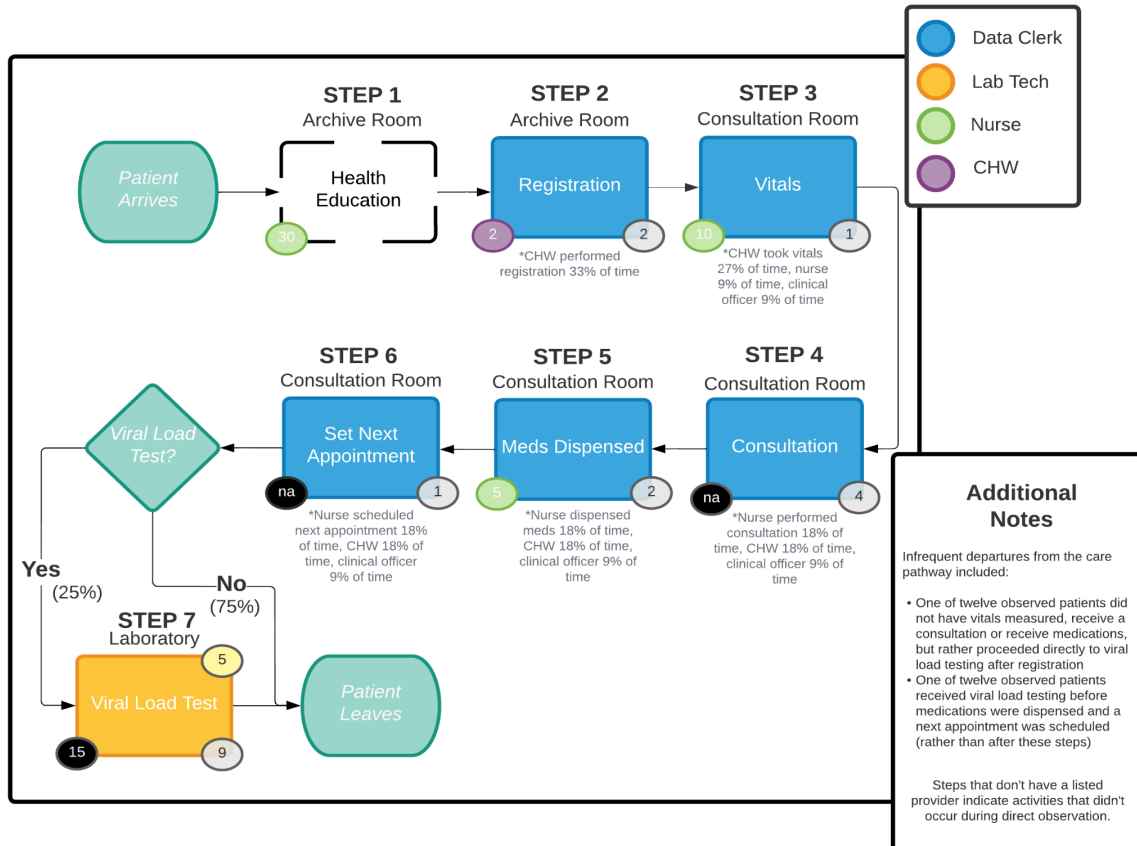
In the following pages, we present a series of six case vignettes of process maps, analyzing comparative differences in ART service delivery at facilities throughout Tanzania. (Appendix A provides a full inventory of process maps.) Each case vignette follows the same formatting to allow readers to easily track differences between facilities:

- *Overview*: Presents the key difference between facilities (e.g. urban vs. rural, health center vs. dispensary, etc.) that motivated the case vignette.
- *Activities*: Highlights similarities/differences in the frequency and pattern of activities.
- *Duration*: Highlights similarities/differences in the duration of activities that are comparable between facilities, and quantifies duration of the overall visit.

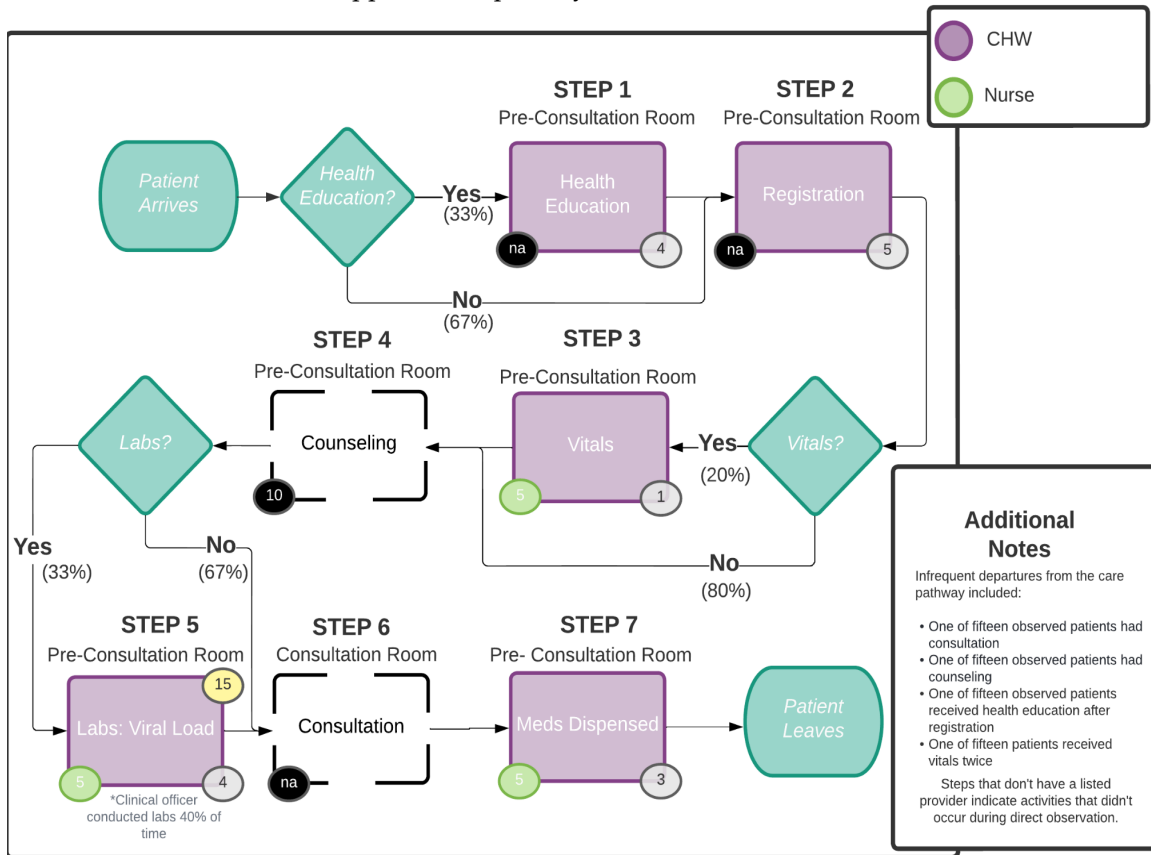
- *Staffing*: Highlights similarities/differences in cadres performing comparable activities.
- *Costs*: Examines similarities/differences in service delivery costs at each facility.

### Case Vignette #1: Luhanga v. Boko Dispensary

**Figure 2: Luhanga Dispensary, ART Stable Patients:**  
Urban, PEPFAR-Supported Dispensary with Low-HIV Prevalence in Mwanza



**Figure 3: Boko Dispensary, ART Stable Patients:**  
Urban, PEPFAR-Supported Dispensary with Low-HIV Prevalence in Mwanza



*Overview.* Luhanga and Boko Dispensaries are both situated in urban centers in different regions of Tanzania: Mwanza and Dar es Salaam. The dispensaries are also both PEPFAR-supported<sup>2</sup> and have a relatively low volume of HIV treated patients (<250 HIV patients per week). As such, the major distinction between the two facilities is their regional location.

*Activities.* While both facilities conducted a small number of similar activities within their care pathways for ART provision (registration, measurement of vitals, dispensing of ART), there were several notable differences. First, health education was conducted a third of the time with patients at Boko Dispensary, while this step was skipped for all patients at Luhanga Dispensary—despite staff having stated that Luhanga Dispensary provides a 30-minute health education session. Additionally, patient consultations and next appointment scheduling occurred consistently at Luhanga Dispensary, whereas patient consultations only occurred with one patient at Boko Dispensary and next appointment scheduling was not part of the workflow routine. It is also notable that Boko Dispensary measured vitals for almost all patients, whereas only 20% of patients had vital signs measured at Luhanga Dispensary. Likewise, blood was drawn for viral load testing less frequently at Luhanga Dispensary: 25% vs. 33% of the time.

<sup>2</sup> The term PEPFAR-supported is intended to denote the public healthcare facilities where PEPFAR provides additional support such as staffing and supervision, beyond those supports contributed by the Ministry.

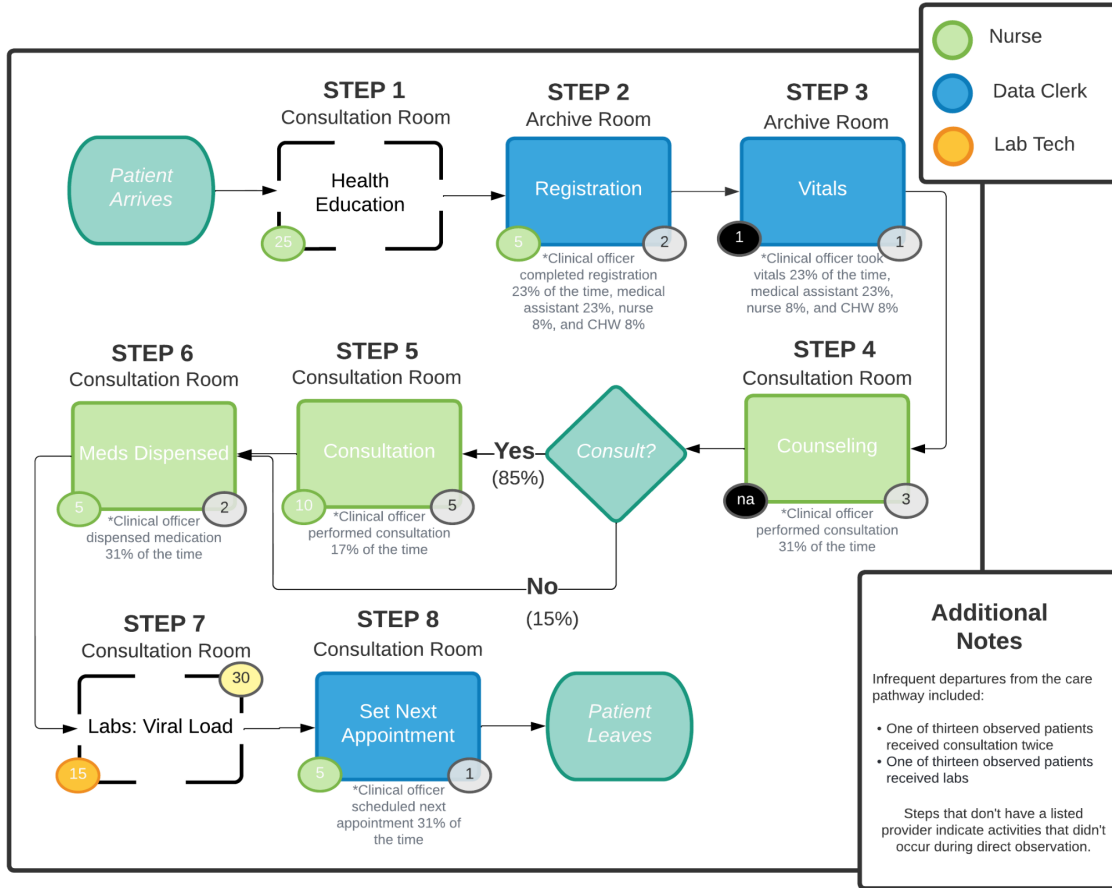
*Duration.* Among those activities that were common across both facilities, registration took a similar amount of time (2-5 minutes) and was performed by an entry-level employee (typically a data clerk or community health worker [CHW]). Vital signs were also taken over a much shorter duration than anticipated by clinical leadership: roughly one minute of provider time with patients, rather than the anticipated 5 or 10 minutes. Likewise, provider-patient interface time during medication dispensing was shorter than anticipated by clinical leadership: 2-3 minutes rather than the anticipated 5 minutes. Total time performing viral load testing activities—including time drawing and processing the sample—were relatively comparable between locations: 14 minutes (Luhanga Dispensary) versus 19 minutes (Boko Dispensary).

*Staffing.* At Luhanga Dispensary, a data clerk was primarily responsible for almost all activities, ranging from registration to consultation to medication dispensing. However, the person performing these duties varied considerably. For example, a data clerk dispensed medications 55% of the time, compared to a nurse 18% of the time, CHW 18% of the time, and clinical officer 9% of the time—suggestive that the staffing of the facility varies considerably. One exception was viral load testing, which was consistently performed by a lab technician. In a similar manner, we found that almost all activities at Boko Dispensary were performed by a CHW. Unlike Luhanga Dispensary, the lead role of the CHW was consistent across patients, and this individual was even responsible for viral load testing. This active role of the CHW differed from reporting among clinical leadership, who stated that nurses are responsible for measurement of vitals, blood draws for laboratory testing and medication dispensing.

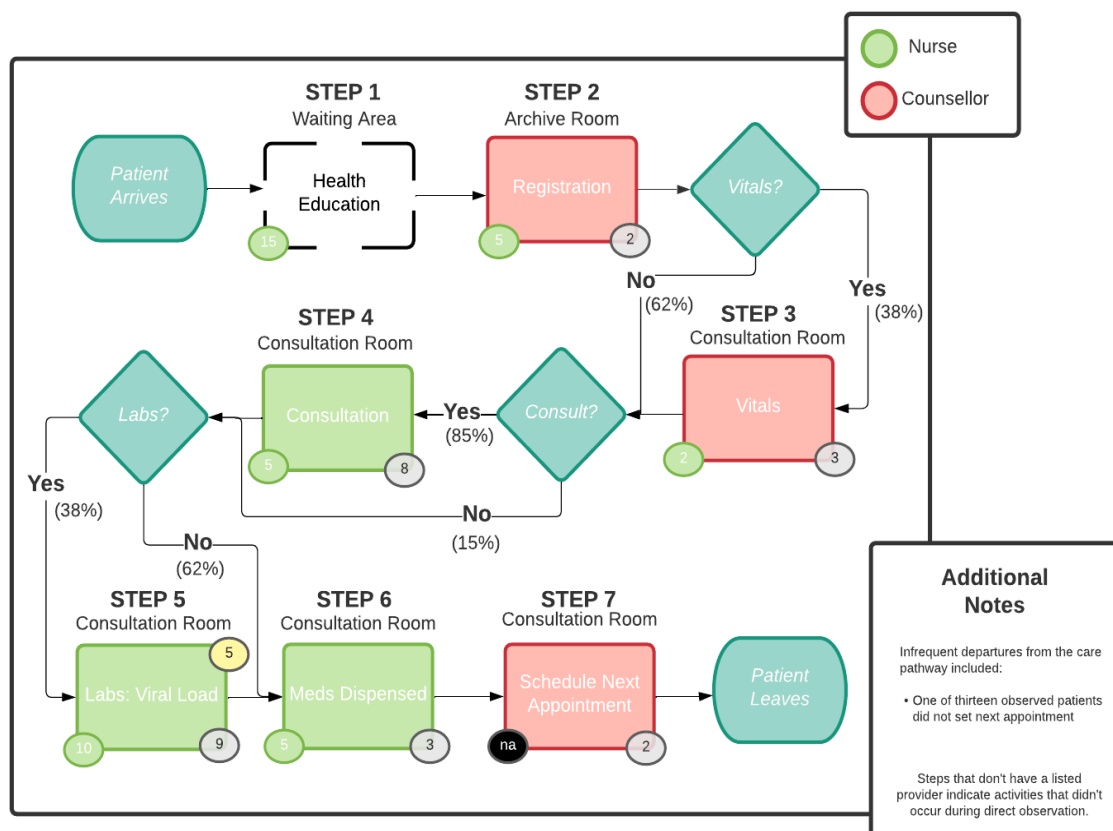
*Cost.* Ultimately, these variations in activities, timing and resourcing led to visits being only 3% more expensive at Boko Dispensary relative to Luhanga Dispensary: \$1.43 vs. \$1.39, not accounting for consumables. Once consumables such as labs and medicines were incorporated, these figures were \$15.93 for Boko Dispensary and \$13.88 for Luhanga Dispensary—a 15% difference. (Ref of the costs, since they are not calculated in this paper).

## Case Vignette #2: Mwanzugi Dispensary v. Mahaha Dispensary

**Figure 4: Mwanzugi Dispensary, ART Stable Patients**  
Rural, PEPFAR-Supported Dispensary in Tabora



**Figure 5: Mahaha Dispensary, ART Stable Patients**  
Rural, PEPFAR-Supported Dispensary in Mwanza



*Overview.* Mwanzugi and Mahaha Dispensaries are both situated in rural areas in different regions of Tanzania: Tabora and Mwanza. The dispensaries are also both PEPFAR-supported. As such, the major distinction between the two facilities is their geographic location.

*Activities.* Mwanzugi and Mahaha Dispensaries shared the majority of activities in common in their care pathways for ART provision (registration, measurement of vitals, consultation, dispensing of ART, scheduling next appointment). One difference between the facilities was that blood was drawn for viral load testing more than a third of the time (38%) with patients at Mahaha Dispensary, while this step was skipped for all but 1 patient at Mwanzugi Dispensary. Additionally, counseling occurred consistently at Mahaha Dispensary, but was not in the care pathway of Mwanzugi Dispensary. Another inconsistency was that vitals were measured consistently at Mwanzugi Dispensary but less than 40% of the time at Mahaha Dispensary. At both facilities, consultation was conducted 85% of the time.

*Duration.* The activities of registration, vitals, medication dispensing, and scheduling next appointment each took a similar amount of time (1-3 minutes) at both facilities. There was variation between the two dispensaries in terms of the time to complete consultation: Mwanzugi averaged 5 minutes (10 minutes were anticipated by leadership) and Mahaha averaged 8 minutes (5 minutes anticipated by leadership). Additionally, registration was anticipated to take 5 minutes by clinical leadership at both facilities but took only 2 minutes at each. The total provider-patient interface time for an average visit at Mwanzugi Dispensary for

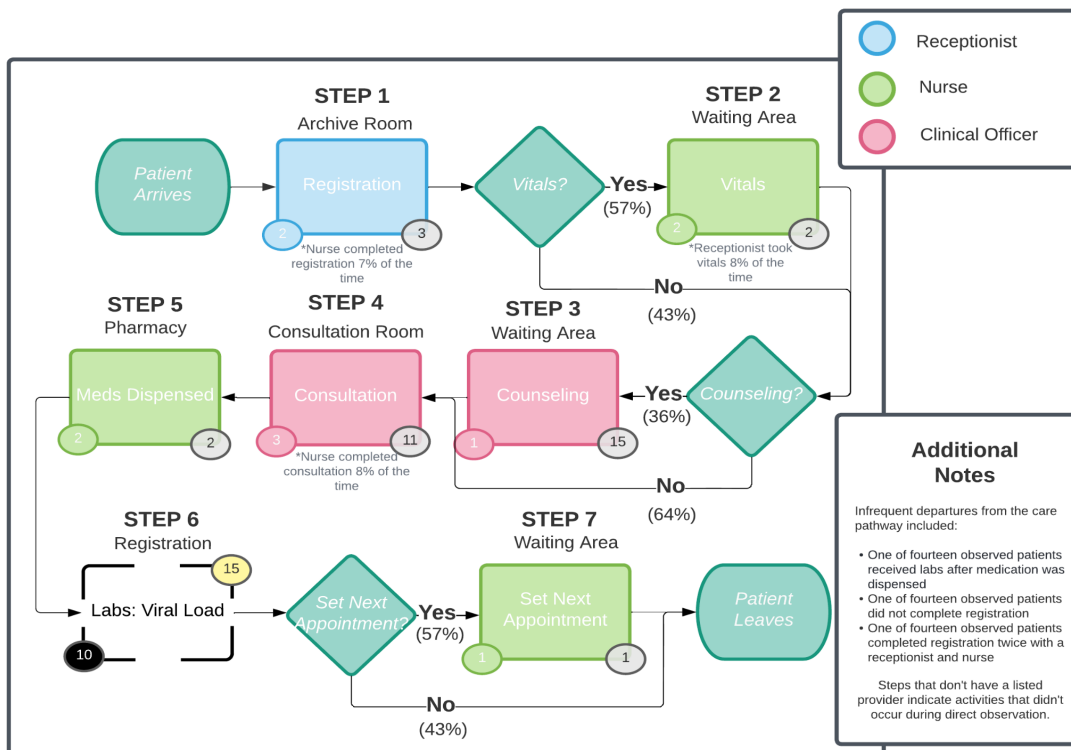
patients receiving ART was 14 minutes if all activities were performed, compared to almost double that (27 minutes) at Mahaha Dispensary. This is primarily attributable to Mahaha Dispensary's inclusion of viral load testing and counseling in its care pathway.

*Staffing.* At Mwanzugi Dispensary, the tasks of registration, vitals measurement, and scheduling next appointment were performed by a data clerk the majority of the time, whereas at Mahaha Dispensary a counselor performed these tasks. In contrast to Mahaha Dispensary, there were inconsistencies in who performed each task at Mwanzugi Dispensary. For example, although a nurse performed counseling most often at Mwanzugi Dispensary, a clinical officer also performed counseling 20% of the time. In the cases of registration and vitals measurement at Mwanzugi Dispensary, the tasks were occasionally performed by a clinical officer, medical assistant, nurse, and CHW in addition to a data clerk -- indicating that staffing varies. At both dispensaries, clinical leadership stated nurses were responsible for registration; however, less senior staff tended to complete registration at both facilities.

*Cost.* Ultimately, these variations in activities, timing and resourcing led to visits being 11% more expensive at Mwanzugi Dispensary versus Mahaha Dispensary: \$1.76 vs. \$1.59, not accounting for consumables. Once consumables and labs were incorporated, these figures were \$11.36 for Mwanzugi Dispensary versus \$16.35 for Mahaha Dispensary, suggesting that Mahaha Dispensary provided more consumables.

