# The Effect of Telemedicine on Quality of Care in Rwanda: Comprehensive Report of the Analysis of SP and Provider Survey Data

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## 1 Introduction

Healthcare is traditionally conducted in the context of in-person office visits allowing providers to physically assess and communicate with the patient. In low- and middle-income countries, several factors make in-person consultations challenging, including geographic accessibility of health facilities, cost of seeking care, population growth, and provider availability across locations. As mobile phone usage expands in emerging markets, mobile health platforms have the potential to provide appropriate solutions for these issues. Remote delivery of health care via telemedicine holds the promise of revolutionizing healthcare by improving access and making receiving care much more convenient (Hollander and Carr, 2020; Dahlstrand, 2021; Goetz, 2023).

However, telemedicine may also change the nature of the provider-patient interaction in ways that may have implications for quality of care. Providers must diagnosis illness without physical examination of patients which could cause mistakes or increased use of specialist services or other costly substitutes to primary care (Ashwood et al., 2017; Li et al., 2021). Providers are less able to use heuristics that have proven helpful to augment clinic practice guidelines for diagnosis (Singh, 2021; Boone, 2024). Patients may be less able to communicate illness concerns and treatment preferences.

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Understanding how telemedicine changes the nature of the patient-provider interaction and hence quality of care is critical to guide the future use of remote medicine.

We investigate how seeing a provider via telemedicine versus in-person in a clinic setting influences medical care decision making. Specifically, we address four sets of research questions:

1. How do quality of care, time spent, and patient costs differ across telemedicine and in-person care? How much of these differences are explained by differences in provider characteristics across platforms?

2. Are providers influenced by patient suggestion of their diagnosis or request of a treatment? Does this vary whether treated via telemedicine or in-person? Does this vary by SP characteristics like gender, age, or insurance status?

3. What characteristics of providers predict quality of care? How does care differ when providers are tired at the end of their shift? When they are busy? When they are burnt-out?

4. How does care differ across SPs with different characteristics, such as gender, age, and insurance status? Does this vary across telemedicine and in-person care?

We study these issues in Rwanda where Babyl UK, a digital healthcare provider, established a Rwanda-based operation in 2016. In partnership with the Ministry of Health and the Rwanda Social Security Board, Babyl Rwanda runs a digital healthcare platform that allows patients to access medical triage and clinical consultations remotely using a mobile phone, as well as an SMS-based system for issuing digital prescriptions that can be filled at any pharmacy in Rwanda.[1] The presence of Babyl provides an alternative to Conventional Care (CC, in-person visit to a public healthcare facility), allowing us to measure the differences between them. As of 2024, Babyl is no longer active in Rwanda; however, the results of this study can be applied to the broader field of telehealth medical care.

We primarily investigate these issues in the context of two important and highly prevalent diseases: acute malaria and upper respiratory illness (URI) in Rwanda. These two cases allow us to compare how the medium affects care in low and high discretion cases. Malaria is a well-understood illness with clear diagnostic and effective treatment protocol and has a high disease burden. Nearly all deaths and serious illness are preventable through effective and inexpensive medication (World Health Organization, 2022). Highly specific and sensitive (i.e., low false positive and negative rates) malaria test diagnostics and treatment with effective front-line medication are widely available and affordable (World Health Organization, 2015; Feachem et al., 2019). Low-cost diagnostics allow ready screening at the first sign of disease, leading to early detection and treatment for infected individuals (Wu and Zaman, 2012; Hillemann et al., 2011).

[1] As of October 1, 2018, Babyl had registered over 2 million users and completed over 190,000 appointments annually.

URI, which is common health issue and can affect large proportions of populations, is much harder to diagnose and treat, relative to malaria. URI is typically associated with non-specific symptoms, such as cough, sore throat, and congestion, which overlap with other conditions and respiratory infections that can be bacterial, viral, or allergen-like in nature. This makes differential diagnosis not straightforward at point-of-care. URI is also self-limiting, meaning that medical treatment is not required for a patient to recover.