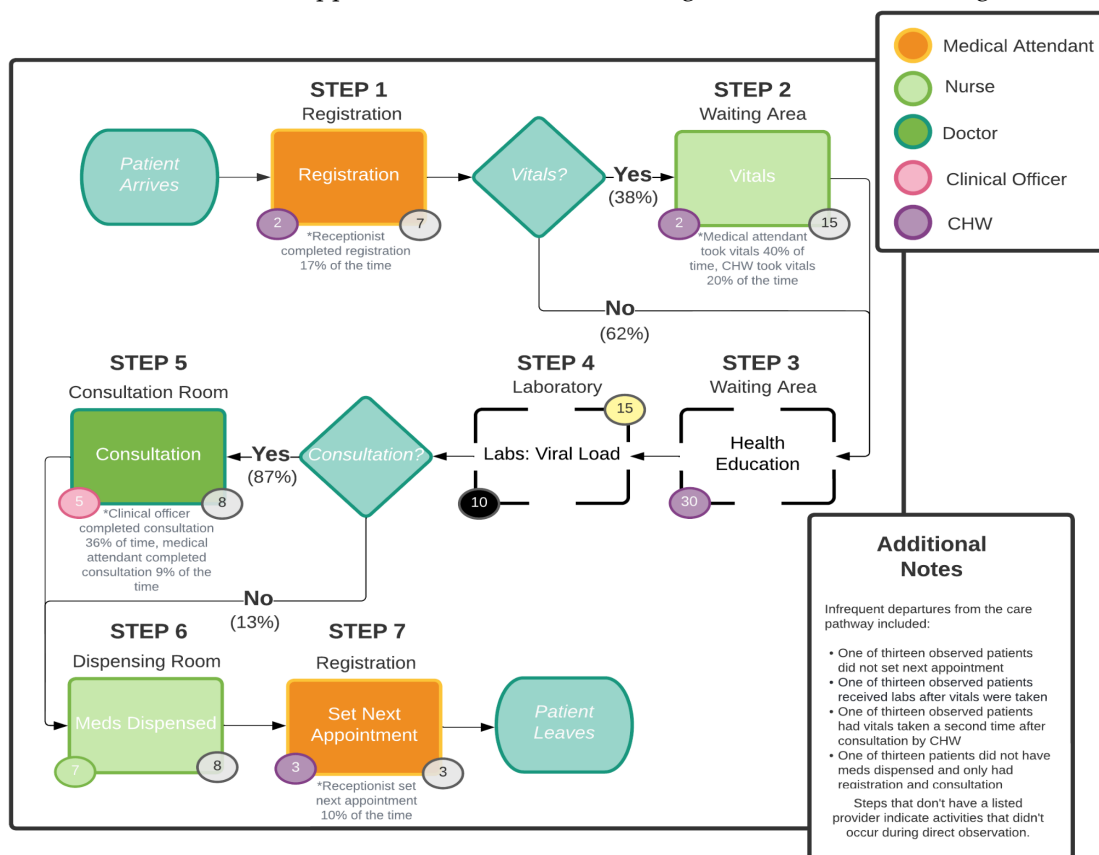
### Case Vignette #3: Njombe Health Center v. Bunazi Health Center

**Figure 6: Njombe Health Center, ART Stable Patients:**  
Urban, PEPFAR-Supported Health Center with High-HIV Prevalence in Njombe





**Figure 7: Bunazi Health Center, ART Stable Patients:**  
Rural, PEPFAR-Supported Health Center with High-HIV Prevalence in Kagera



*Overview.* Njombe and Bunazi Health Centers are both PEPFAR-supported and have a relatively high volume of HIV patients (>1,250 HIV patients per week). The major distinction between the two facilities is their rurality and (by extension) location within Tanzania, with Njombe located in the urban Njombe region and Bunazi located in the rural region of Kagera.

*Activities.* Both health centers conducted the following steps in their care pathways: registration, measurement of vitals, dispensing of ART, scheduling of next appointment. However, there were several differences between the health centers such as counseling was conducted a third of the time with patients at Njombe Health Center, while this step was not part of the patient pathway in Bunazi Health Center. It was also notable that Njombe Health Center measured vitals for a majority (57%) of patients, whereas this activity occurred only 38% of the time at Bunazi Health Center. Additionally, patient consultations were provided to all patients at the Njombe Health Center and to most patients (11 of the 13) at Bunazi Health Center. Clinical staff at both facilities stated that blood was drawn for viral load testing prior to patient departure. However, only one observed patient at each health center had their blood drawn for testing. Further, next appointment scheduling occurred consistently at Bunazi Health Center, whereas only 57% of observed patients at Njombe Health Center scheduled their next appointment during this visit.

*Duration.* At both facilities, the tasks of registration, consultation, and scheduling of the next appointment were similar in length. While comparable, patient-provider interface time at

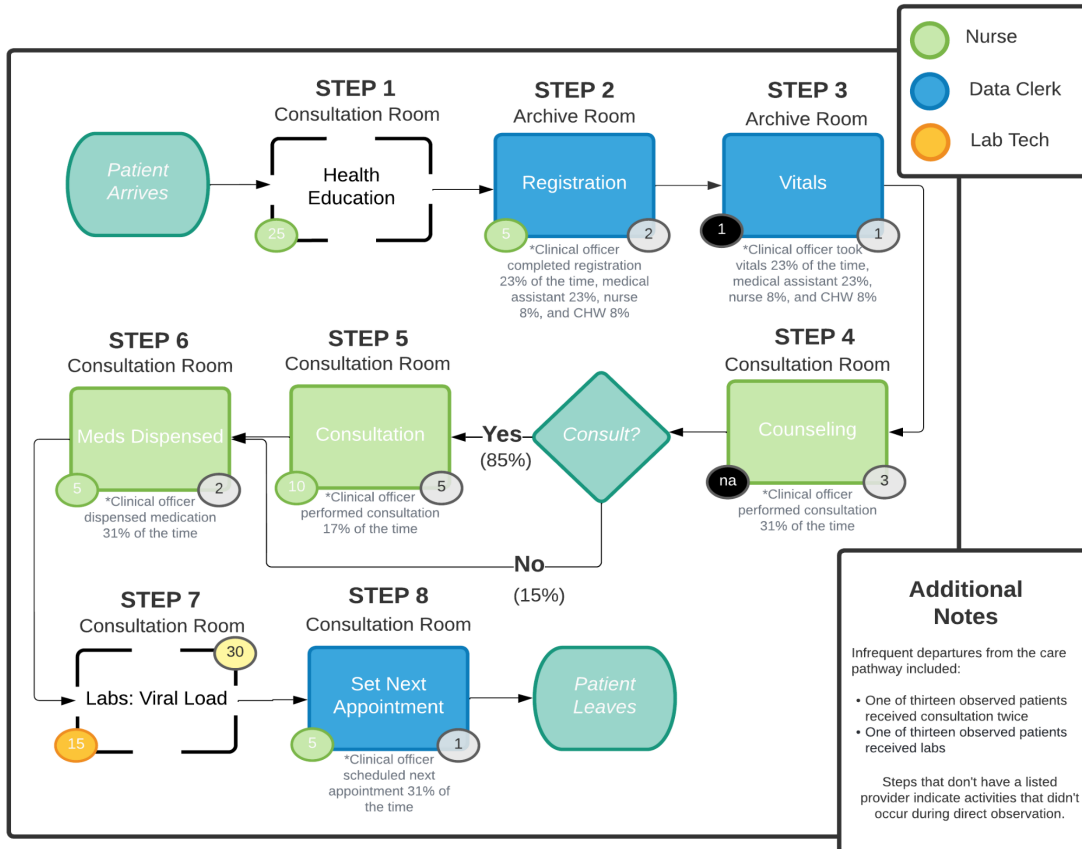
Bunazi Health Center for these activities was on average longer than that in Njombe Health Center. The greatest source of time variance between facilities was the duration spent measuring patient vital signs: Njombe Health Center took 2 minutes on average, while Bunazi Health Center took 15 minutes. Likewise, the dispensing of medication took on average 6 minutes longer at Bunazi: 2 minutes at Njombe vs 8 minutes at Bunazi. Cumulatively, the total provider-patient interface time for an average visit at Njombe Health Center for patients receiving ART was 34 minutes if all activities were performed, compared with 41 minutes at Bunazi Health Center.

*Staffing.* Responsibility for activities was primarily divided between nurses and clinical officers at Njombe Health Center. The only exception was registration, which was completed by a receptionist 92% of the time and a nurse the remaining 8% of the time. We found a wider range of staffing and variation in responsibilities at Bunazi Health Center. Clinical leadership at Bunazi Health Center indicated that CHWs were responsible for all activities, with the exception of consultation and medication dispensing. However, we observed that individuals performing these duties varied considerably. For example, a nurse measured vitals 40% of the time, compared to a medical attendant 40% of the time, and a CHW 20% of the time—suggestive that staffing of the facility varies considerably from one day to the next. The one exception was medication dispensing, which was consistently performed by a nurse.

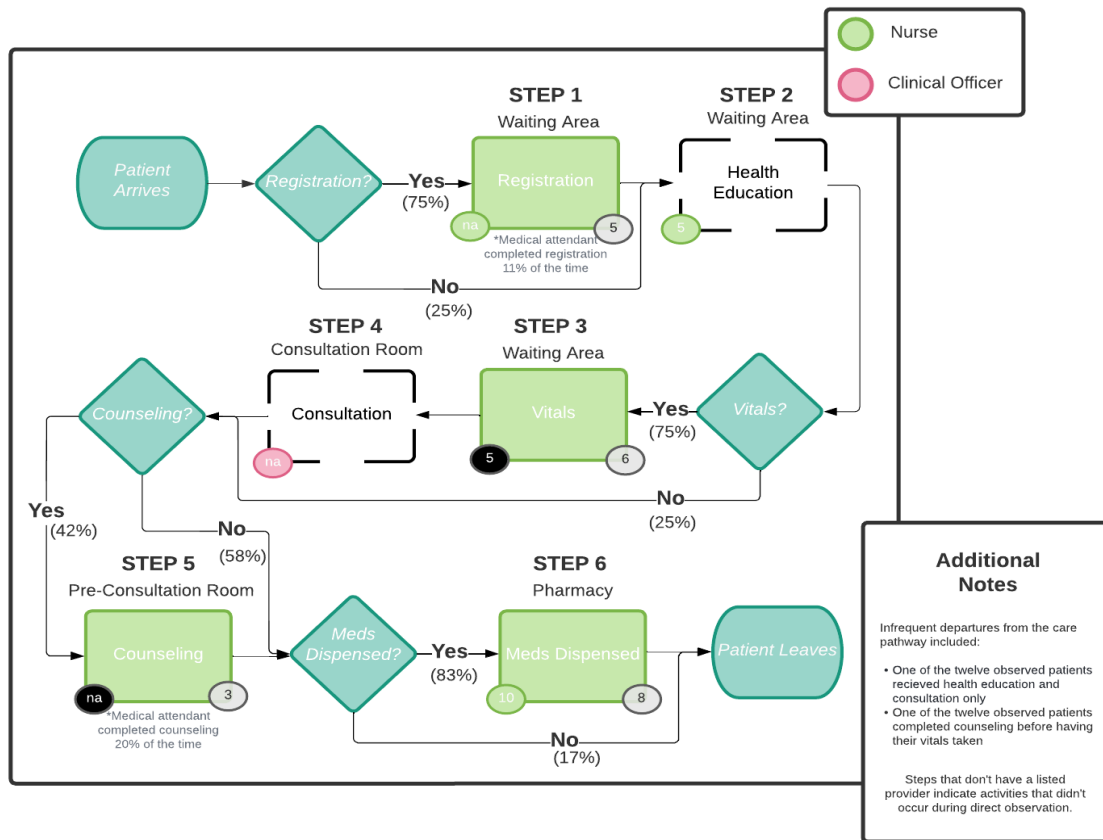
*Cost.* Ultimately, these variations in activities, timing and resourcing led to visits being 4% more expensive at Njombe Health Center versus Bunazi Health Center: \$1.29 vs. \$1.24, not accounting for consumables. Once consumables and labs were incorporated, these figures were \$15.97 for Njombe Health Center versus \$13.18 for Bunazi Health Center.

## Case Vignette #4: Mwanzugi Dispensary v. Mwisole Dispensary

**Figure 8: Mwanzugi Dispensary, ART Stable Patients:**  
Rural, PEPFAR-Supported Dispensary with Low-HIV Prevalence in Tabora



**Figure 9: Mwisole Dispensary, ART Stable Patients:**  
Rural, GoT-Supported Dispensary with Low-HIV Prevalence in Tabora



*Overview.* Mwanzugi and Mwisole dispensaries are both situated in rural areas in the Tabora region. The dispensaries both also have a low volume of HIV patients (<250 HIV patients per week). As such, a major distinction between the two facilities is that Mwanzugi is a PEPFAR-supported dispensary while Mwisole is supported by the Government of Tanzania.

*Activities.* The activities of registration, measurement of vitals, counseling, dispensing of medication were the same at each dispensary, however, there were several notable differences. First, consultation happened regularly (85% of the time) at Mwanzugi, but only one of the twelve patients (8%) received consultation at Mwisole. Likewise, next appointment scheduling occurred consistently at Mwanzugi, but was not a part of the care pathway for Mwisole. While staff stated that health education was provided to patients at both facilities, only one of the twelve patients received this in Mwisole, and it was skipped entirely in Mwanzugi. Likewise, blood draws for viral load testing was listed by staff as a regular step in the care pathway in Mwanzugi, but only one of 13 patients had labs drawn. Blood draws for viral load testing was not part of the care pathway in Mwisole. Additionally, counseling was performed less frequently at Mwisole Dispensary: 100% vs. 42% of the time. Registration, viral load testing and medication dispensing were provided to all patients at Mwanzugi Dispensary, but with less regularity at Mwisole Dispensary (75% and 83%, respectively).

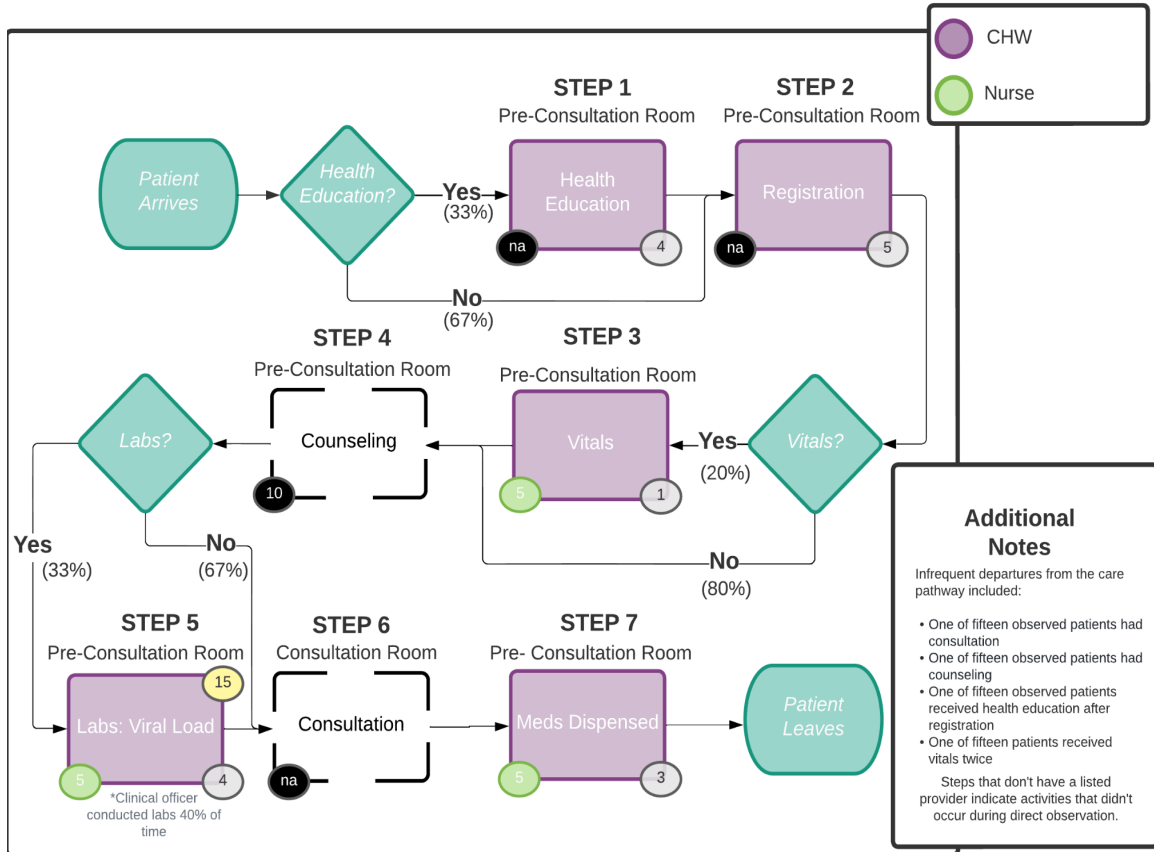
*Duration.* At both facilities, counseling took the same amount of time (3 minutes) and was performed by a nurse. Patient interface time during medication dispensing (2-8 minutes), taking vital signs (2-6 minutes) and registration (2-5 minutes) varied between Mwanzugi and Mwisole Dispensaries, with Mwisole Dispensary consistently taking longer to complete tasks. Time estimates by clinical leadership were roughly similar to actual provider time with patients, with medication dispensing taking shorter in both dispensaries than anticipated (2-8 minutes rather than 5-10). While health education wasn't routinely done at either facility, anticipated time by clinical leadership differed greatly at 25 minutes in Mwanzugi and 5 minutes in Mwisole. Cumulatively, the total provider-patient interface time for an average visit at Mwanzugi Dispensary was 14 minutes if all activities were performed, compared to 22 minutes at Mwisole Dispensary.

*Staffing.* At Mwisole, a nurse was primarily responsible for, and completed all care steps a majority of the time. The only exceptions were registration and counseling where a medical attendant completed the step a smaller proportion of time (11% and 20%, respectively). We found a wider range of staffing and variation in responsibilities at Mwanzugi Dispensary. Clinical leadership at Mwanzugi Dispensary indicated that nurses were responsible for all activities, with the exception of taking vitals and viral load testing. We observed, however, that there was great variation in the individuals performing these duties at Mwanzugi Dispensary. For example, a data clerk registered patients 38% of the time, a clinical officer 23% of the time, a medical assistant 23% of the time, a nurse 8% of the time and a CHW 8% of the time.

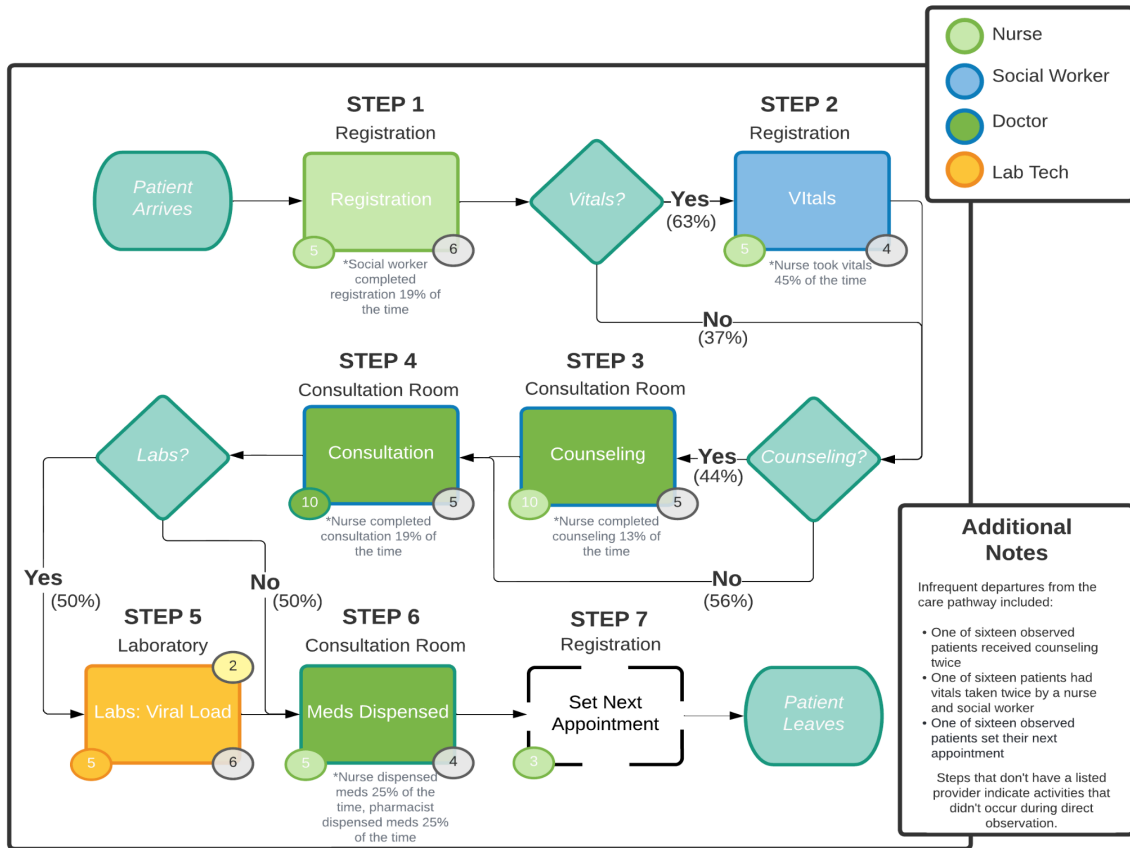
*Cost.* Ultimately, these variations in activities, timing and resourcing led to visits being 58% more expensive at Mwanzugi Dispensary versus Mwisole Dispensary: \$1.76 vs. \$1.12, not accounting for consumables. Once consumables and labs were incorporated, these figures were \$11.36 for Mwanzugi Dispensary versus \$10.09 for Mwisole Dispensary.

**Case Vignette #5:**  
**Boko Dispensary v. Magomeni Health Center v. Mbagala District Hospital**

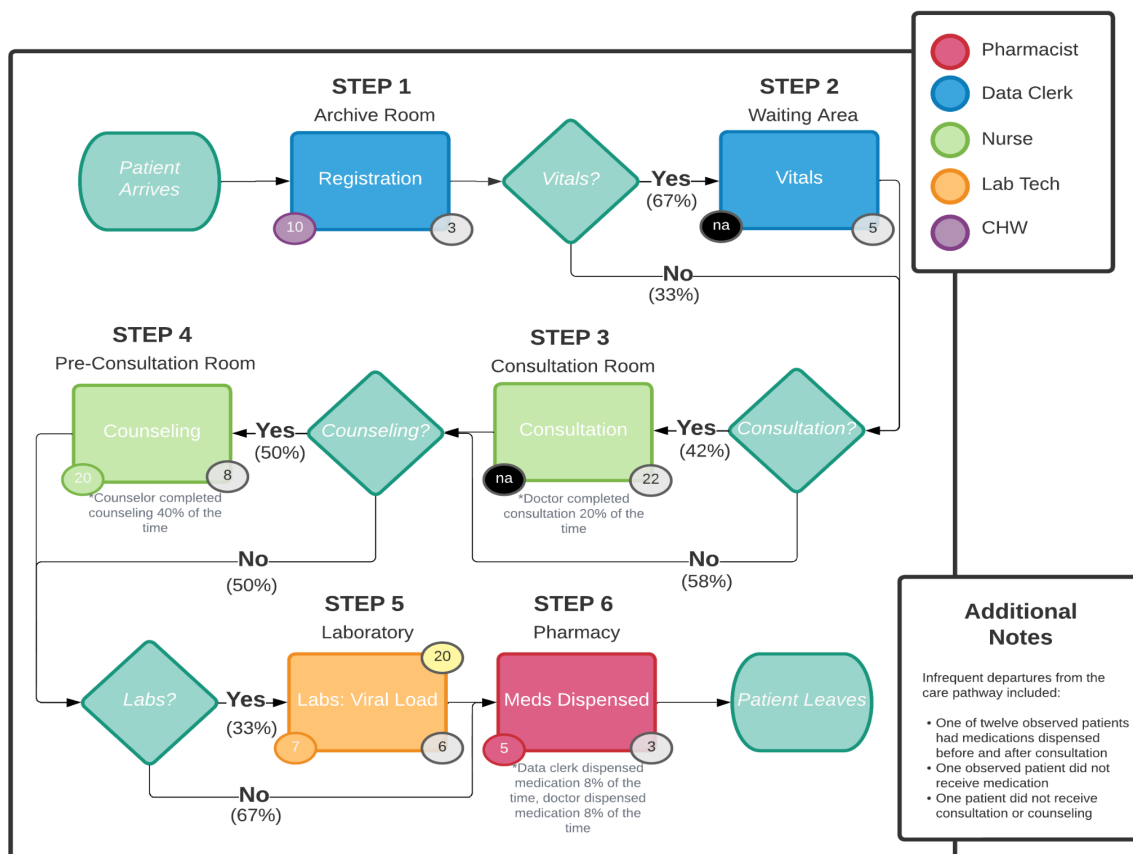
**Figure 10: Boko Dispensary, ART Stable Patients:**  
 Urban, PEPFAR-Supported Dispensary in Dar Es Salaam



**Figure 11: Magomeni Health Center, ART Stable Patients:**  
 Urban, PEPFAR-Supported Health Center in Dar Es Salaam



**Figure 12: Mbagala District Hospital, ART Stable Patients:**  
Urban, PEPFAR-Supported Hospital in Dar Es Salaam



*Overview.* Boko Dispensary, Magomeni Health Center, and Mbagala District Hospital are all urban health facilities situated in Dar Es Salaam. The centers are also PEPFAR-supported. As such, the major distinction between the three facilities is the levels of care they represent: dispensary, health center, and hospital.

*Activities.* All three facilities conducted a number of the same activities within their care pathways for ART provision (registration, measurement of vitals, labs, dispensing of ART), with some variation. First, health education occurred only at Boko Dispensary; however, in practice this only occurred 33% of the time. Additionally, patient consultation and counseling occurred at Magomeni Health Center and Mbagala District Hospital, but only occurred for 1 in 15 patients at Boko Dispensary, despite clinical leadership at the dispensary stating that these steps were part of the care pathway. Magomeni Health Center was the only facility of the three that included next appointment scheduling; however, in practice, this occurred less than 10% of the time. Additionally, patient consultations occurred consistently at Magomeni Health Center, whereas patient consultations occurred only 42% of the time at Mbagala District Hospital. It is also notable that vitals measurement occurred most of the time at Magomeni Health Center (63%) and Mbagala District Hospital (67%), whereas only 20% of patients had vital signs measured at Boko Dispensary. Likewise, blood draws for viral load testing were performed less



frequently at Boko Dispensary (33%) and Mbagala District Hospital (33%), compared to Magomeni Health Center (50%).

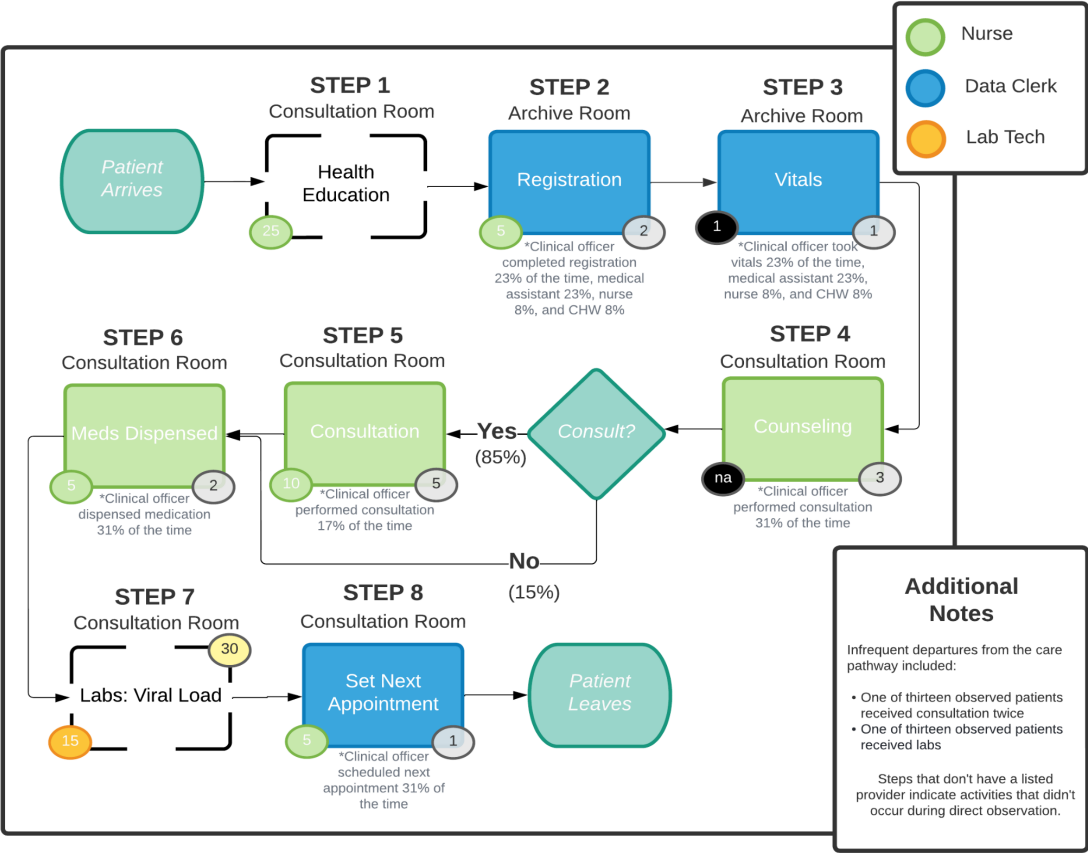
*Duration.* Activities of similar duration across the three facilities included: medication dispensing (3-4 minutes) and labs (4-6 minutes); duration of vital sign measurement varied from 1-5 minutes. Additionally, time to complete consultations varied widely—with Magomeni Health Center taking 5 minutes on average and Mbagala District Hospital taking 22 minutes on average. Counseling had a much shorter duration than anticipated by clinical leadership: 10 vs. 20 minutes. The shorter-than-ideal counseling time could potentially affect the quality of services provided, making clients feel rushed or unable to receive the level of feedback required for an effective counseling session. Total time performing viral load testing activities—including time drawing and processing the sample—varied widely between the three locations: 19 minutes (Boko Dispensary) versus 8 minutes (Magomeni Health Center) versus 26 minutes (Mbagala District Hospital). Overall, the total provider-patient interface time for an average visit at Boko Dispensary for patients receiving ART was 17 minutes if all activities were performed, compared to 30 minutes at Magomeni Health Center, and 47 minutes at Mbagala District Hospital.

*Staffing.* At both Magomeni Health Center and Mbagala District Hospital, a lab tech performed labs; however, at Boko Dispensary, a CHW completed labs the majority of the time. Moreover, at Boko Dispensary, almost all activities were performed by a CHW—ranging from registration to measurement of vitals to medication dispensing. Similar to other facilities, the lead role of the CHW was consistent across all patients and differed from reporting among clinical leadership that stated that nurses are responsible for measurement of vitals, laboratory testing and medication dispensing. Between Magomeni Health Center and Mbagala District Hospital, staff assignment to tasks was wide-ranging. For instance, at Magomeni Health Center a social worker took vitals the majority of the time, whereas at Mbagala District Hospital a data clerk took vitals. Furthermore, at Mbagala District Hospital, a pharmacist dispensed medications 82% of the time, compared to a data clerk 9% of the time, and doctor 9% of the time. At Magomeni Health Center, a doctor dispensed medications 50% of the time, compared to a nurse 25% of the time, and a pharmacist 25% of the time.

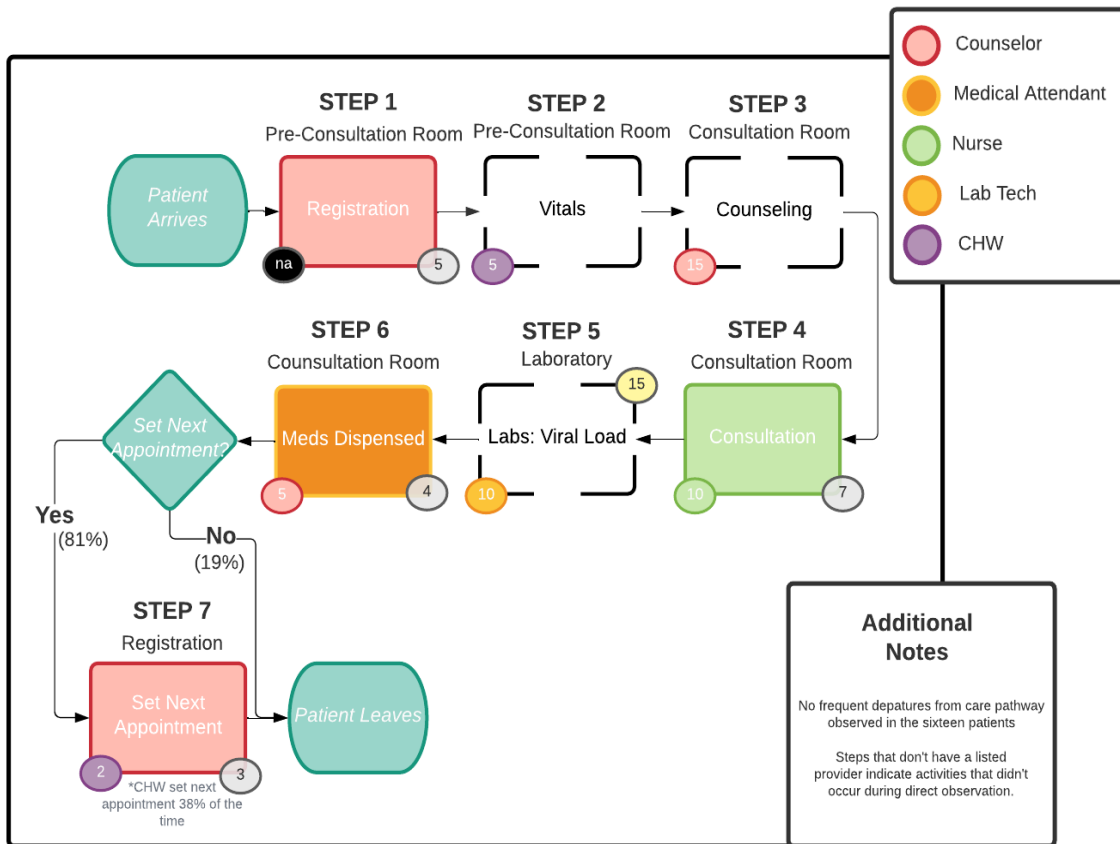
*Cost.* Ultimately, these variations in activities, timing and resourcing led to visits being 69% more expensive at Mbagala Hospital (\$1.86) versus Magomeni Health Center (\$1.10), not accounting for consumables. By comparison, the cost of care at Boko Dispensary was \$1.43. Once consumables and labs were incorporated, these figures were \$22.46 for Mbagala District Hospital, \$17.23 for Magomeni Health Center, and \$15.93 for Boko Dispensary.

**Case Vignette #6:**  
**Mwanzugi Dispensary v. Upuge Health Center v. Nzega District Hospital**

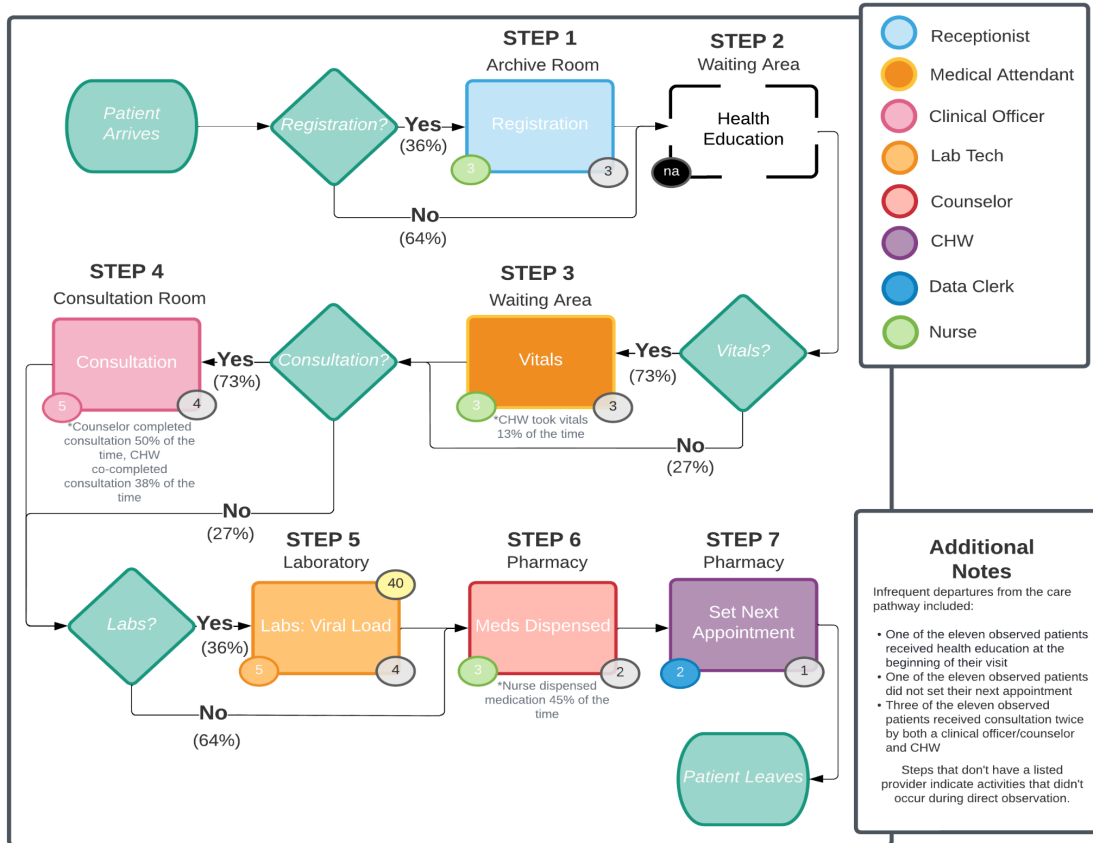
**Figure 13: Mwanzugi Dispensary, ART Stable Patients:**  
 Rural, PEPFAR-Supported Dispensary in Tabora



**Figure 14: Upuge Health Center, ART Stable Patients:**  
Rural, PEPFAR-Supported Health Center in Tabora



**Figure 15: Nzega District Hospital, ART Stable Patients:**  
Rural, PEPFAR-Supported Hospital in Tabora



*Overview.* Mwanuzi Dispensary, Upuge Health Center, and Nzega District Hospital are all rural healthcare facilities situated in Tabora. The centers are also all PEPFAR-supported. As such, the major distinction between the three facilities is the levels of care they represent: dispensary, health center, and hospital.

*Activities.* The three facilities performed the majority of the same activities in their care pathways including: registration, consultation, dispensing of ART, next appointment scheduling. Differences included that Nzega District Hospital and Mwanuzi Health Center both had health education as part of their care pathways, but this step was skipped at Mwanuzi Dispensary. Between the health center and hospital, only 1 observed patient at Nzega Hospital actually received health education. Additionally, vitals measurement was not observed at Upuge Health Center, despite it being part of the care pathway and occurring most of the time at Mwanuzi Dispensary and Nzega District Hospital. In the case of counseling, all observed patients received counseling at Mwanuzi Dispensary. While it was part of the care pathway at Upuge Health Center, it was not observed, and it was not a part of the care pathway at Nzega District Hospital. Blood draws for viral load testing was a part of the care pathway at each facility; however, it only occurred with regularity at Nzega District Hospital—where

approximately a third of patients had their blood drawn. Also of note, registration occurred consistently at Mwanzugi Dispensary and Upuge Health Center, but only occurred approximately a third of the time at Nzega District Hospital.

*Duration.* Among the activities that were common across the three facilities, medication dispensing (2-4 minutes) and next appointment scheduling (1-3 minutes) took a similar amount of time. Time to complete consultation varied more: with Nzega District Hospital taking 4 minutes, Mwanzugi Dispensary taking 5 minutes, and Upuge Health Center taking 7 minutes. Total time performing viral load testing activities—including time drawing and processing the sample—at Nzega District Hospital was 45 minutes. Similarly, the estimated time to perform viral load testing at Mwanzugi Dispensary was 45 minutes, compared to 25 minutes at Upuge Health Center. For an average visit at Mwanzugi Dispensary for patients receiving ART the total provider patient interface was 14 minutes if all activities were performed, compared to 19 minutes at Upuge Health Center and 17 minutes at Nzega District Hospital.

*Staffing.* At both Mwanzugi Dispensary and Nzega District Hospital, consultation was completed mostly by a nurse, whereas at Upuge Health Center consultation was completed by a clinical officer half of the time and a counselor and/or CHW the other half of the time. Staff assignments for other tasks varied widely amongst the three facilities. For instance, each task at Mwanzugi Dispensary was completed by either a data clerk or nurse most of the time. However, tasks at Nzega Hospital were completed by receptionists, clinical officers, medical attendants, lab techs, counselors, and CHWs. Each facility showed some variation of staffing within tasks as well, particularly Mwanzugi Dispensary. For example, a data clerk measured vital signs 40% of the time, a clinical officer 23% of the time, a medical assistant 23% of the time, a nurse 7% of the time, and a CHW 7% of the time.

*Cost.* Ultimately, these variations in activities, timing and resourcing led to visits being \$0.91 at Nzega District Hospital, \$0.88 at Upuge Health Center, and \$1.76 at Mwanzugi Dispensary, not accounting for consumables. Once consumables and labs were incorporated, these figures were \$15.13 for Nzega District Hospital, \$20.16 for Upuge Health Center, and \$11.36 for Mwanzugi Dispensary.

## DISCUSSION

We conducted an analysis of six case vignettes, each comparing process maps corresponding to patient care pathways for routine ART services. On the one hand, these process maps illustrated a relatively common pattern of activities—such as registration, vitals measurement, consultation, medication dispensing, next appointment scheduling, and discharge. However, we also found substantial heterogeneity across regions, urbanicity, funders, and levels of care.

Among the steps that were skipped most frequently, these included health education, counseling, consultation, and viral load testing. We observed instances in which interviewees stated these activities as a routine component of their activities. However, in practice, these activities occurred infrequently or were sometimes skipped entirely. This stood out particularly at lower levels of care, including dispensaries. One likely explanation for this is that lower levels of care have fewer resources and staff, and they therefore were unable to provide

comprehensive services. It is also possible that the low frequency of specific activities was intentional: for example, viral load testing was only measured if a provider suspected poor compliance, based on consultation with the patient and contrary to HIV treatment guidelines that require at least two viral load tests per annum per patient. While such patterns of differentiated care are common in the literature,<sup>9</sup> the inconsistency between what health care providers stated was happening versus what was directly observed is suggestive that there is a degree of haphazardness in current care delivery processes that could yield differences in quality of care. Administrators may be particularly interested in examining inconsistencies in ordering labs and dispensing medications, as consumables are large cost drivers in Tanzania.

In addition to variation in activities, we also found inconsistencies in the cadres performing these activities. For example, at Luhanga Dispensary, we observed that a data clerk was chiefly responsible for virtually all activities—ranging from registration and vitals measurement to consultation and medication dispensing. This is indicative of a shortage of nurses and medical doctors, leading to reliance on other support staff, including medical attendants—which make up approximately one-third of the health care workforce in Tanzania.<sup>10</sup> To provide a second illustration: across all case vignettes, we observed that registration was variously performed by data clerks, CHWs, counselors, receptionists, medical attendants, and nurses. While it is understandable that staffing will vary across levels of care and regionally, the degree of variation is still worth further consideration among administrators. Higher levels of care (hospitals, in particular) appeared to employ a wider array of cadres, allowing for differentiation in roles that included data clerks or receptionists consistently performing registration. It is an open question whether lack of differentiation at lower levels of care corresponded with supplementary training to support the broader set of responsibilities and affected quality of care.

Third, we observed consistent patterns pertaining to the duration of activities. First, interviewees routinely overestimated the amount of time that patients spent with providers. This is particularly notable for consultations. Longer provider-patient interfaces during medical consultations have the potential to yield significant benefits for patients.<sup>11</sup> In several instances, interviewees expressed an expectation that consultations were 10 minutes when they were in fact half this duration, or else the consultation was skipped altogether. Other activities for which the duration was overestimated included time at the pharmacy for the patient discussing and receiving medications, registration, and scheduling for a subsequent appointment. In numerous instances, the duration of these activities was only 1-2 minutes, suggesting that staff were seeking to move rapidly through patient volume.

Taken together, these observations yield several recommended next steps. Chief among these is to present case vignettes to health care providers and health administrators for inspection. Whether and to what extent discrepancies are intentional versus haphazard is a judgment call that the research team was unable to make. However, this information should be empowering to those with the relevant expertise and decision-making authority. The government has developed national guidelines for the management of HIV/AIDS, including which activities should be performed in which circumstances.<sup>12</sup> For those facilities that fail to provide services in a manner corresponding to these guidelines, officials will need to carefully examine whether such failures are motivational (and in need of closer oversight), due to

inadequate resources that need bolstering, or a need to re-examine standard practices of care as the HIV epidemic evolves. Along these lines, we also recommend that—following discussions with health care providers and health administrators and the development of consistent guidelines—the Government should consider instituting TDABC data collection and process mapping on a routine basis to determine whether care delivery is improving with time.

We note several study limitations. First, our focus on case vignettes was intended to highlight diversity in care delivery processes across a small handful of facilities in Tanzania. Our findings are not intended to be generalizable to facilities throughout the country. Second, as noted above, it is not possible for the research team to identify which variations in care delivery processes were deliberate and intentional, and which variations were unintentional and in need of correction. We have therefore focused on a series of potential interpretations which need verification. Lastly, we aspired to ensure consistency in data collection by using standardized forms, training and supervision. However, it is possible that data collectors' behaviors differed and could account for some of the observed heterogeneity, or that social desirability bias and observation bias could also have altered patients' and providers' behaviors, respectively.

## **CONCLUSION**

In summary, process maps provide a useful, graphical representation of care delivery processes, including the sequence and frequency of activities involved, staffing, and timing associated with care. By cross-referencing process maps to compare service delivery in different geographies and levels of care, administrators should feel empowered to have a more accurate understanding of how resources are being allocated and whether clinicians are adhering to protocols and guidelines. In the Tanzanian context, we find that ART services vary widely from one setting to another—including the who, what, when, and where of service delivery. As a next step, we anticipate that these results will be shared with participant facilities to provide further insights as to why operations are constructed in the manner observed and to discuss opportunities to optimize provision of ART over time.