We use data from an audit study that employs standardized patients (SPs) to measure the appropriateness of the care delivered using the same clinical case scenario.[2] We trained individuals (SPs) to present identical standardized illness case scenarios as real walk-in patients to see providers and conducted a pilot to confirm and validate that the implementation of SPs did not pose any risk to the individuals involved. Based on the successful pilot demonstrating that the SP method did not pose any risks, given that informing providers in advance of the study would jeopardize the study objectives, that the research was sanctioned by providers' employers (Babyl and the Rwandan Ministry of Health), and following other studies utilizing the SP method in similar contexts (Kwan et al., 2018, 2019; Rhodes and Miller, 2012; Boone et al., 2023; Daniels et al., 2023), we sought and received ethical clearance a waiver of provider consent. Thus, for our study, we interpret visits conducted with SPs as indistinguishable with visits made by real patients.[3]

We developed acute malaria and viral URI SP case scenarios and trained individuals as SPs to present these cases to providers in CC and Babyl telemedicine settings. For malaria, international and Rwandan national clinical practice guidelines offer little discretion; the guidelines recommend that the patient should be given a malaria test and then a frontline anti-malarial drug (Artemether-Lumefantrine) if the patient tests positive (Republic of Rwanda Ministry of Health, 2020). Providers have much more discretion in the diagnosis and treatment of URI. There is no clear diagnostic test or treatment, and so we define correct case management as not ordering any unnecessary labs or prescribing unnecessary medicines (most notably, antibiotics).

In the analysis, we use regression analysis to compare outcomes delivered through Babyl telemedicine to outcomes delivered through conventional care in-person visits to clincs. We explicitly control for both patient and provider selection to identify the pure effect of the medium: telemedicine versus in-person. By using trained SPs portraying a standardized case of either malaria or URI, we generate quality of care data that avoids bias from selection on patient illness type and severity that is inherent in other common quality of care data collection approaches, such as patient exit interviews, direct clinical observation, or health records (Peabody et al., 2000; Kwan et al., 2019). We also include SP fixed effects in the empirical models to control for any additional unobserved SP heterogeneity that may be correlated with care decisions. We also control for a rich set of provider background, training, experience, and medical knowledge characteristics to

[2]SPs have been used to measure quality of care extensively. For example see: Peabody et al. (2000); Das et al. (2012); Mohanan et al. (2015); Das et al. (2016); Kwan et al. (2018, 2019); Das et al. (2022); Kwan et al. (2022); Boone et al. (2023); Wagner et al. (2024)

[3]The study protocol including the waiver of provider consent for the SP component of the study was approved by the Republic of Rwanda National Ethics Committee (IRB No. 899).

adjust for any potential provider heterogeneity that may be correlated with both choosing to work at Babyl and medical decisions.

Our data come from Babyl and a sample of 81 public for-profit primary health care facilities in Rwanda. These facilities were randomly sampled from the 506 health facilities approved by Babyl and were stratified by (1) the presence/absence of Babyl agents, (2) baseline Babyl penetration rate, (3) geographic location (rural or urban), and (4) average outpatients' workload in the 3 months prior to randomization. In total, our SPs made 1,459 in-person visits to CC facilities and 1,218 virtual visits to Babyl vi mobile phone. We surveyed 327 providers in CC facilities and 130 providers at Babyl who treated our SPs.

We find that quality of care in telemedicine is at least as good as CC, if not better. SPs presenting the malaria case at Babyl are just as likely to receive correct case management (CCM) as in CC. SPs presenting the URI case, where providers have more discretion, are almost 30% more likely to receive CCM at Babyl. During these telemedicine consultations, providers ask patients more medical history questions. They also prescribe more optional medicines to help alleviate patient symptoms.

In addition to being of higher quality, telemedicine visits appear more efficient than CC. Providers in telemedicine are able to gather more information and provide the same or better care during shorter consultations. Patients also receive care faster, waiting an average of an hour less for a telemedicine consultation. Babyl providers prescribe fewer unnecessary medicines for URI SPs and, in both cases, order fewer labs. SPs pay less out of pocket for these telemedicine visits than they do in CC.

We also find that telemedicine changes the nature of the patient-provider interaction. When SPs request an unnecessary antibiotic, providers in face-to-face interactions are more likely to give it to the patient. Our results suggest that it may be easier for providers to say no over than phone than in person. Treating demanding patients via telemedicine instead of in person may help to reduce bias in prescribing.

In our setting, we find that telemedicine improves quality of care, improves efficiency, and reduces provider bias in response to patient requests. These findings have implications for policymakers looking to efficiently increase access to high-quality health care.

## 2 Institutional Context

Rwanda is an East African country with over 14 million residents and a GDP of US$966. It is internationally recognized for its success in offering universal access to healthcare. With over 84% of Rwandans insured by the mutuelle de santé, Rwanda has ensured that her citizens have access to primary health care. The country currently operates a well-functioning, decentralized

healthcare public service system that provides in-person conventional care at 1700 health posts, 500 health centers, 42 district hospitals, and five national referral hospitals. Rwanda also has a vibrant private health services sector, which comprises of two general hospitals, two eye hospitals, 50 clinics and polyclinics, eight dental clinics, four eye clinics, and 134 dispensaries.