## **ACKNOWLEDGMENTS**

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**APPENDIX A**  
**HIV Treatment “Stable”**

Figure A1. HIV Treatment “Stable” - Boko Dispensary

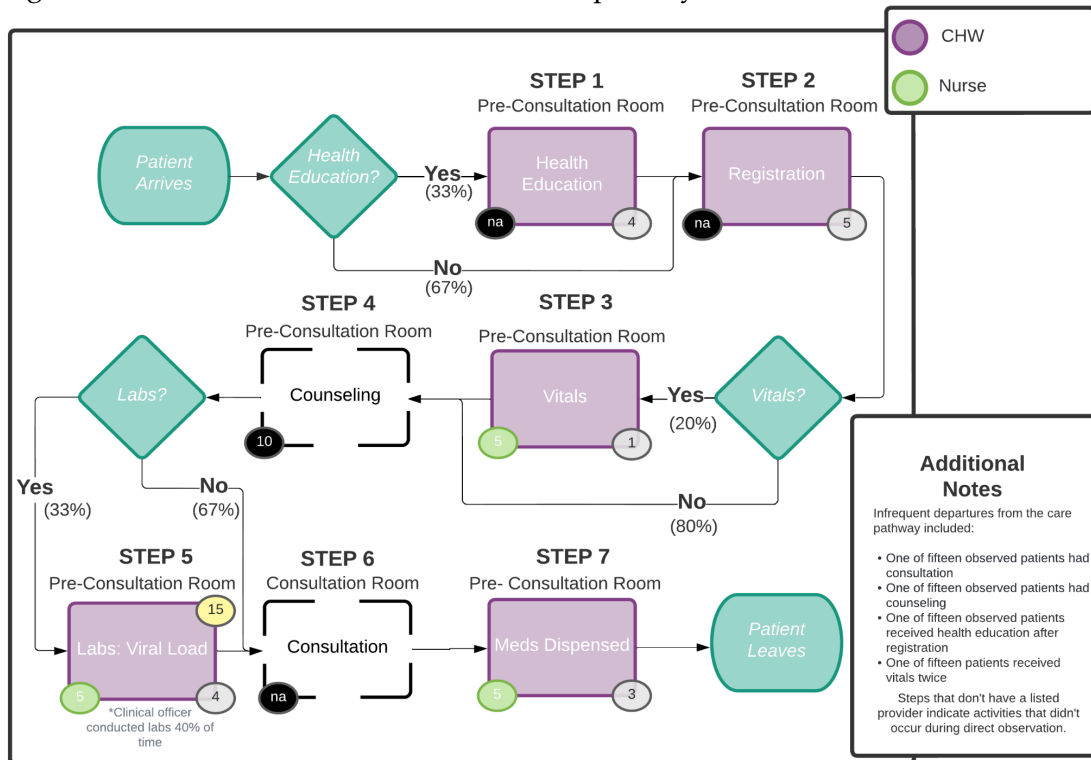


Figure A2. HIV Treatment “Stable” - Luhanga Dispensary

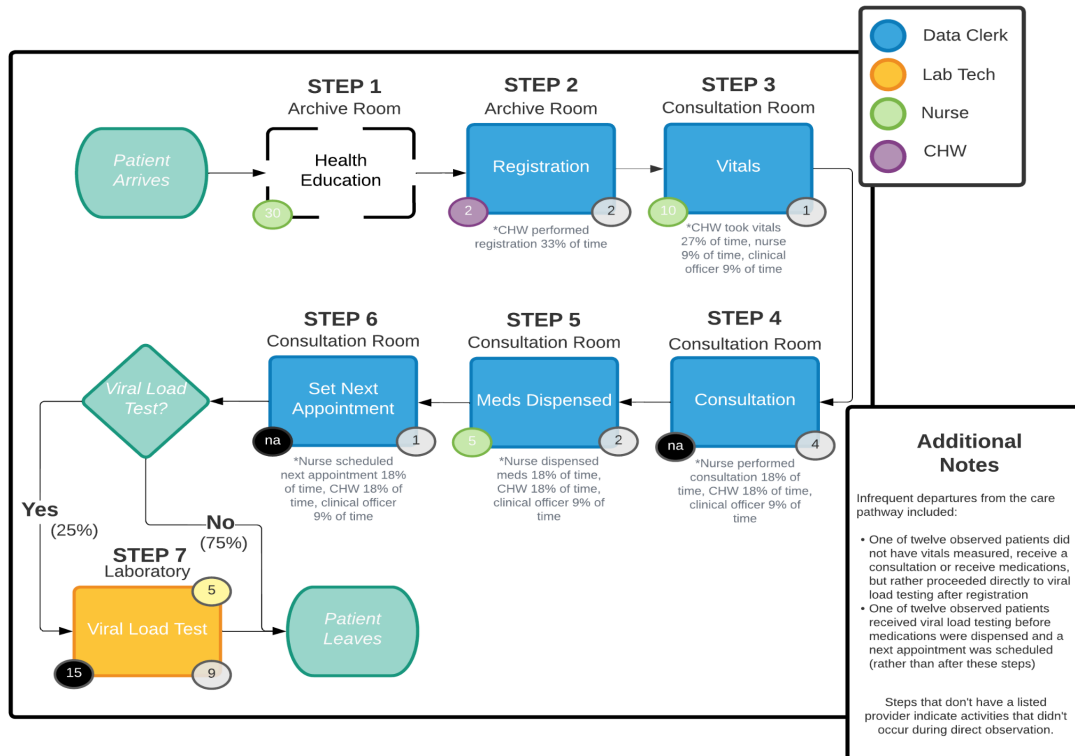


Figure A3. HIV Treatment “Stable”- Magomeni Health Center

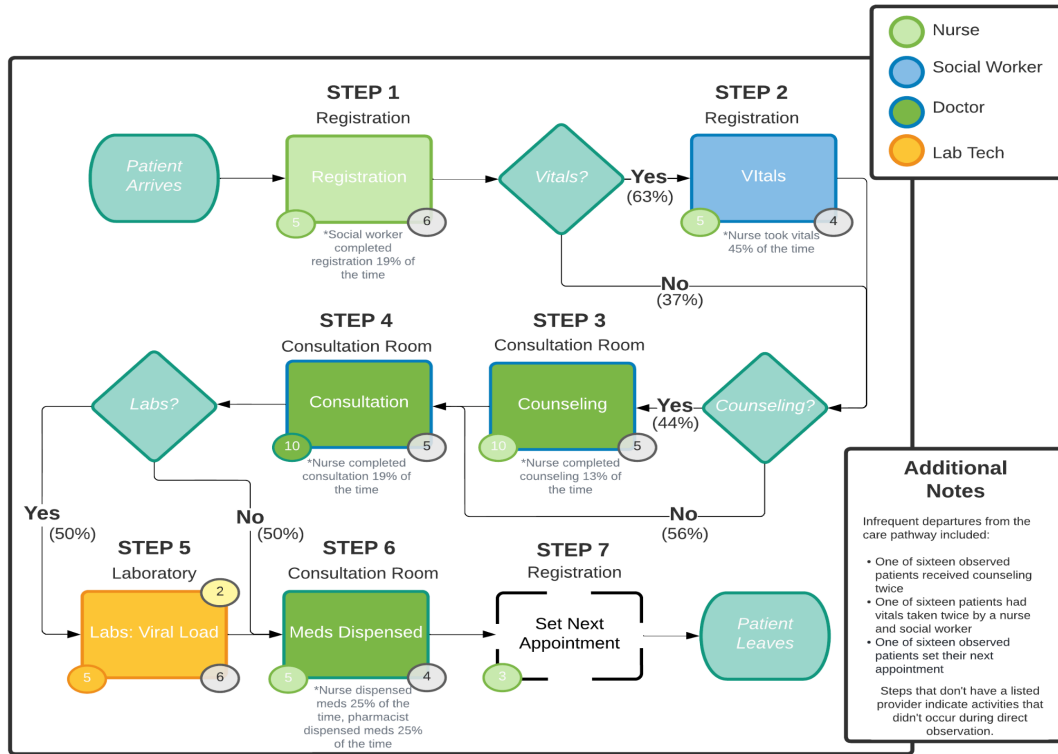


Figure A4. HIV Treatment “Stable”- Mahaha Dispensary

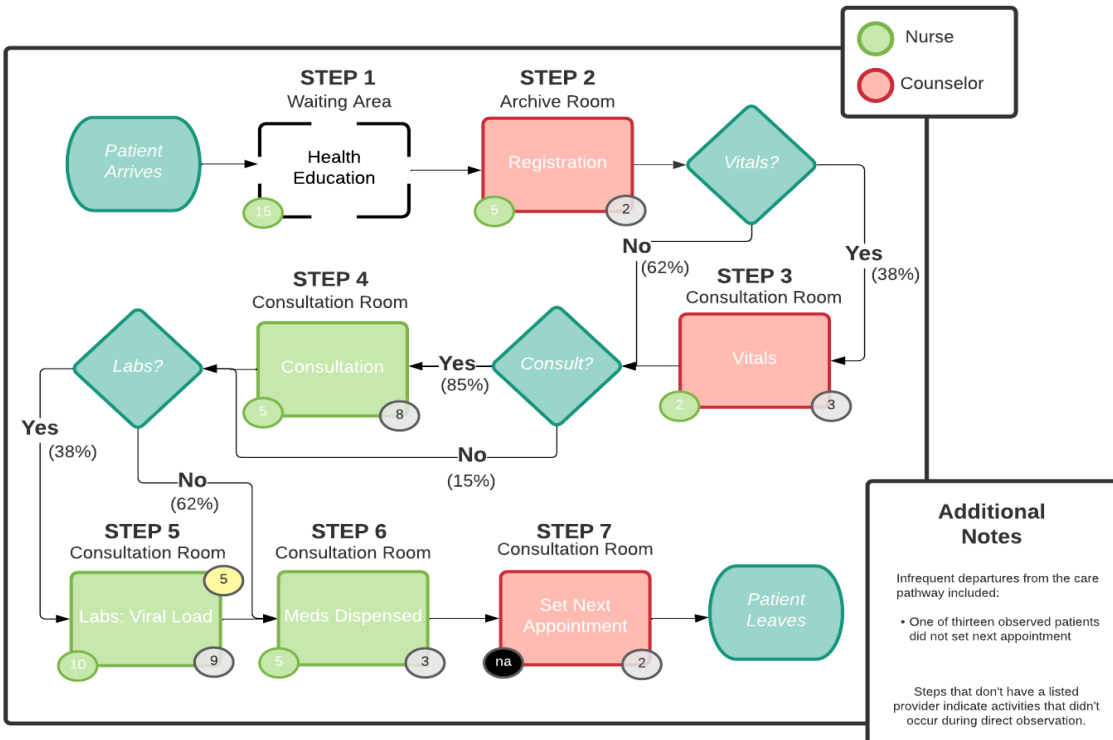


Figure A5. HIV Treatment “Stable”- Mbagala District Hospital

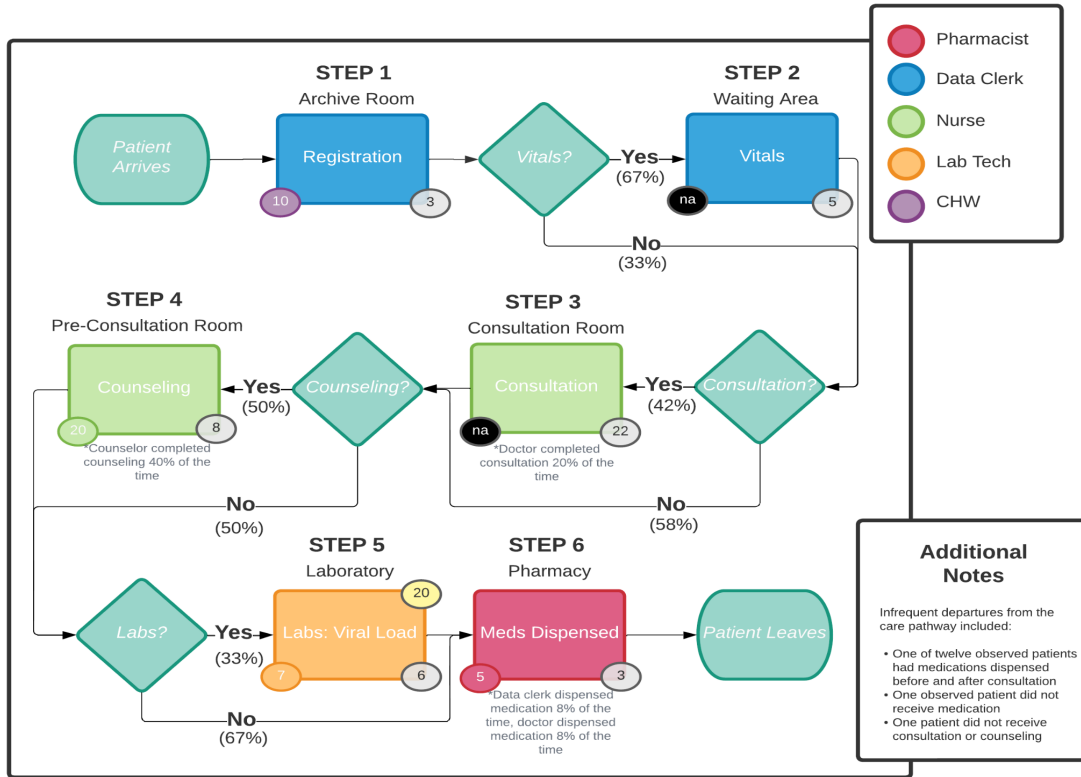


Figure A6. HIV Treatment “Stable”- Mwisole District Hospital

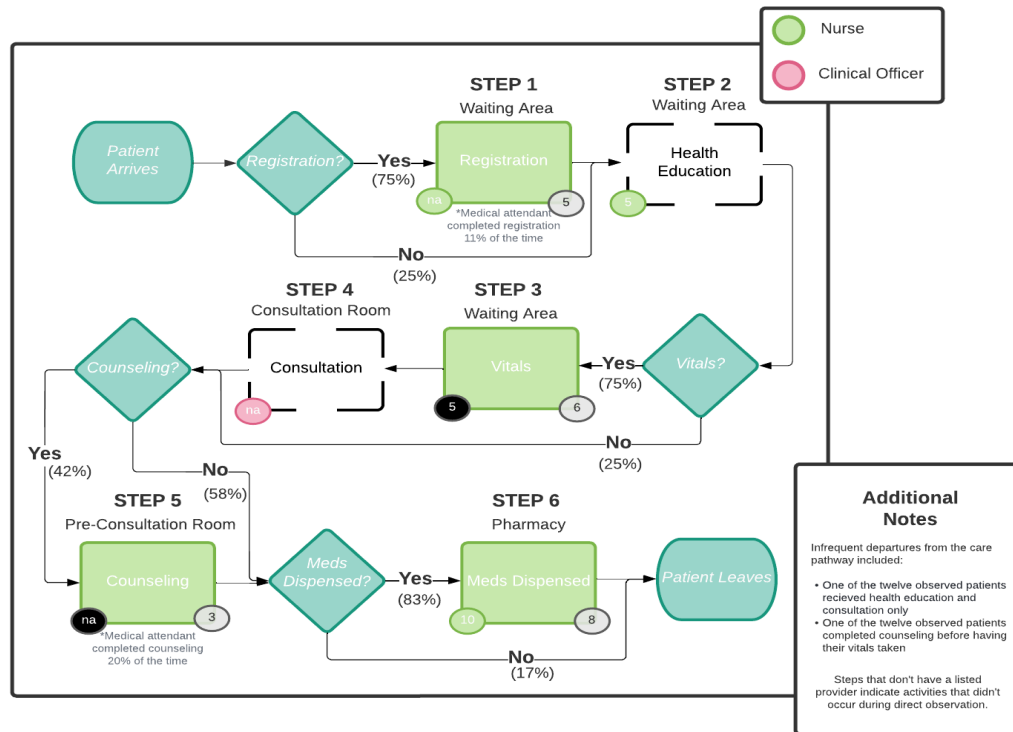


Figure A7. HIV Treatment “Stable”- Njombe Health Center

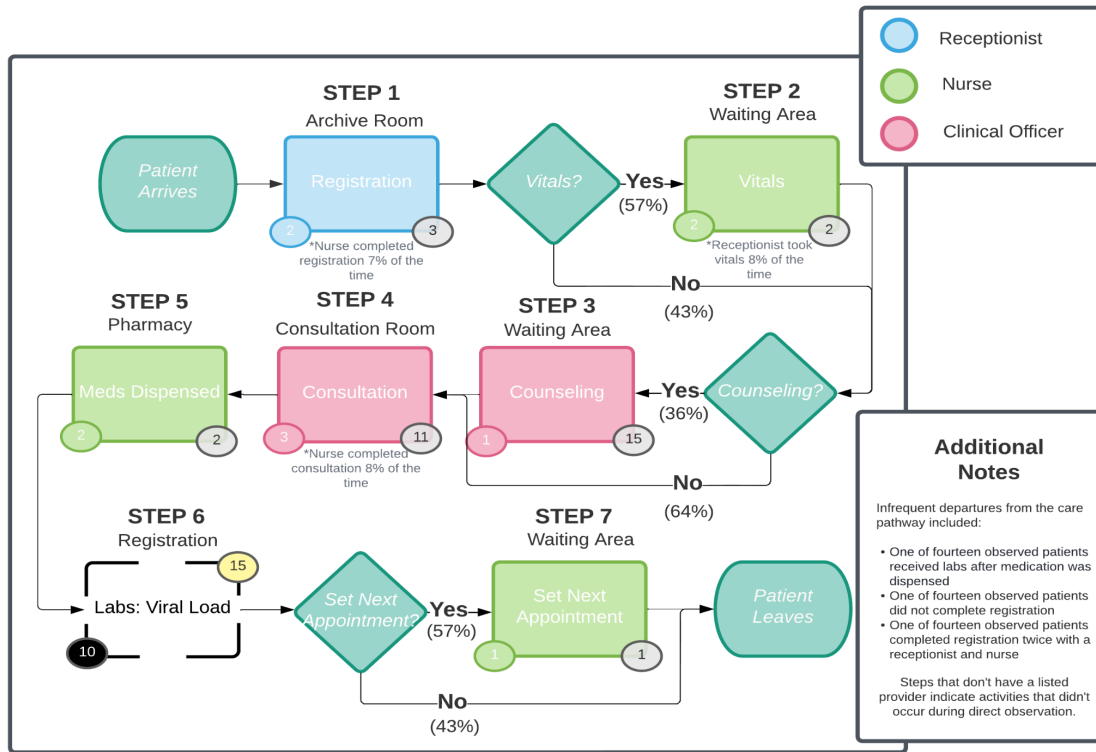


Figure A8. HIV Treatment “Stable”- Nzega District Hospital

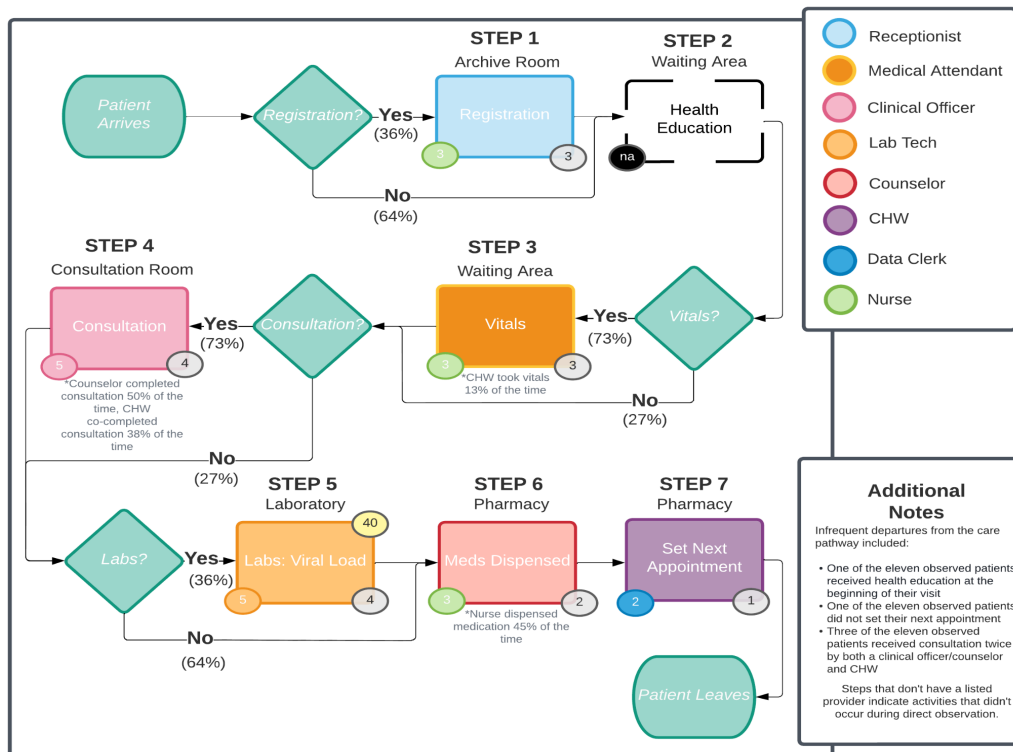


Figure A9. HIV Treatment “Stable”- Upuge Health Center

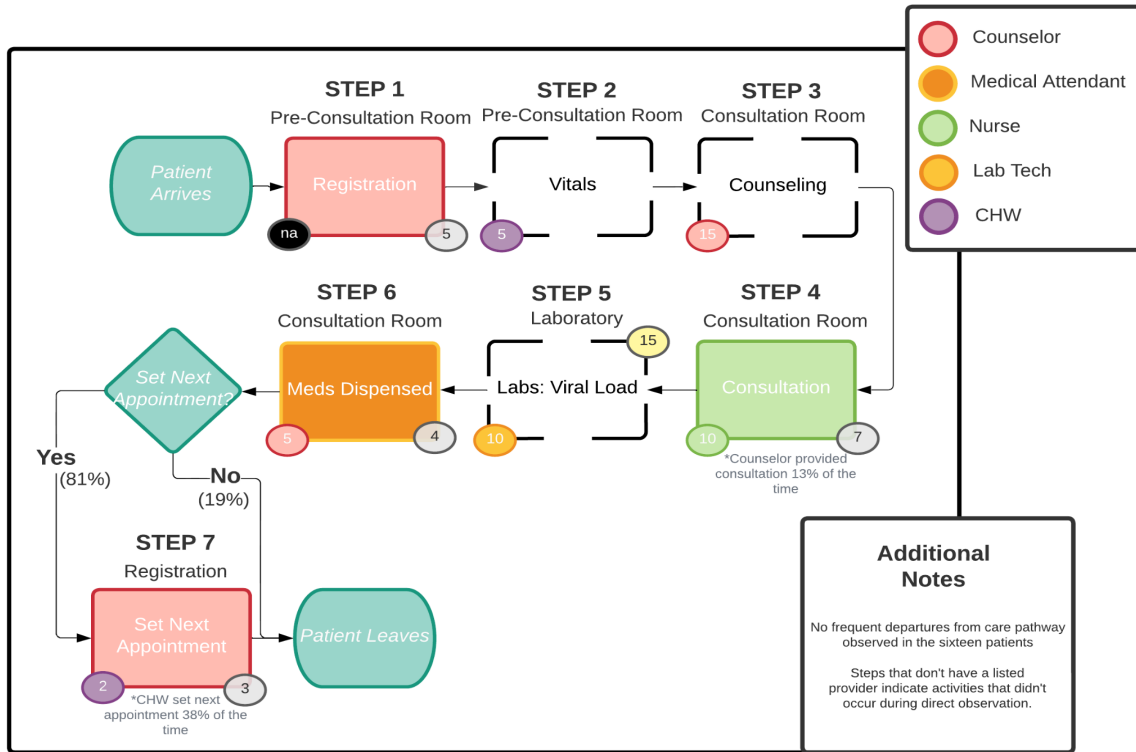


Figure A10. HIV Treatment “Stable”- Bunazi Health Center

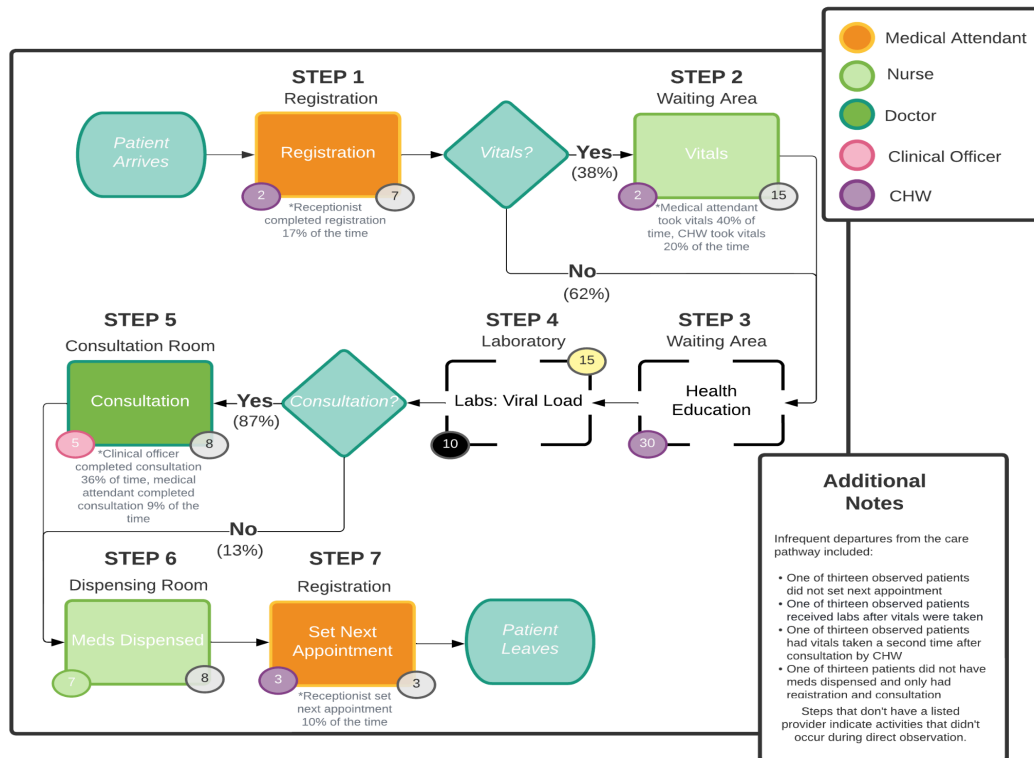
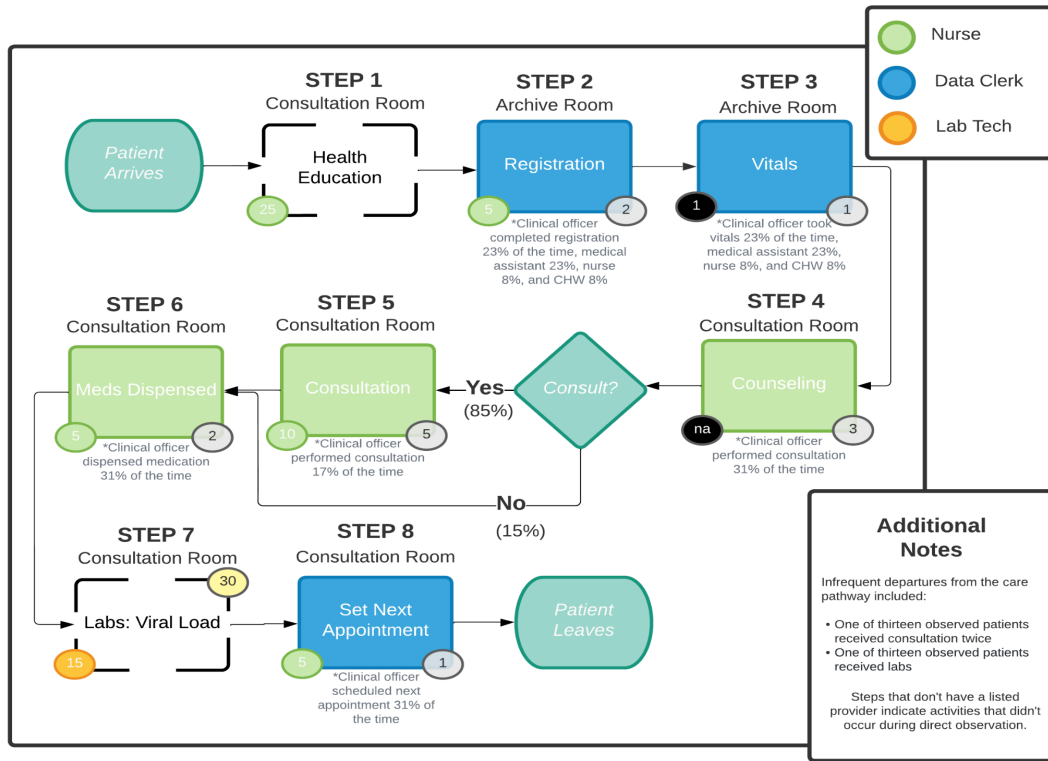


Figure A11. HIV Treatment “Stable”- Mwanzugi Dispensary



**Appendix B**  
**HIV Treatment “Unstable”**

Figure B1. HIV Treatment “Unstable”- Boko Dispensary

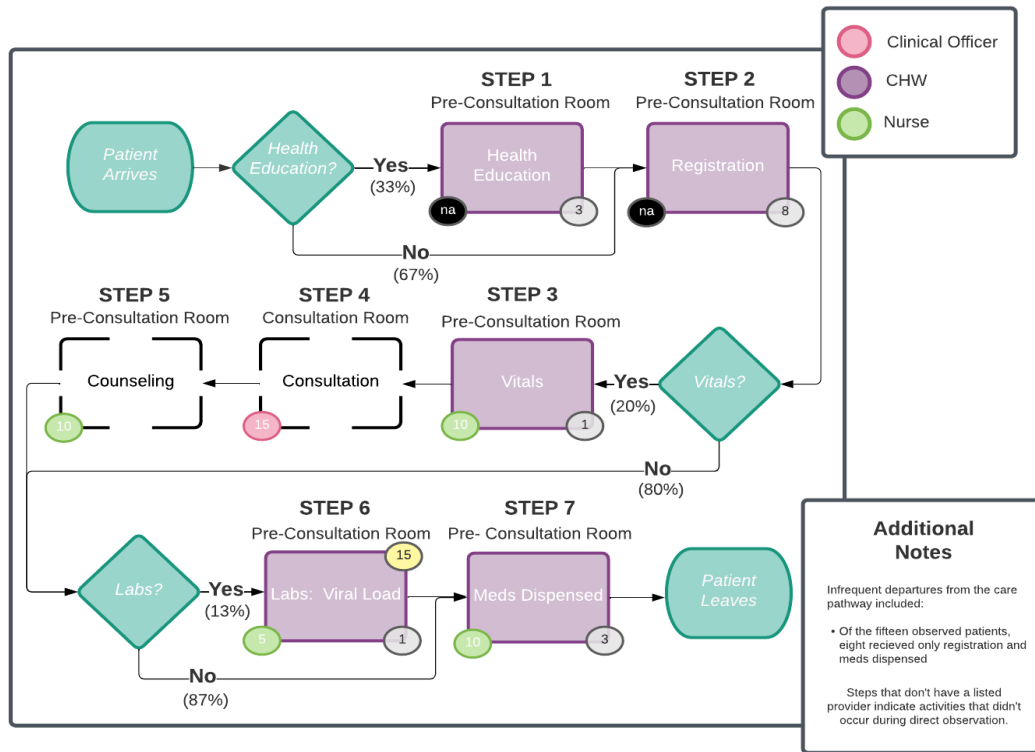


Figure B2. HIV Treatment “Unstable”- Luhanga Dispensary

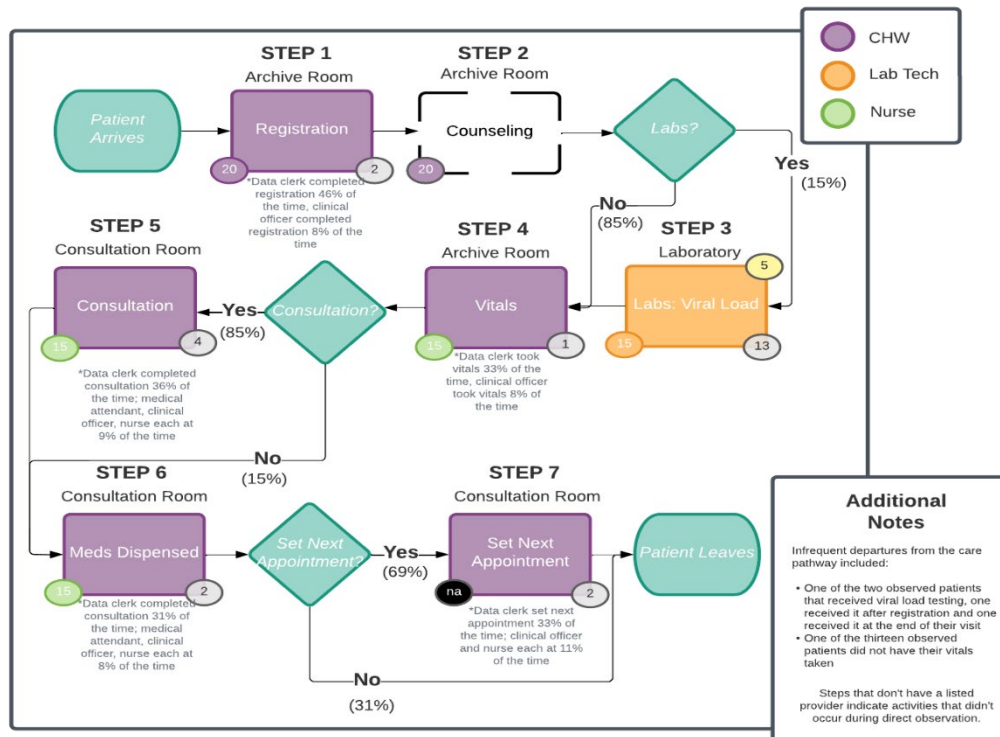




Figure B3. HIV Treatment “Unstable” - Magomeni Health Center

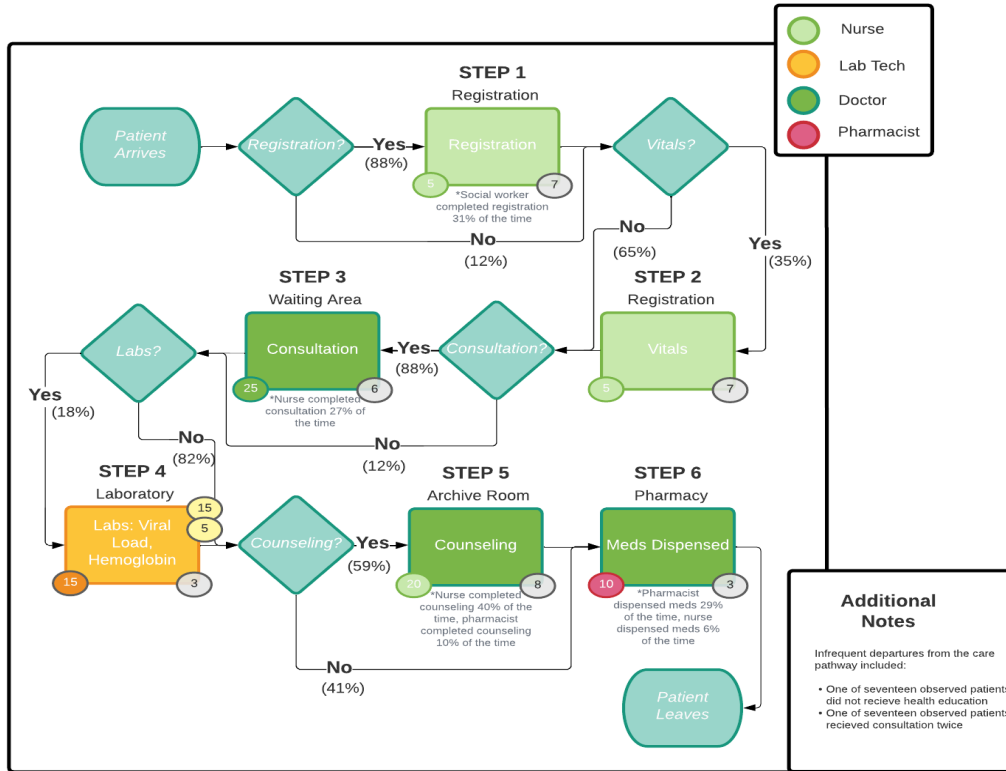


Figure B4. HIV Treatment “Unstable” - Mahaha Dispensary

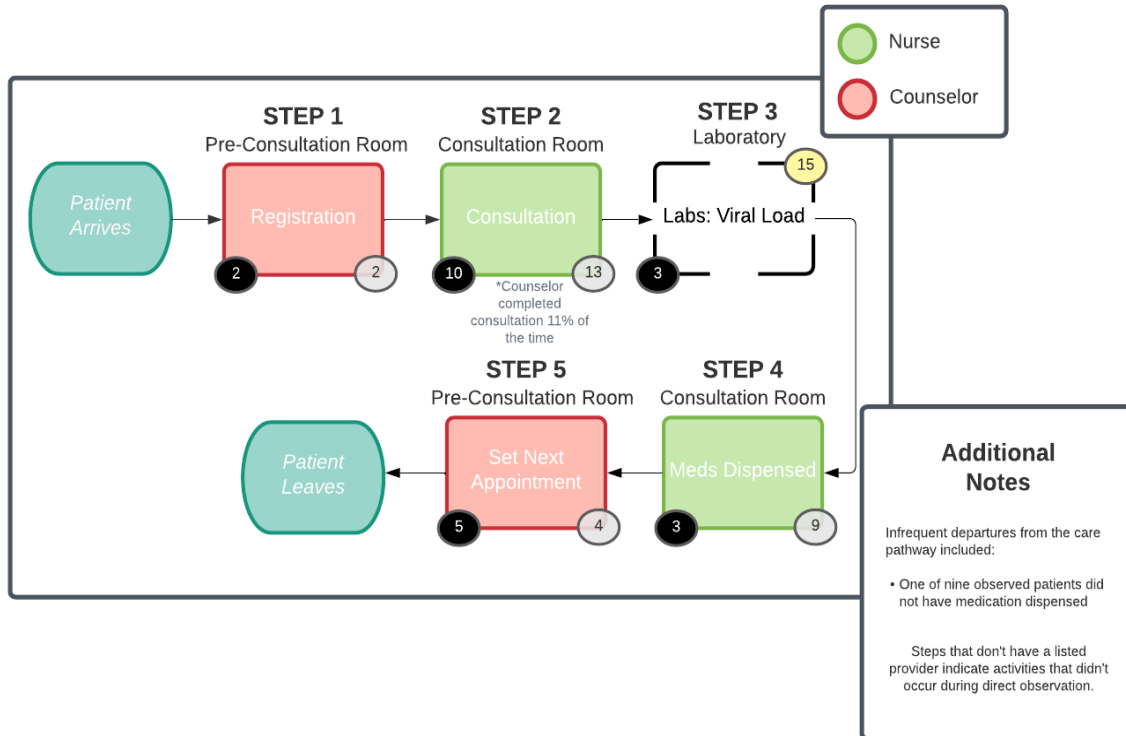


Figure B5. HIV Treatment “Unstable”- Mbagala District Hospital

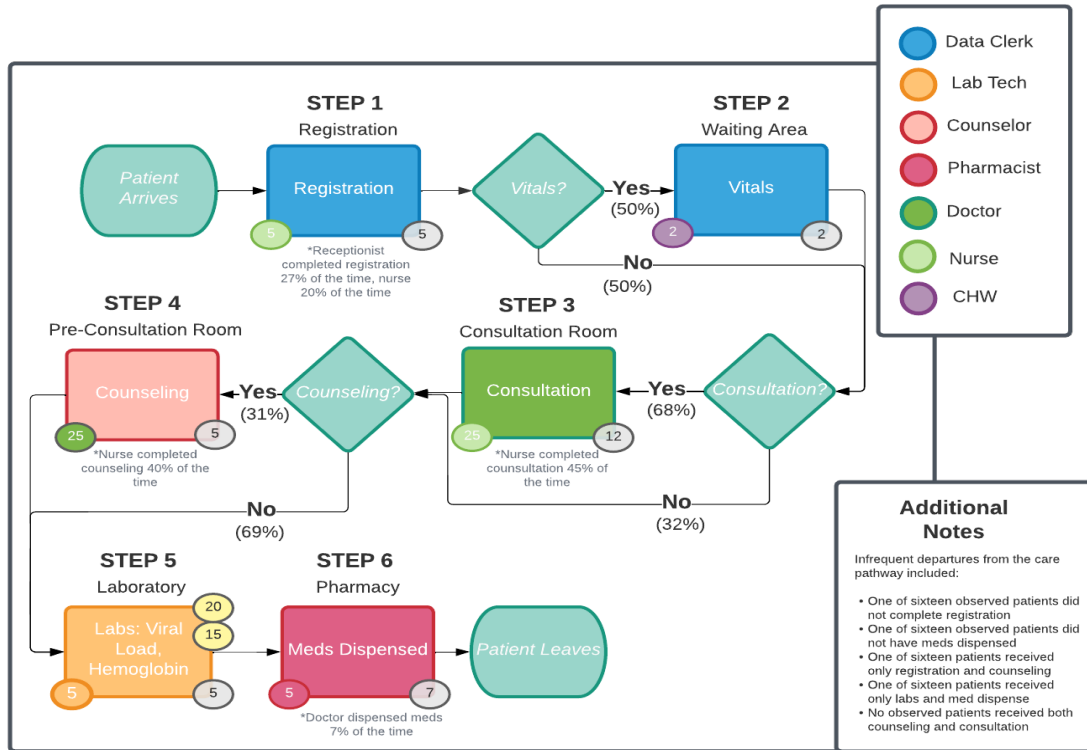


Figure B6. HIV Treatment “Unstable”- Mwisole District Hospital

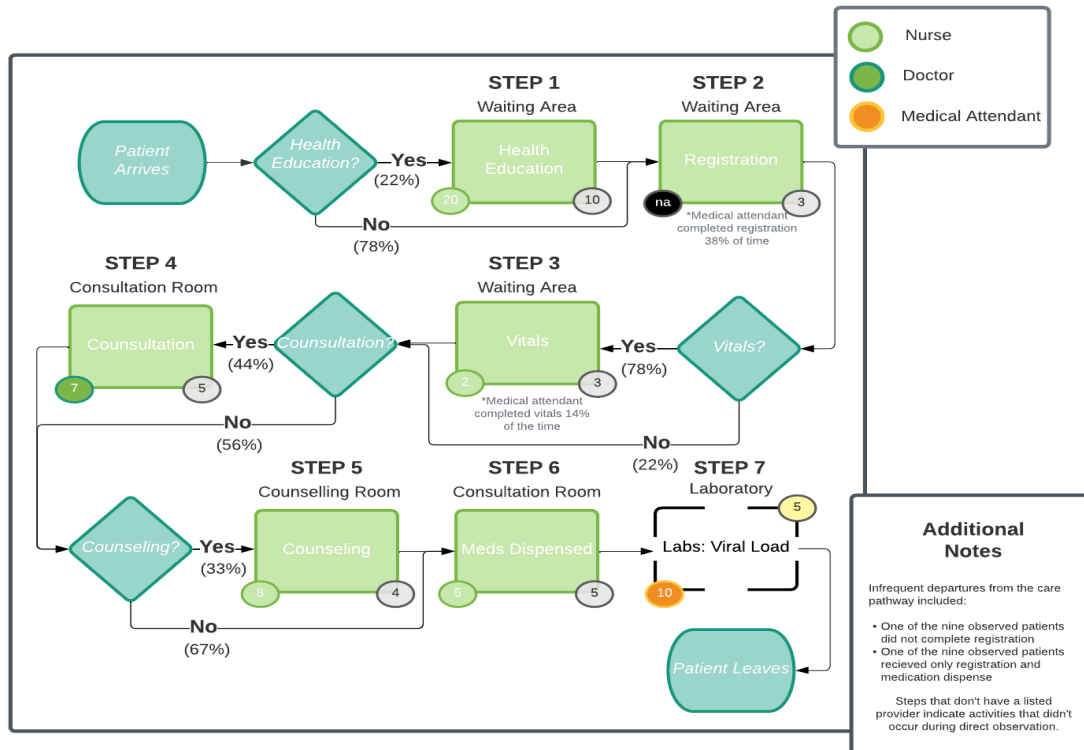


Figure B7. HIV Treatment “Unstable”- Njombe Health Center

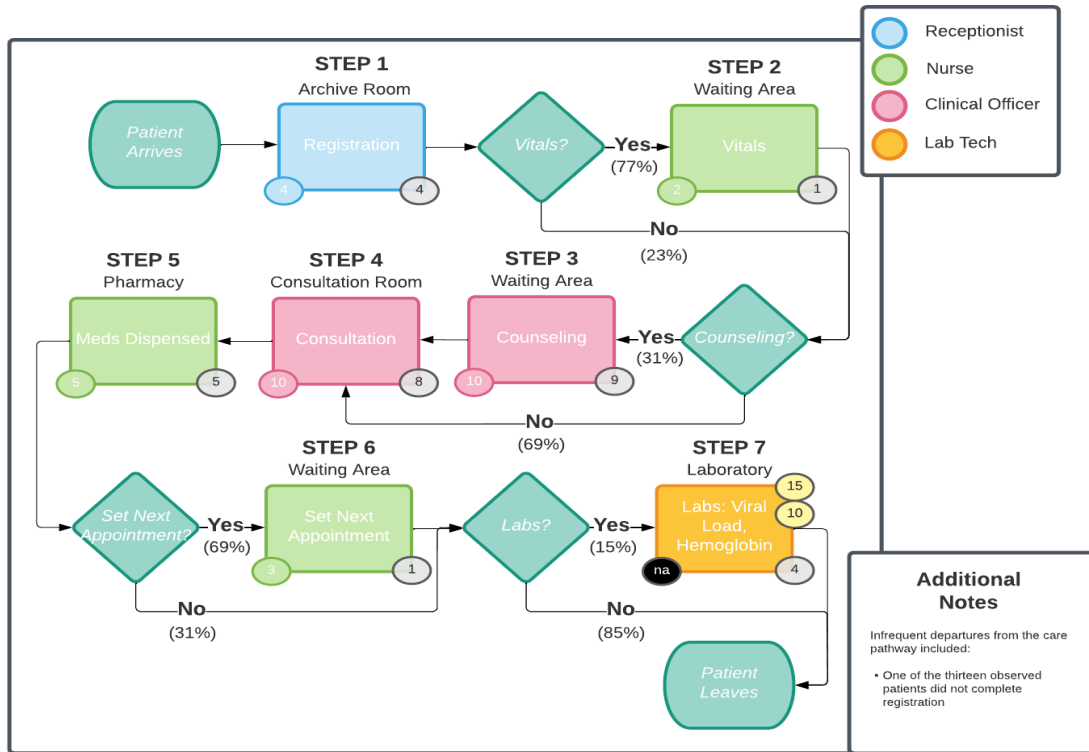


Figure B8. HIV Treatment “Unstable”- Nzega District Hospital

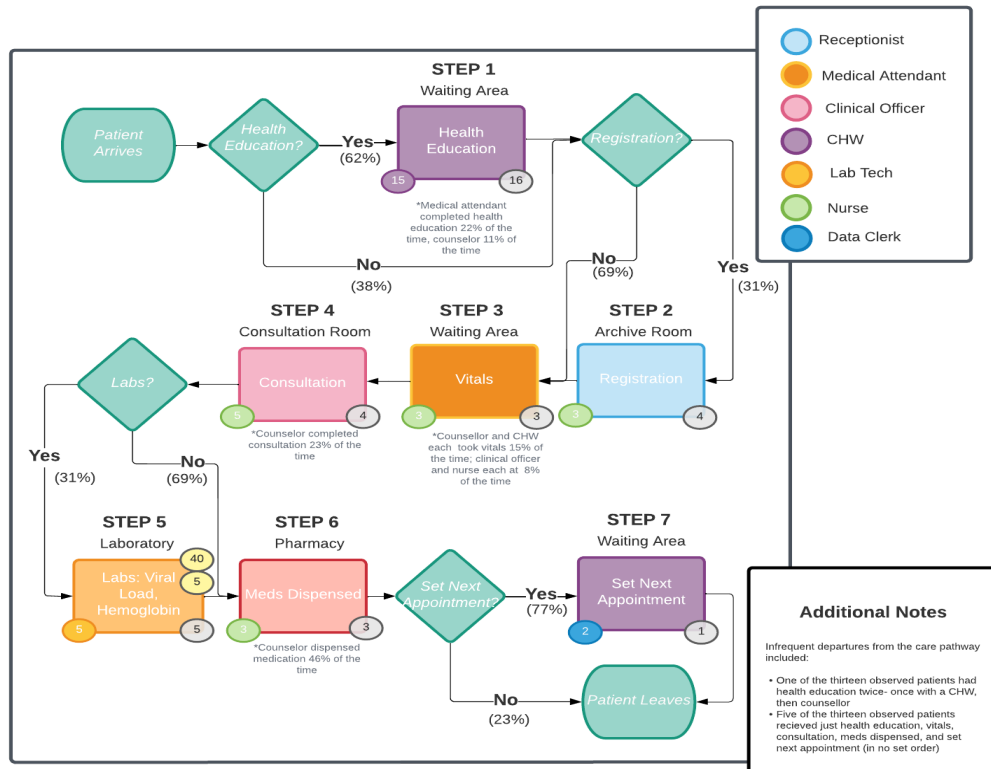


Figure B9. HIV Treatment “Unstable”- Upuge Health Center

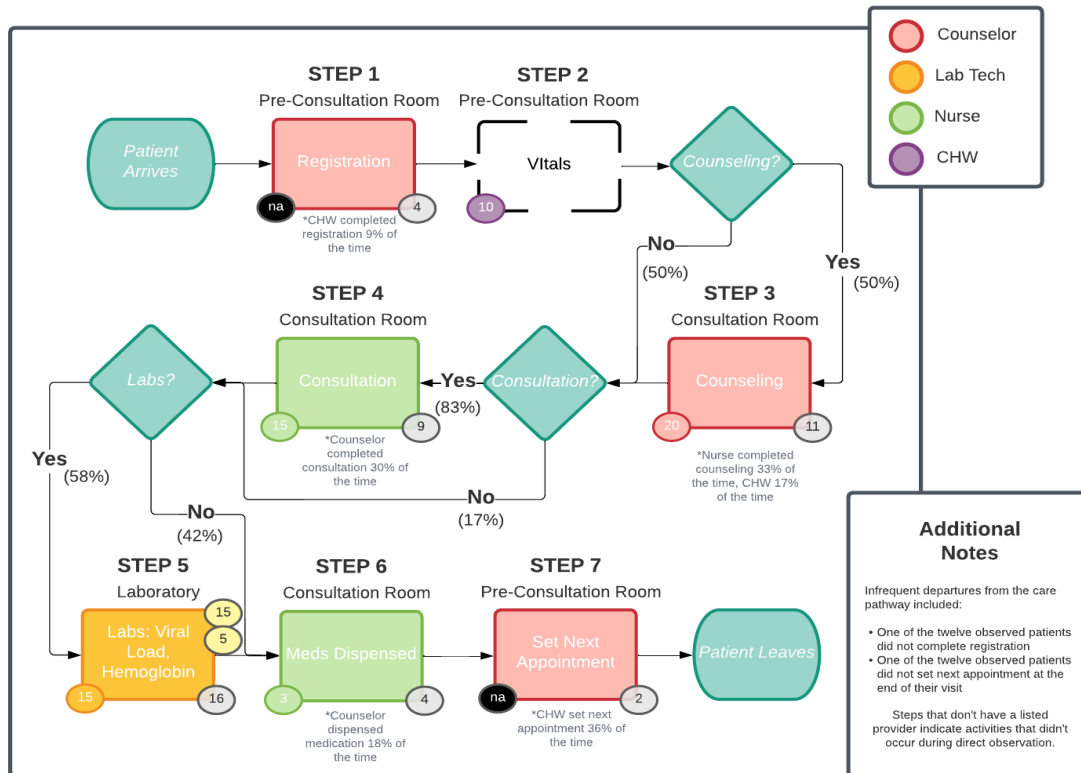


Figure B10. HIV Treatment “Unstable”- Bunazi Health Center

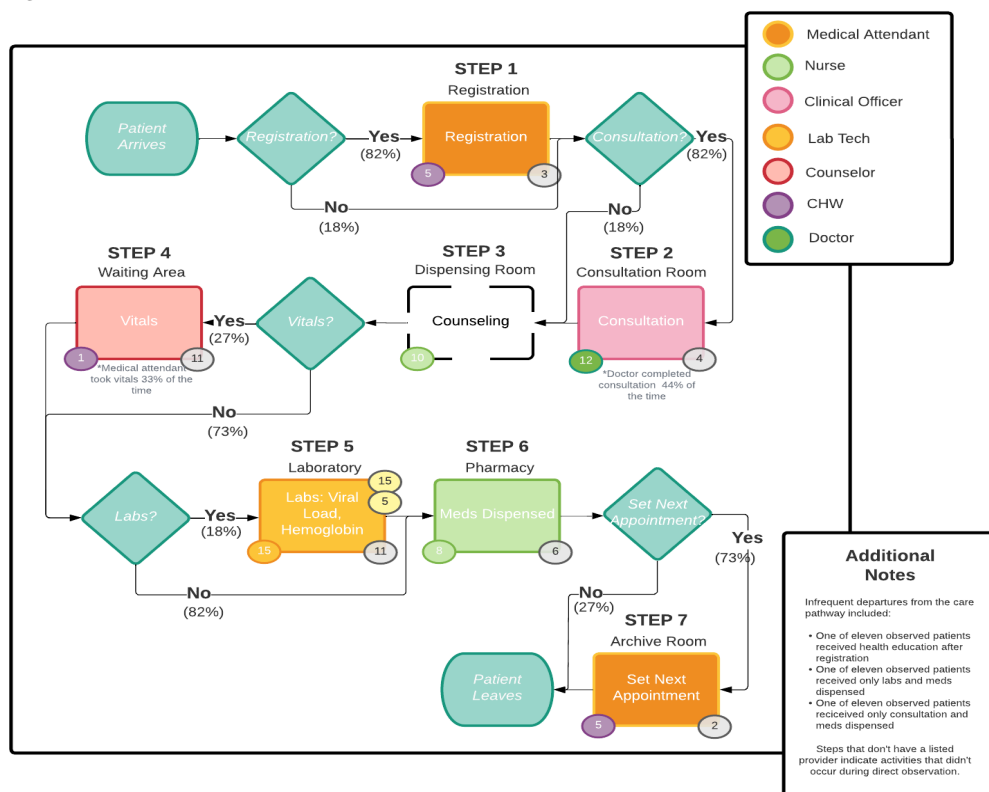
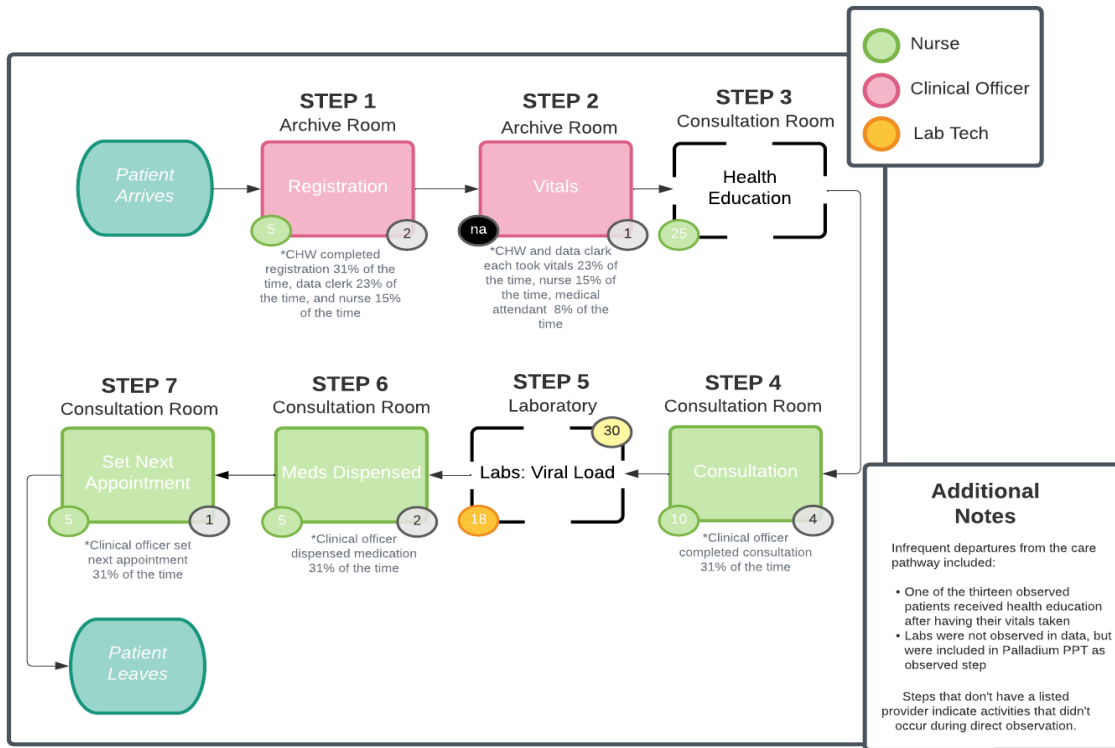