Telemedicine was introduced to Rwanda through an agreement between Babylon Health UK and the Government of Rwanda to provide medical advice and treatment for select conditions that can be effectively addressed through digital health. Babylon Health UK established its Rwanda-based operation, Babyl, in 2016, with the aim of increasing access to healthcare in Rwanda using a digital healthcare model. To date, Babyl Rwanda has over 2 million registered users.

Babyl offers USSD and voice-based service to provide triage and consultation to patients and a Short Message Service (SMS) based system to provide digital prescriptions. Users can register and book an appointment to talk with a Babyl healthcare provider by dialing *811# on their phones. In a phone conversation, Babyl nurses and general practitioners (GPs) provide diagnosis, advice, and next steps for treatment to patients based on their signs and symptoms.

A patient's digital consultation with Babyl can lead to several outcomes, some of which may require conventional care as well. Babyl services in Rwanda are limited to patients above 16 years, for select primary healthcare conditions. Access is dependent on having a SIM card/phone number that is uniquely linked to the patient's national ID. Care depends on the type of health condition and whether the diagnosis requires a physical examination or a lab test for confirmation. Outcomes may include a medication/treatment prescription, medical advice, and/or referral to conventional care. Conditions that are either digitally untreatable or outside Babyl's license should be referred.

Patients whose conditions fall within the scope of Babyl's license and consult with a Babyl doctor or senior nurse may require diagnostic lab tests, medication or an in person conventional consultation at a clinic:

- Prescription for a lab test: Babyl sends a code for a lab test prescription to the patient's phone, which the patient can have executed at a physical lab within Babyl's network partner labs. Codes are decoded by a Babyl agent at the lab. Once the lab has sent the results back to Babyl, the Babyl provider contacts the patient to continue the consultation.
- Referral to a conventional health facility: for example, in cases that may require physical examination to confirm the diagnosis.
- Prescription for medication: Babyl sends a code to the patient's phone his/her medication that can be filled at a pharmacy within Babyl's network partner pharmacies. Codes are decoded by Babyl agents at these pharmacies.

# 3 Data

We use data from two key sources: SP Surveys and Provider Surveys. Data from the SP encounters were collected via a debriefing SP exit questionnaire that took place shortly after the interaction as well as a medicines survey that took place either at the same time as the debrief (CC) or after the SP went to a health care facility to pick up prescribed medications (Babyl). A total of 1,542 SP visits to 81 conventional care facilities took place from June 16, 2022 to February 1, 2023 and 1,213 SP calls to Babyl took place from June 20, 2022 to February 2, 2023.

After the SP fieldwork concluded, we re-visited the facilities where the SP visits took place to survey providers who treated the SPs. This provider survey collected information on clinical knowledge, training, experience, as well as attitudes, personality traits and behavioral measures. We surveyed a total of 327 providers in CC and 130 at Babyl from July 5, 2023 to September 29, 2023.

## 3.1 Standardized Patient Surveys

In order to measure and compare outcomes of healthcare visits in the settings of telehealth medicine and conventional care, we use data collected through the employment of standardized patients (SP). SPs are locally recruited individuals who are trained to present a pre-scripted, standardized case scenario. In this study, SPs were trained on three different standardized case scenarios and conducted: (i) visits as real walk-in clients to providers in CC settings, and (ii) calls into Babyl telemedicine services while portraying real patients. After either the in-person (CC) or televisit, SPs would debrief their encounter with the provider by using an exit questionnaire. These responses are the basis for our quality of care data. The questionnaire collected information regarding the visit, including lab tests ordered and results, and medicines dispensed (sold). For each SP visit, SPs and their field supervisors attempted to identify all providers seen by the SPs. This list informed the provider survey sampling frame, described below.

With the SP method, we are able to avoid bias from selection on patient illness type and severity that is inherent in care data collected using other common methods such as patient exit interviews, direct clinical observation, or health record abstraction (Peabody et al., 2000; Kwan et al., 2019; King et al., 2019). Below, we describe SP cases, recruitment, training and pilot, fieldwork, and the analytic sample in this study.