Figure B11. HIV Treatment “Unstable”- Mwanzugi Dispensary



## Appendix C HIV Testing

Figure C1. HIV Testing - Boko Dispensary

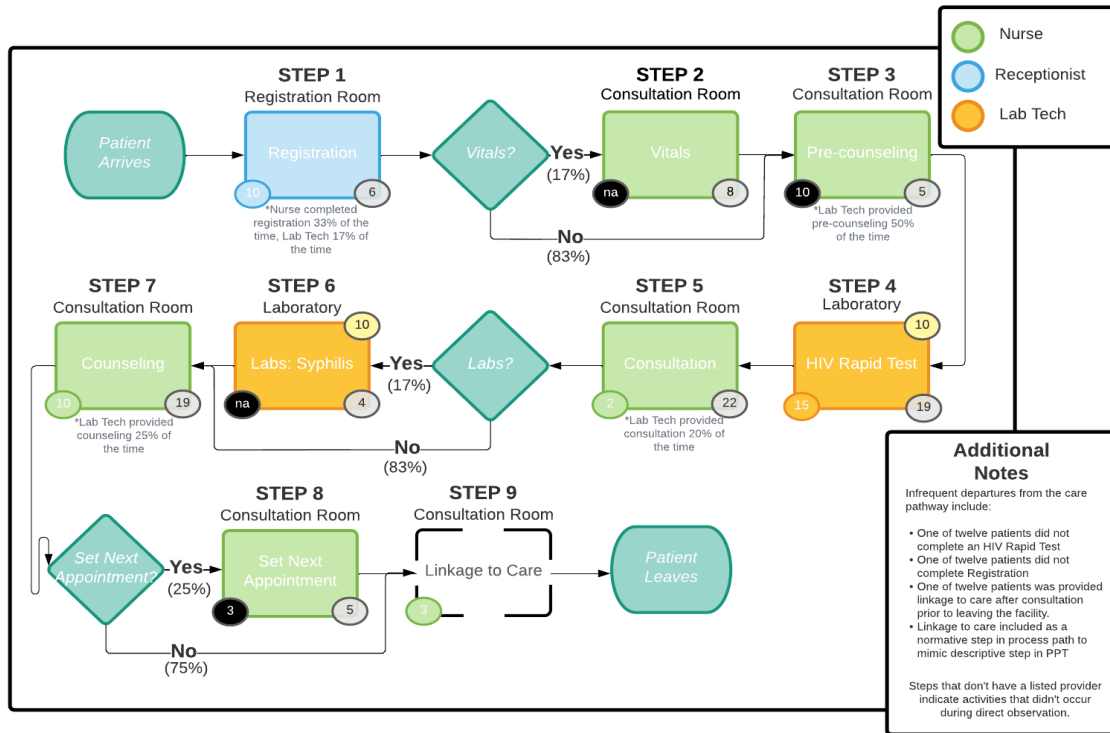


Figure C2. HIV Testing - Luhanga Dispensary

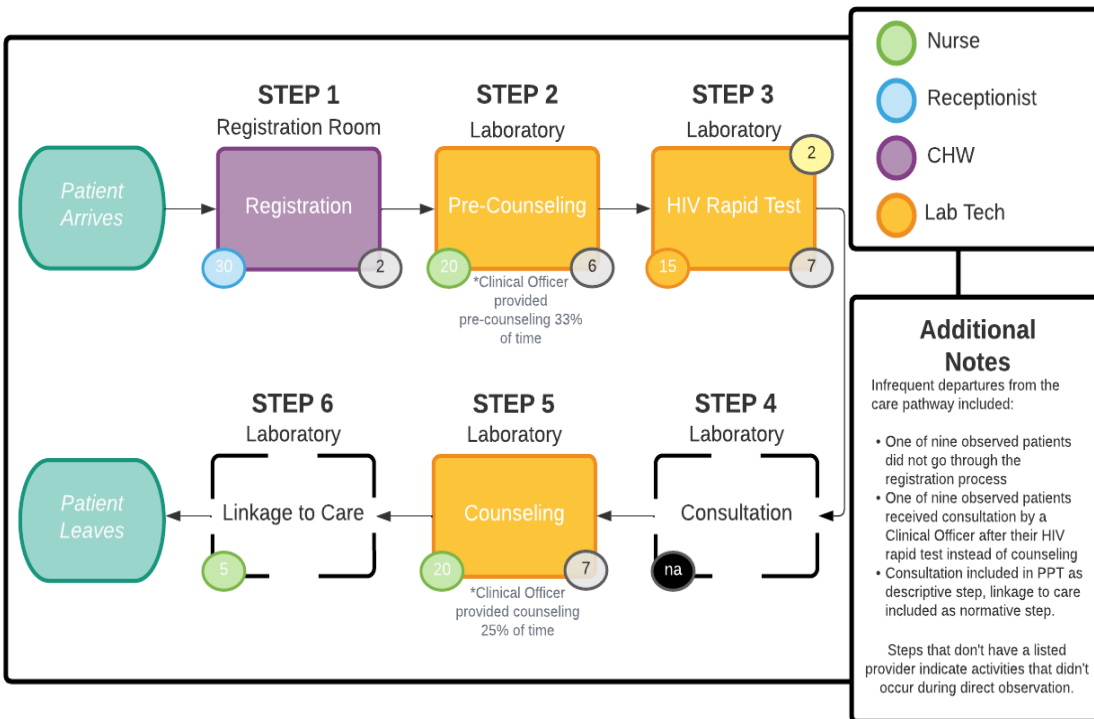


Figure C3. HIV Testing - Magomeni Health Center

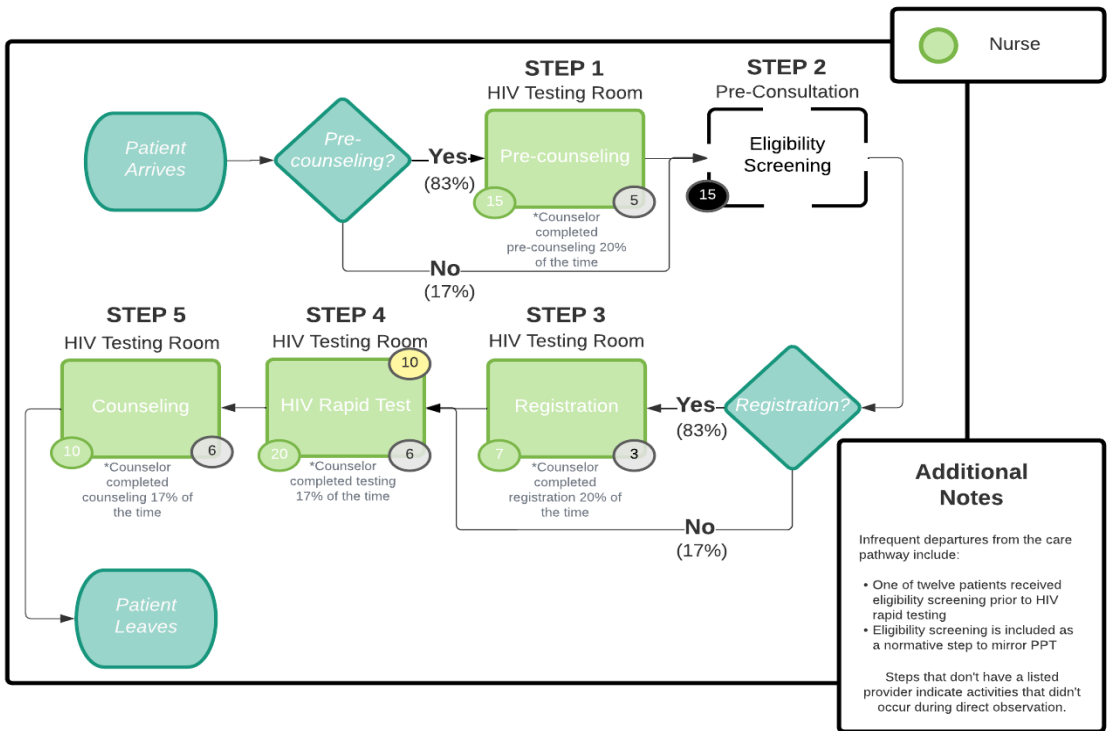


Figure C4. HIV Testing - Mahaha Dispensary

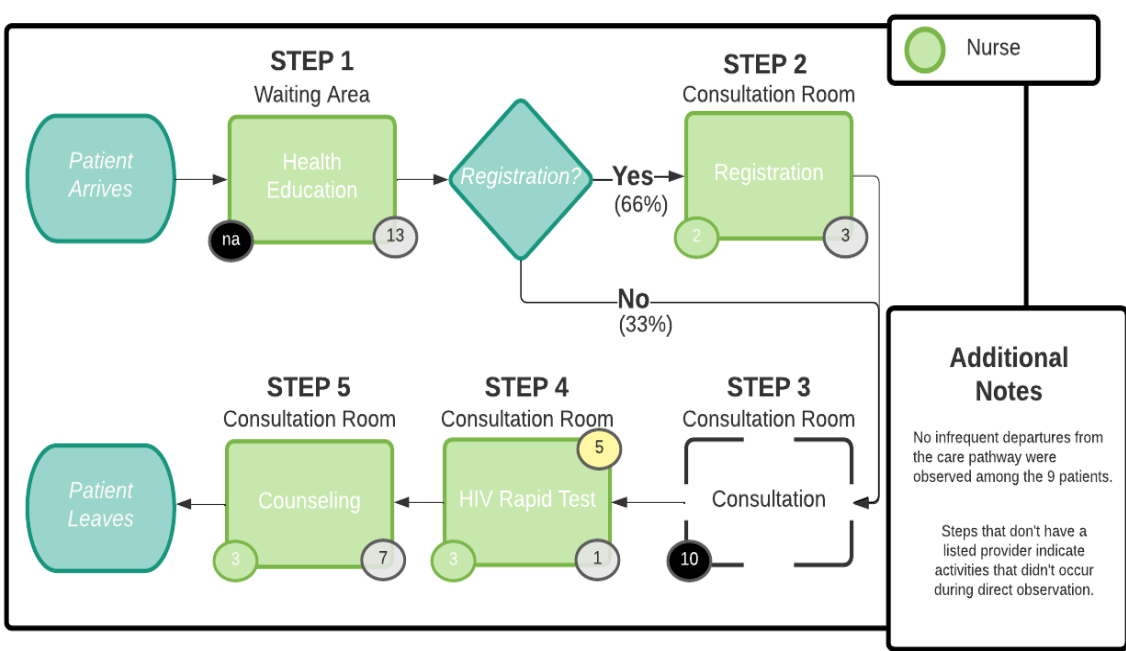


Figure C5. HIV Testing - Mbagala District Hospital

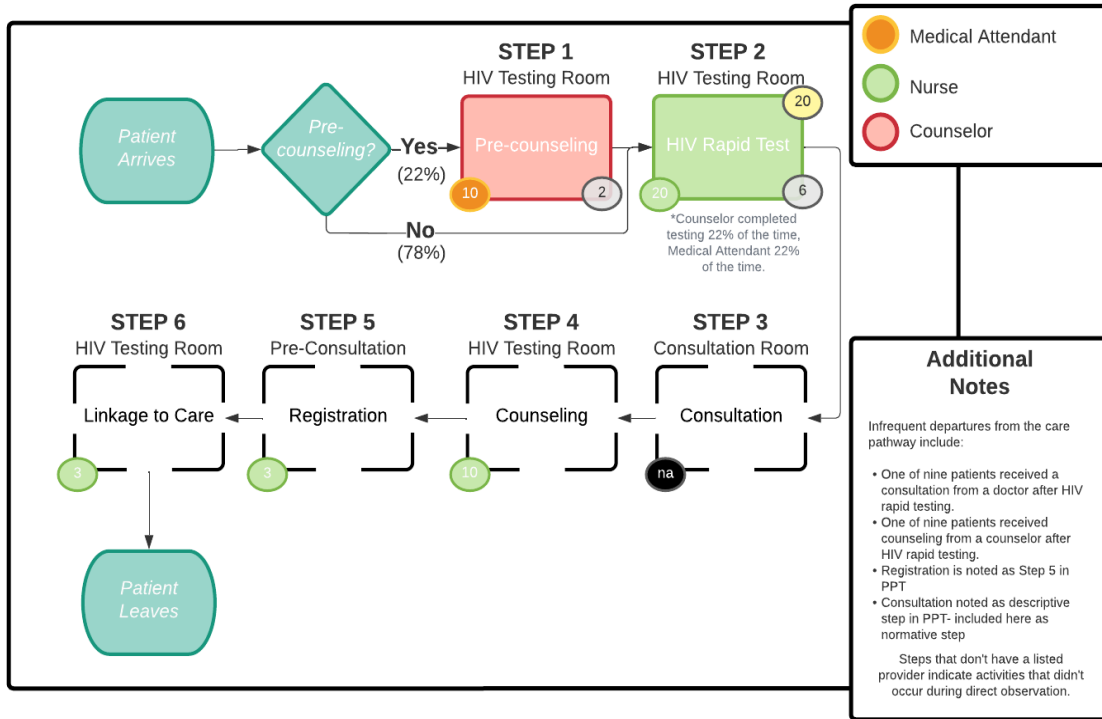


Figure C6. HIV Testing - Mwisole District Hospital

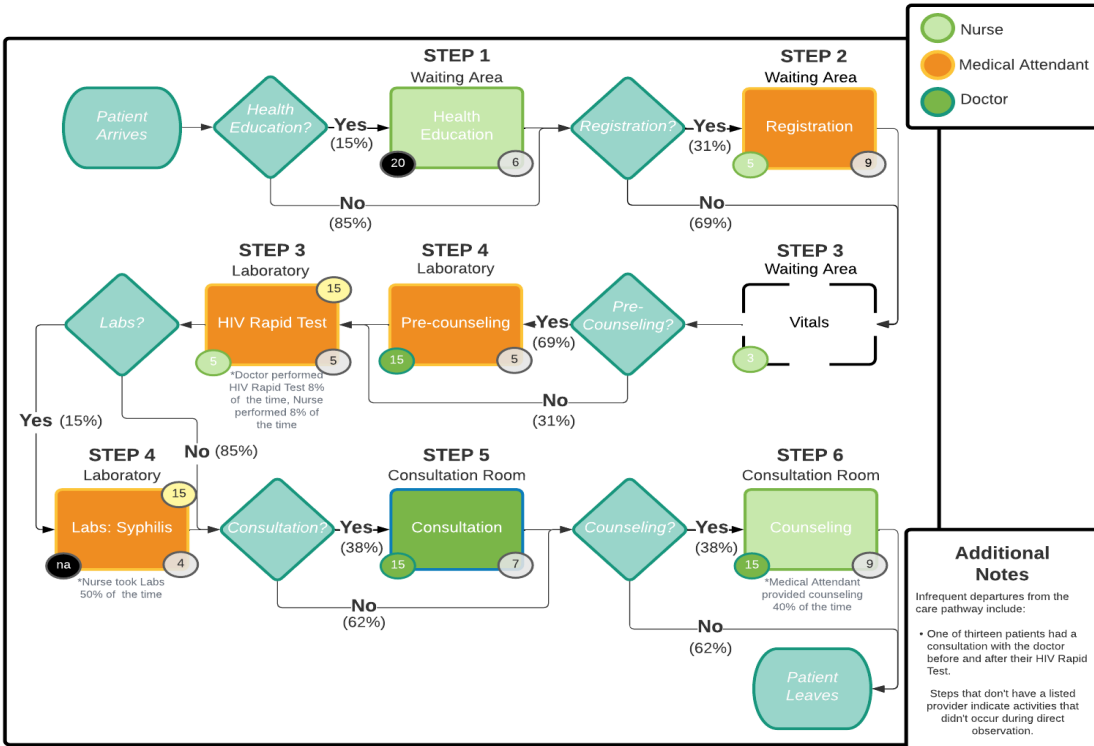




Figure C7. HIV Testing - Njombe Health Center

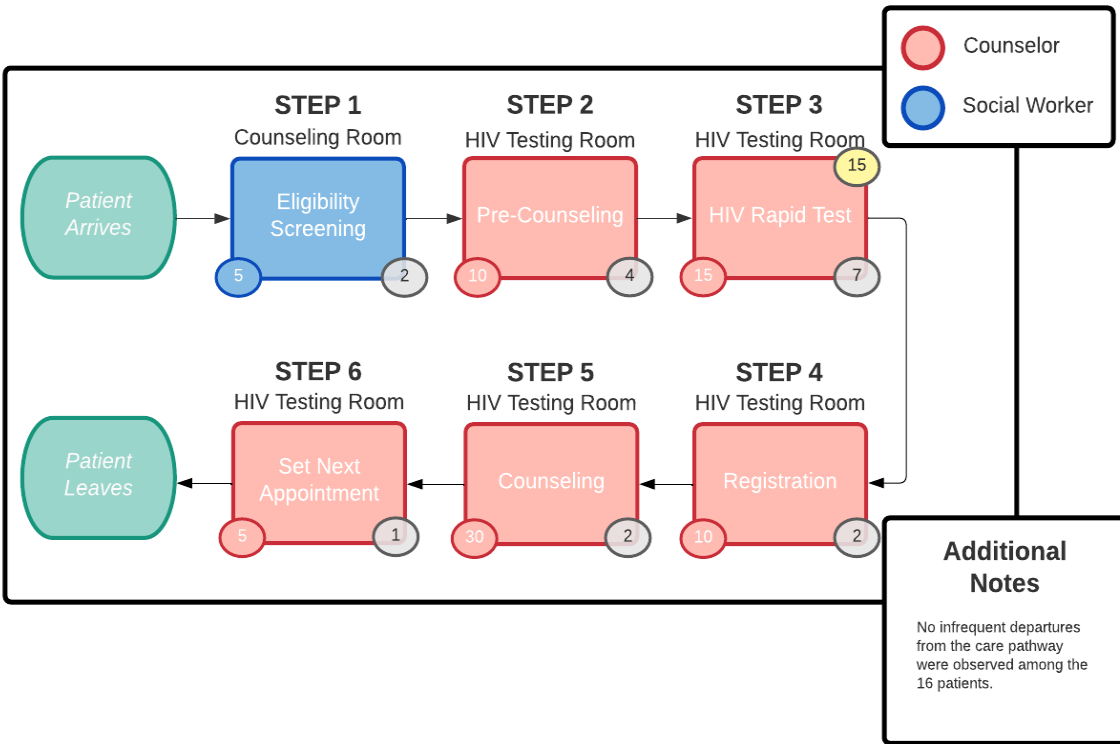


Figure C8. HIV Testing - Nzega District Hospital

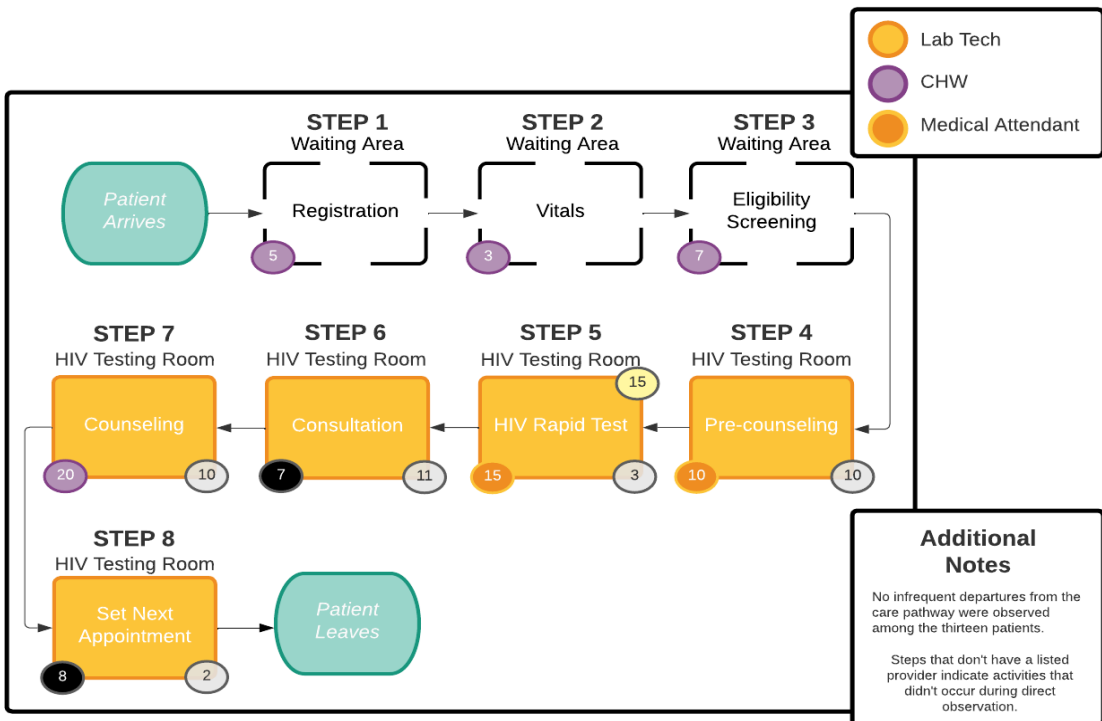


Figure C9. HIV Testing - Upuge Health Center

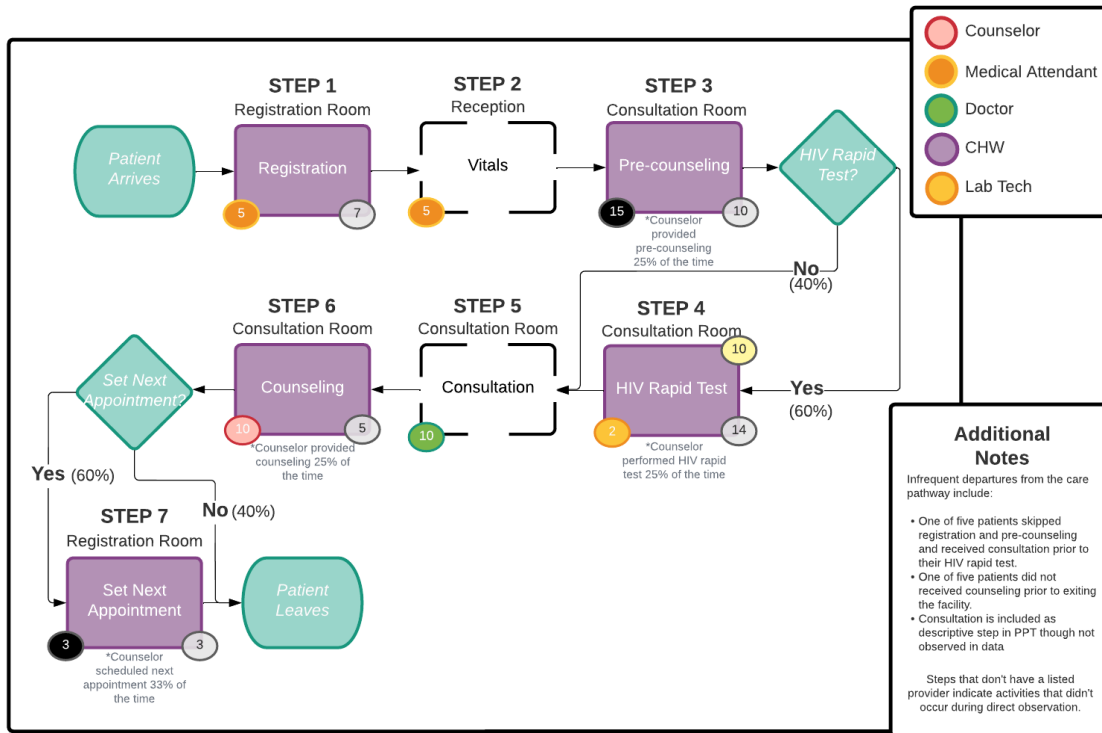


Figure C10. HIV Testing - Bunazi Health Center

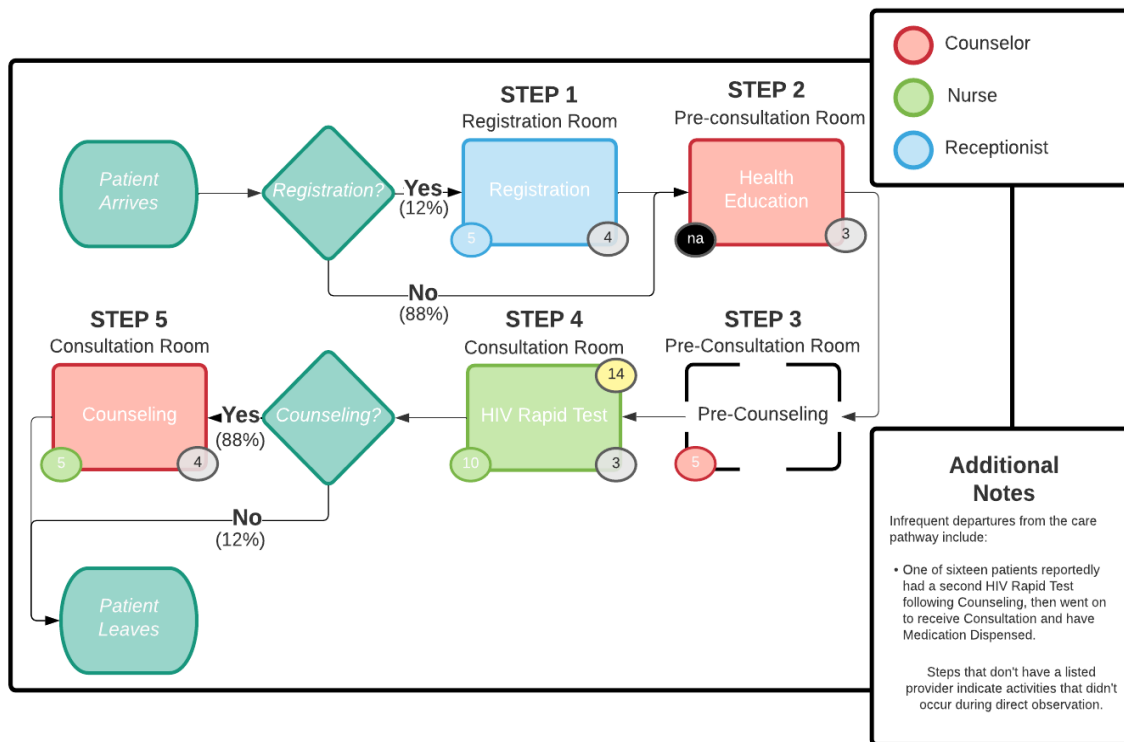
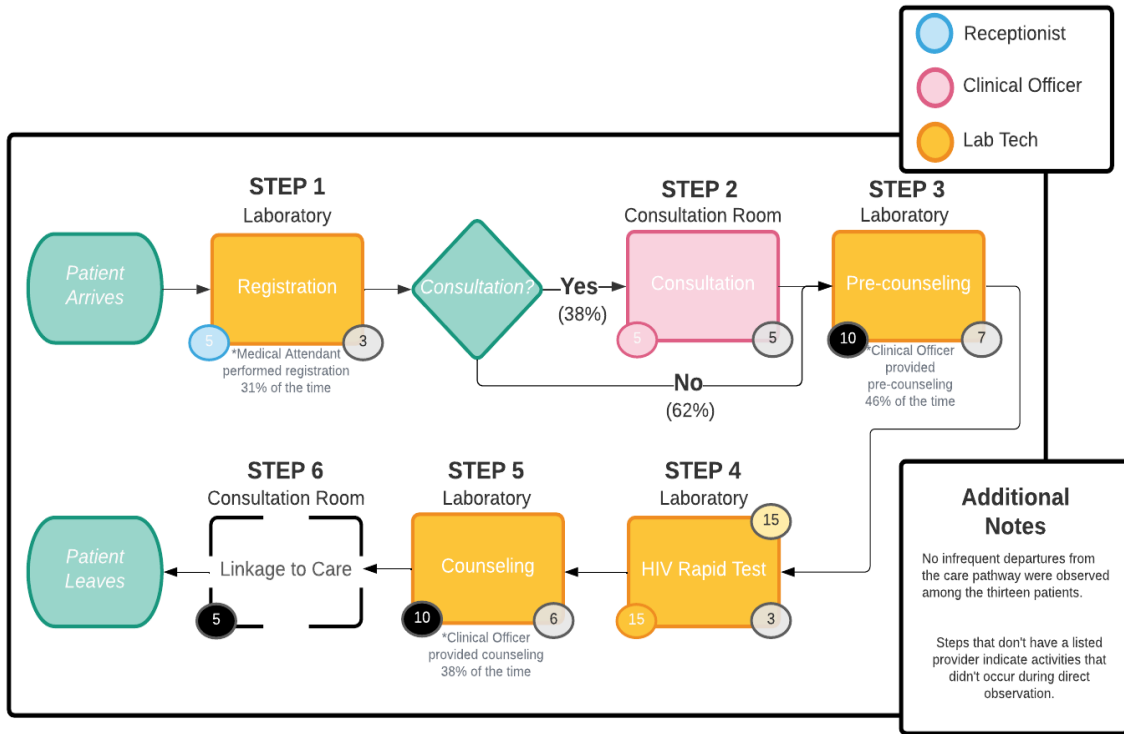