### 3.1.1 SP Case Scenarios

Three standardized, pre-scripted case scenarios were developed for this study: malaria, viral URI, and diarrhea. These cases were selected to cover a range of provider behavior, including both under- and over-treatment. Each case includes an opening statement, along with a standardized

script, a corresponding debriefing exit questionnaire that was designed to capture data on care received for the CC and/or telemedicine visit, and a set of correct and not correct case management outcomes. Below we describe each case scenario:

- Case 1. Acute Malaria (CC & Babyl) - SP opens with, *[Doctor/Nurse], I felt cold with headache and joint pain the last few days and now I'm worse. I have come to you for help.*
  - We define **correct case management** as correctly completing the first step in this process: ordering either a malaria microscopy test or rapid diagnostic test (RDT).
- Case 2. Viral URI (CC & Babyl) - SP opens with, *[Doctor/Nurse], I have been coughing the last few days and have been experiencing some fever. I have come to you for help.*
  - Providers have much more discretion in the diagnosis and treatment of URI, or the common cold. There is no clear diagnostic test or treatment and so we define **correct case management** as not ordering any unnecessary labs or prescribing unnecessary medicines (most notably, antibiotics). This measure is also a proxy for the propensity of providers to over-treat.
- Case 3. Viral, Non-specific Diarrhea (Babyl) - SP opens with, *[Doctor/Nurse], Hello, I have had a stomachache, vomiting, and diarrhea since the day before yesterday. I decided to call you for help.*
  - According to the Babyl protocol, we define **correct case management** as whether an SP is referred directly to a health facility for in-person care. With this case, we test whether Babyl providers can accurately recognize and refer emergent cases that should not be treated via telehealth.

The three SP case scenarios above were developed based on Gertler and Kwan (2024), Boone et al. (2023), and Kwan et al. (2022). All case scenarios utilized adaptations from several other SP studies (King et al., 2022; Das et al., 2012; Daniels et al., 2017; King et al., 2021; Kwan et al., 2018, 2019; Sylvia et al., 2015). The scripts for each of the three conditions are presented in Appendix Section A.

For in-person CC visits, the SP walks into a clinic and sees the provider recommended by triage. Once with the provider, the SP states the opening statement, responding to any question with pre-scripted answers. Once the visit is completed, the SP leaves the clinic and meets the supervisor to debrief the encounter through a case-specific exit questionnaire.

For telemedicine visits, the SP dials a number to contact Babyl and connects with a telemedicine provider over the phone. The visit is audio only and does not include video. The SP gives the opening statement to the provider, responding to any question with pre-scripted answers. Once the visit is completed, the SP hangs up and debriefs the encounter with a supervisor through a case-specific exit questionnaire. If any medicines are prescribed or labs are ordered, those SPs

calling into Babyl would receive a code on their phone which they are instructed to bring to the nearest health facility with a Babyl agent. This Babyl agent is then responsible for decoding the code to help the patient pick up the prescribed medicines and take the ordered lab tests. For malaria and URI visits with Babyl, our SPs followed this process as instructed unless they were asked to take an invasive test other than a malaria test. In that case, SPs were trained in tactics to avoid the test.

To develop the clinical aspects of the SP case scenarios, we convened a Technical Advisory Group (TAG) consisting of two 6.3 clinicians with clinical practice and guideline expertise in primary care. Our TAG advised not only on case development, but also on local guidelines, and outcome measures. The TAG participated in SP training and helped to prepare for different situations. The cases were extensively pilot tested in a CC facility sample and telemedicine sample similar to our analytic sample.

#### 3.1.2 Experimental Variants of SP Cases

Within the malaria and URI cases, we introduce three additional sources of variation in the case presentation, which we refer to as the SP experiments. These three variants introduced as SP experiments are:

- **SP Experiment 1. "Suggestion"** - Developed to answer the research question, **To what extent are providers swayed by patient suggestion?**
  - Case 1 Suggestion experiment if assigned adds to the opening statement either (i) a malaria suggestion: *Do you think this is malaria?* or (ii) a COVID-19 suggestion: *Do you think this is COVID-19?*
  - Case 2 Suggestion experiment if assigned adds to the opening statement either (i) a Pneumonia suggestion: *Do you think this is pneumonia?* or (ii) a Common cold suggestion: *Do you think this is a cold?*
- **SP Experiment 2. "Requesting"** - Developed to answer the research question, **Do providers give patients unnecessary medicines when specifically requested by the patient?**
  - Case 1 Requesting experiment if assigned asks to be prescribed Bactrim.
  - Case 2 Requesting experiment if assigned asks to be prescribed Ciprofloxacin.
  - For both cases if assigned, the SP can request at three possible moments during the encounter when appropriate: (i) when the provider is writing a prescription or about to dispense drugs, (ii) when the doctor asks what the patient wants, or, (iii) at the end of the interaction and if the provider hasn't given something that will make it go away yet, the SP stands up to close the visit (seem as if the SP wants to leave then turns back and makes the request to the doctor in a pleading tone).