Figure C11. HIV Testing - Mwanzugwi Dispensary



## Appendix D PMTCT

Figure D1. PMTCT - Boko Dispensary

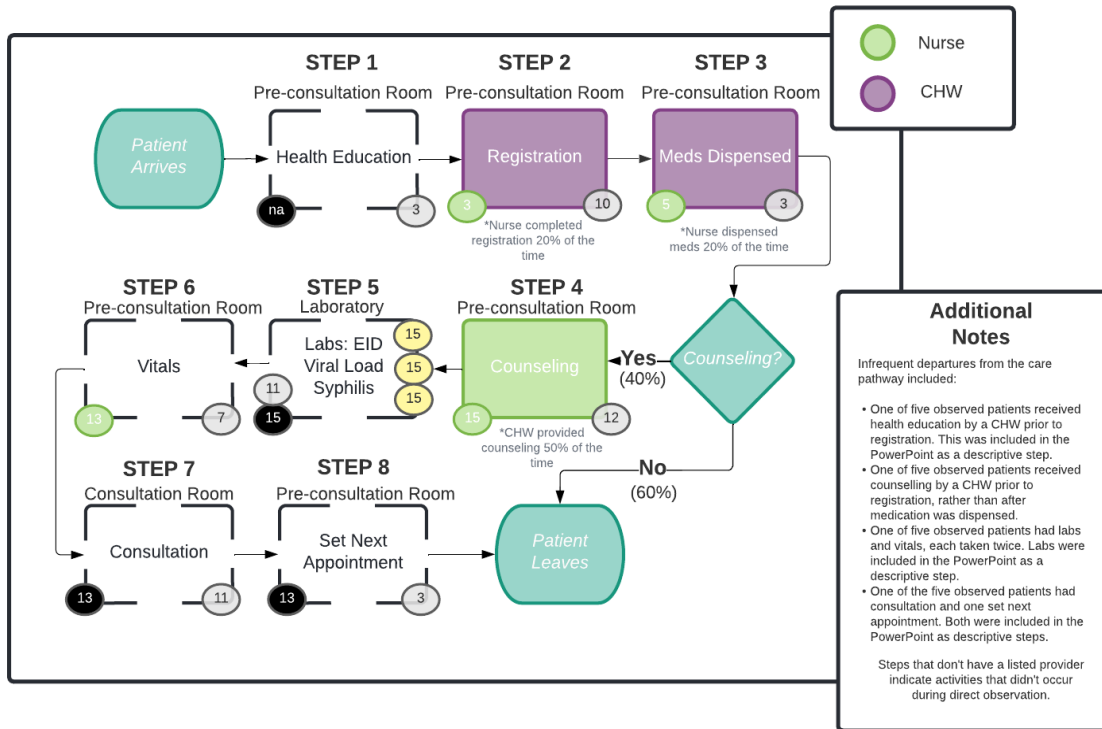


Figure D2. PMTCT - Luhanga Dispensary

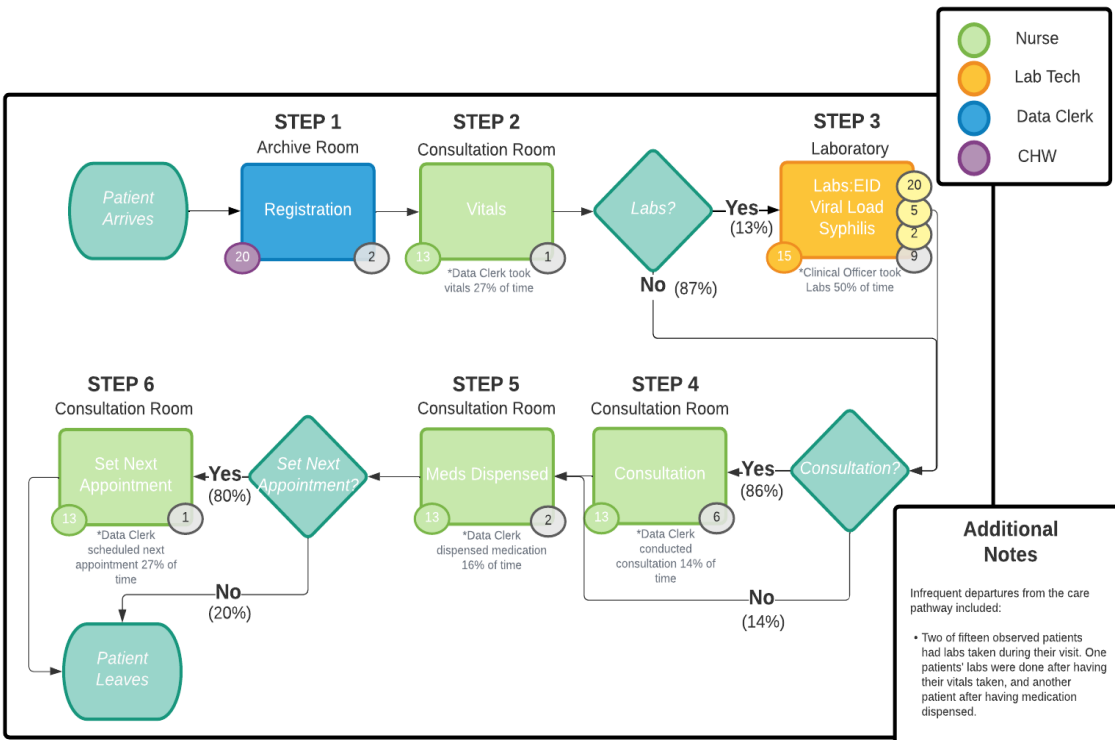


Figure D3. PMTCT - Magomeni Health Center

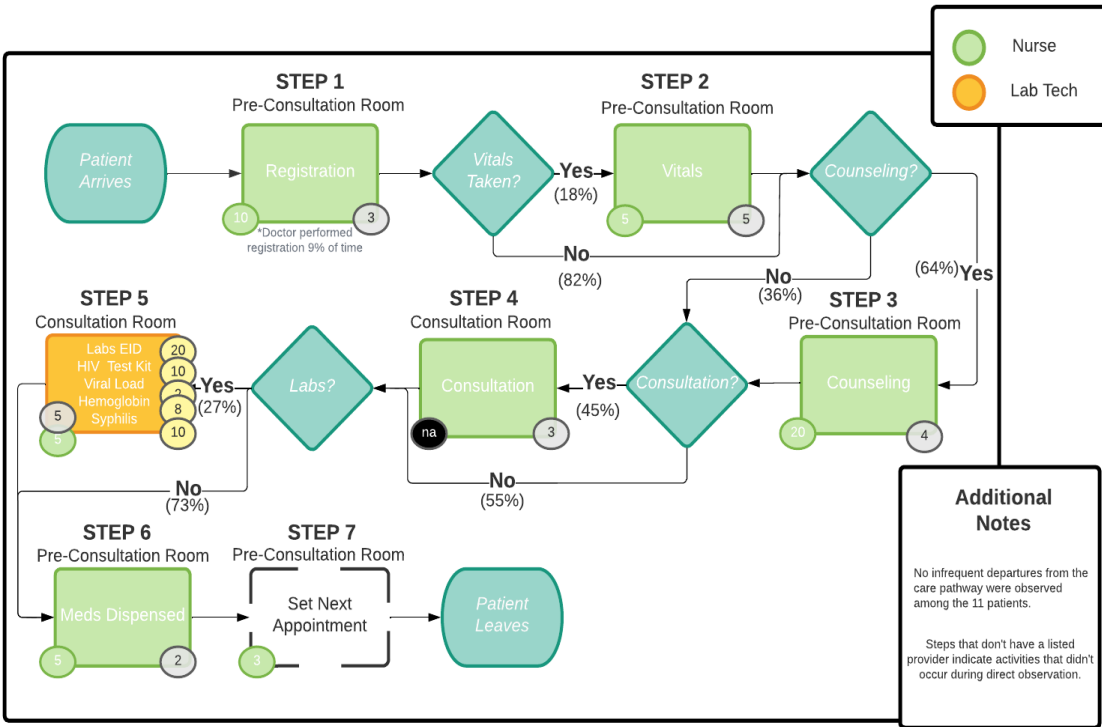


Figure D4. PMTCT - Mahaha Dispensary

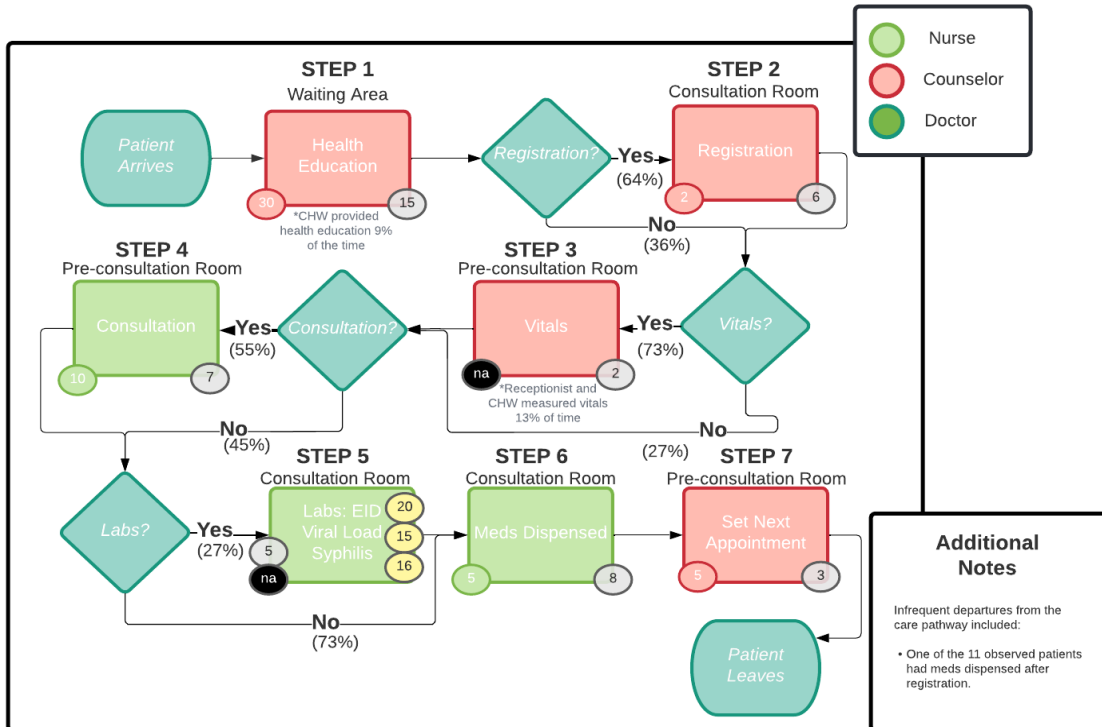


Figure D5. PMTCT - Mbagala District Hospital

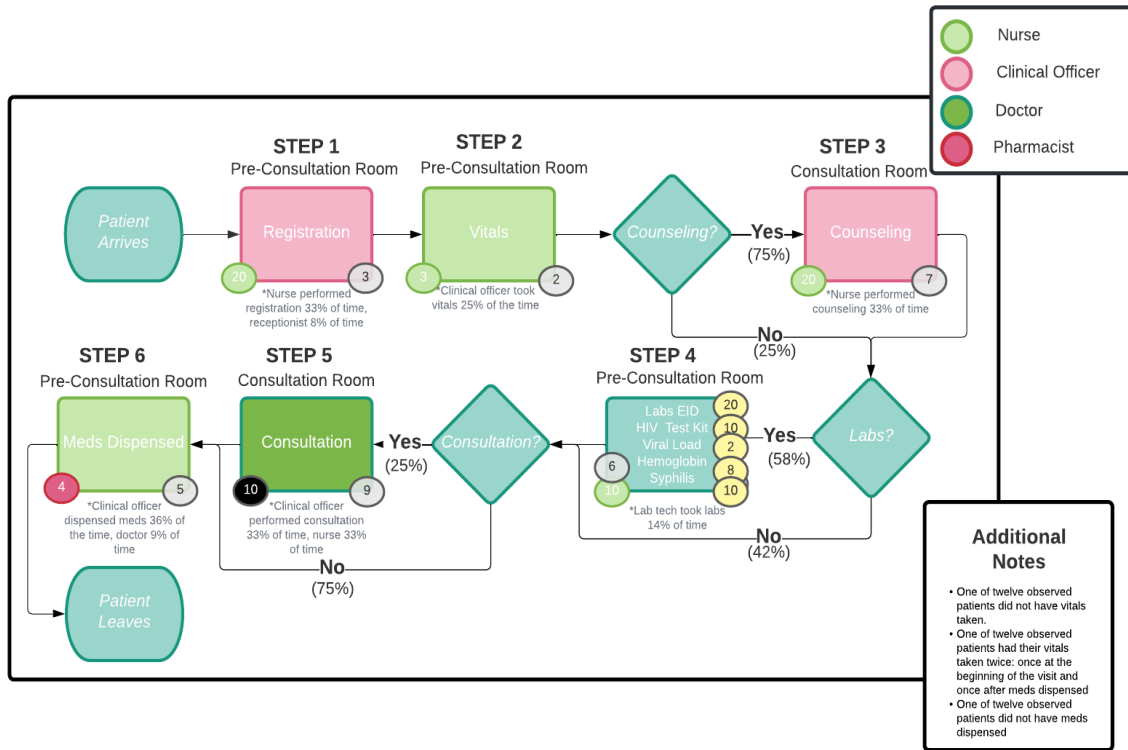


Figure D6. PMTCT - Mwisole District Hospital

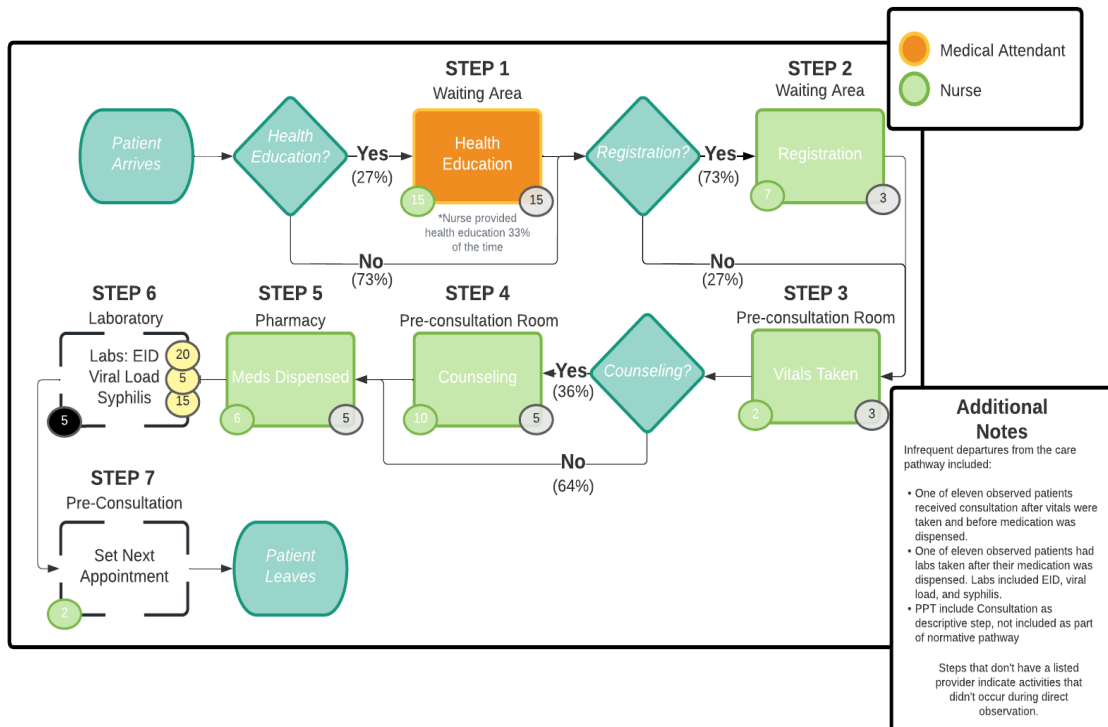


Figure D7. PMTCT - Njombe Health Center

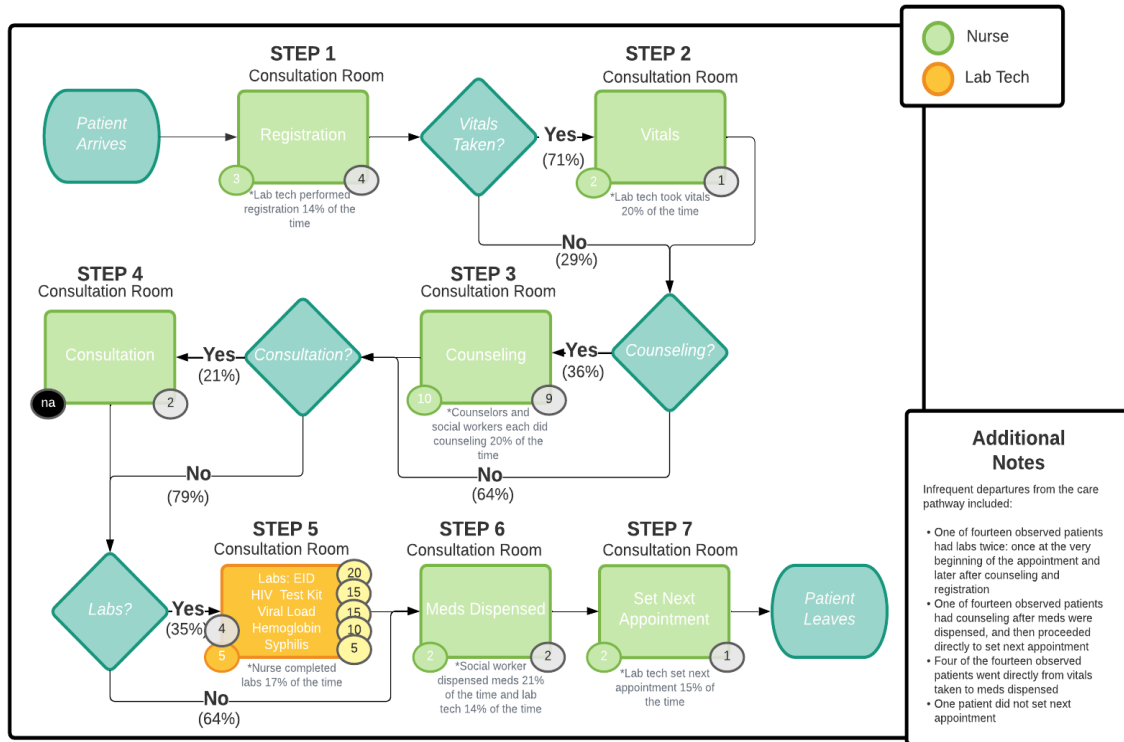


Figure D8. PMTCT - Nzega District Hospital

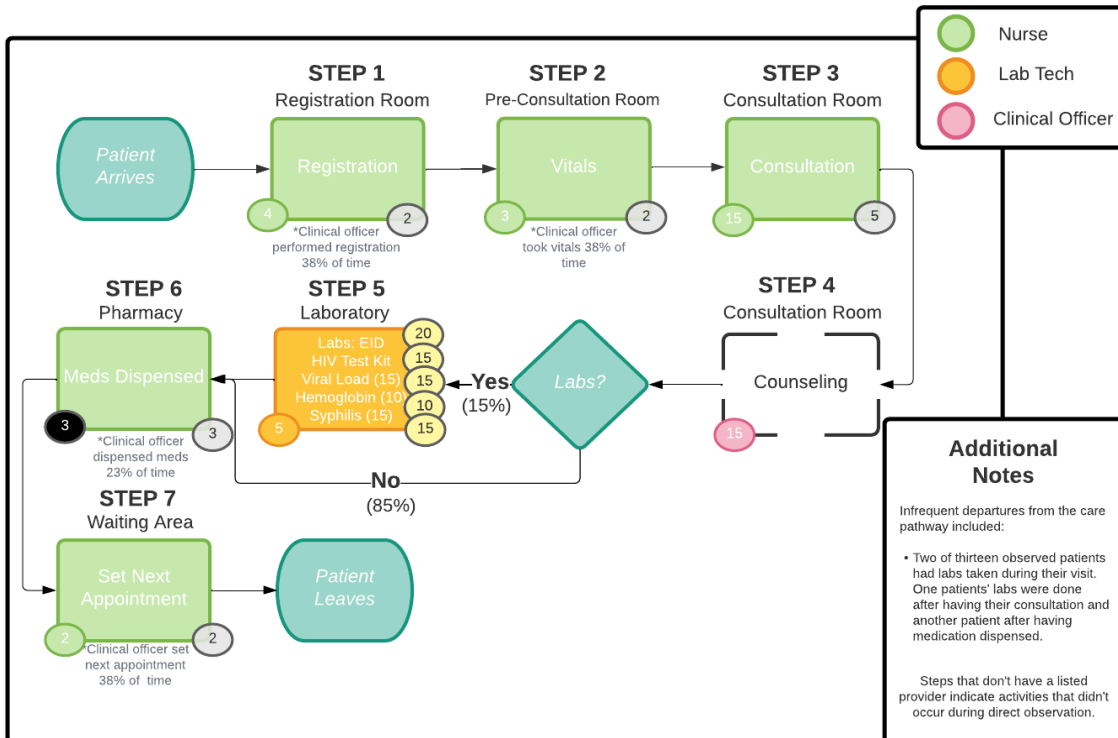


Figure D9. PMTCT - Upuge Health Center

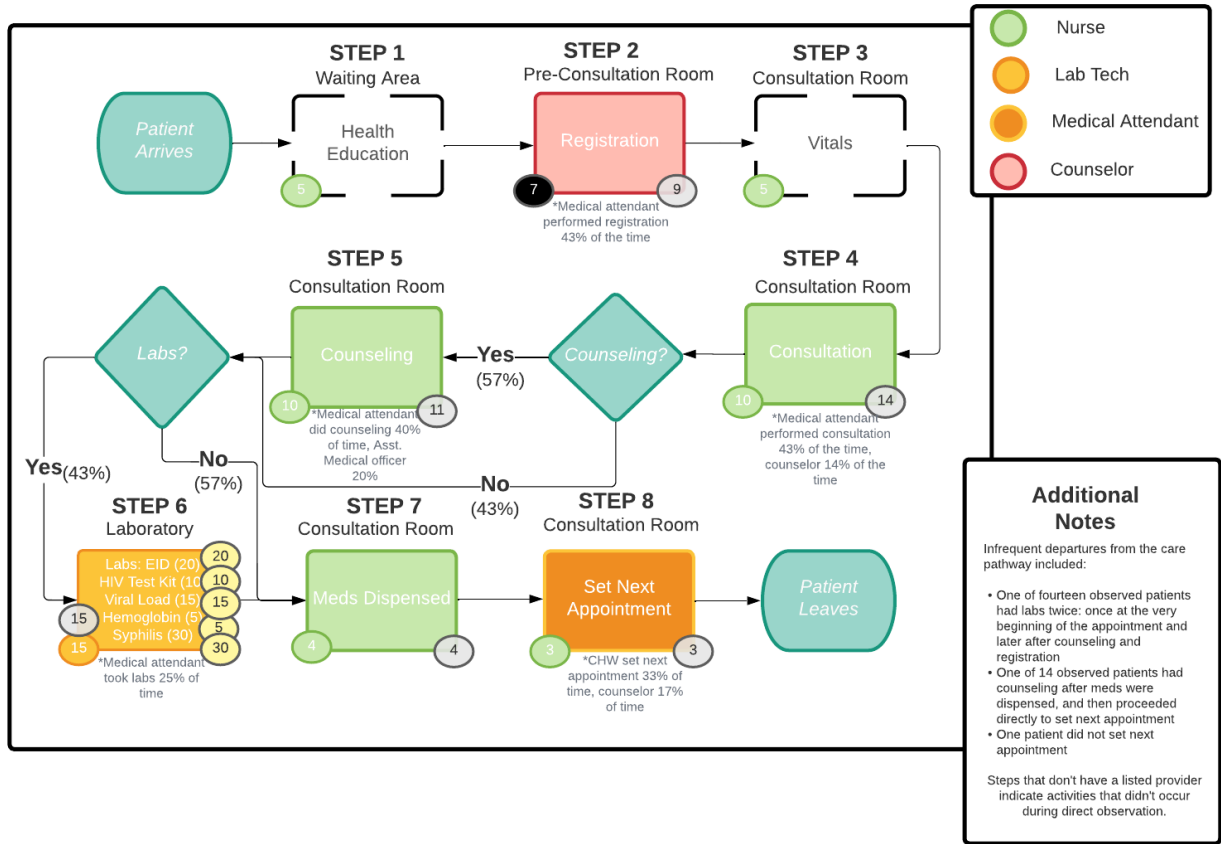




Figure D10. PMTCT - Bunazi Health Center

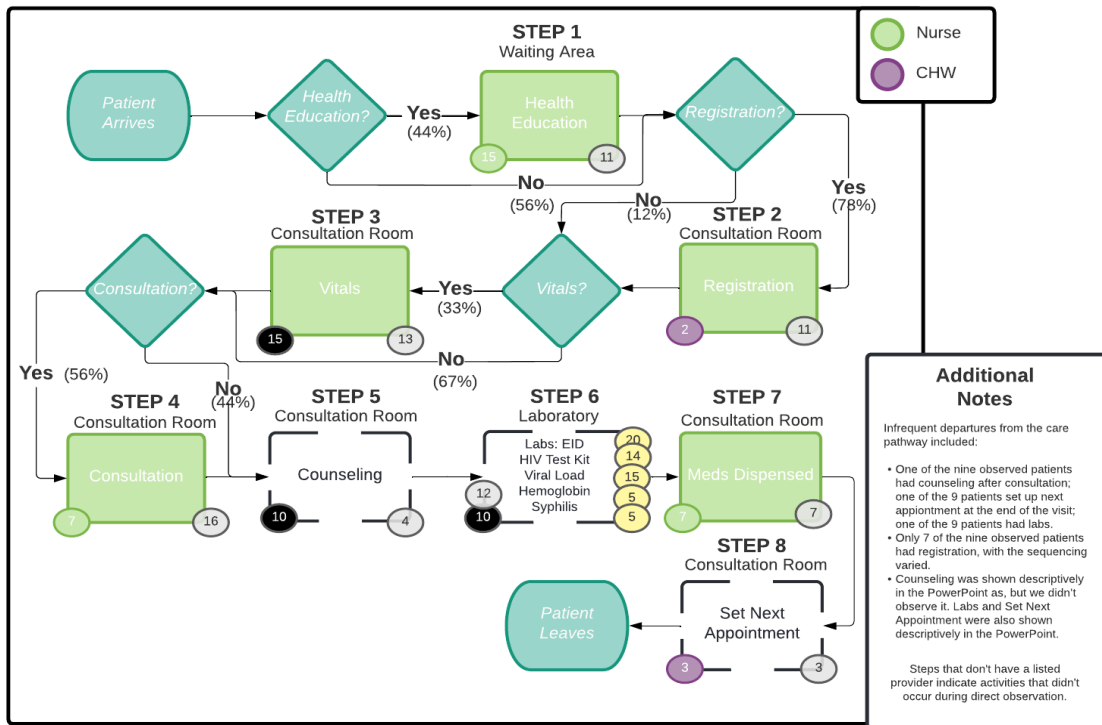


Figure D11. PMTCT - Mwanuzigi Dispensary