- **SP Experiment 3. "Insurance"** - Developed to answer the research question, **Do patients with insurance receive different treatment than patients paying fully out-of-pocket without insurance?**
  - Case 1, 2, or 3 Insured experiment adds: At beginning of visit, SPs will be asked how they will be paying for services that day either by the Conventional Care Receptionist or Babyl Registration (e.g., What type of insurance do you have?). If assigned to present with CBHI, the SP will respond (i) *CBHI*. If assigned or to present without insurance and pay out of pocket, the SP will respond (ii) *None*.

If assigned to a suggestion visit, SPs suggested a potential diagnosis at the beginning of the interaction by asking whether the doctor thought it was a particular condition (e.g., "Do you think this is malaria?"). This suggestion experiment, novel to the SP framework, is intended to make a provider think of a particular condition without providing any clinically relevant information. To assess whether providers were influenced by patient suggestions, we evaluate whether providers were more likely to treat the patient in line with their suggested diagnosis. For SPs suggesting malaria or COVID-19, we test whether providers ordered a test for the suggested condition. For a URI suggestion, we evaluate whether SPs were more likely receive correct case management. For SPs suggesting pneumonia, we evaluate whether the SP was prescribed a medicine to treat Pneumonia.

If assigned to a requesting experiment, SPs were instructed to request an unnecessary antibiotic at the end of the patient interaction (Bactrim for malaria; Ciprofloxacin for URI). We evaluate whether SPs were more likely to be prescribed these drugs when requested. Other studies utilizing the SP method have also experimentally identified the effects of requesting or demanding certain types of services, including antibiotics or other antimicrobial treatment (Currie et al., 2011, 2014; Cheo et al., 2020; Kwan et al., 2022).

The final variation in case presentation is insurance status declared at point of care. SPs were assigned to either pay for the visit with community-based health insurance (CBHI) or to pay directly out of pocket with no insurance. In Rwanda, wealthier patients may choose to pay out of pocket instead of using CBHI and may receive differential treatment. We test this directly through this experiment.

#### 3.1.3 SP Recruitment, Training, and Pilot

**Recruitment.** First, SP recruitment focused on obtaining a mix of females and males who represented the appropriate age for the three SP case scenarios. The most promising SP recruits did not report any potentially undesirable characteristics for this type of fieldwork: (i) discomfort with deception (i.e., pretending to be ill), (ii) fear of being in a health facility or other issues related to the health system, (iii) had previous work history or had close relatives working in medical care,

and (iv) was judgmental of medical care providers. Further, it was important that individuals portraying SPs did not have the actual conditions in the case scenarios and were seemingly healthy to ensure care outcomes would not be confounded by individual SP variation in health. (Fieldwork supervisors also monitored SPs for any potential illness symptoms throughout all of SP training, pilot, and field work, from May 2022 to February 2023.)

**Training and Pilot.** SP training was conducted on May 9-27, 2022 in Kigali, Rwanda and was followed by a two-week pilot where: (i) teams traveled to different parts of the country to visit clinics in-person, and (ii) teams conducted teleconsultation visits over the phone.

SP training lasted for three weeks and was modified from Kwan et al. (2019). Week 1 focused on learning the SP case, adapting the case to different regions across Rwanda, and dress code. The SPs participated in developing the non-clinical aspects of the standardized narrative (e.g., name, age, family situation, living situation, etc.) for each case scenario and were trained to provide standardized responses to history and other questions if asked by the provider. Week 2 included mock interviews (play scenarios in the classroom between providers and patients), improvisation techniques, risk mitigation strategies, and the post encounter questionnaires. SPs were intensively trained in risk mitigation strategies. SPs were trained to not accept or receive any potentially invasive or harmful procedures during any visit. These mitigation strategies included avoiding injections, taking tablets or syrups, having blood drawn, or taking any intravenous fluids. Week 3 included more complex mock interviews and dry runs at health clinics. Over the course of the three-week training, we implemented a selection process where we invited back the strongest SPs who demonstrated qualities that would be fitting for fieldwork. At the end of training, the most promising candidates were then recruited to conduct the two-week pilot.

Immediately following training, the case scenario, SP experiments, and fieldwork protocol were piloted by supervisors and SPs over a two-week period. The pilot was designed to mirror the plan for SP field work as closely as possible in settings like the clinic and telemedicine sample. The pilot objectives were to test: (1) the case flow and answers prepared for provider questions, (2) data flow, and (3) that providers treat the SPs as they would real patients and did not detect them as actors.

Based on their performance in the pilot, a total of 131 individuals (49 females and 82 males) were hired as SPs for the field work. During fieldwork and because of Babyl record keeping, SPs were able to complete at most one Babyl visit every 2 weeks. Because of this limitation, we did a second round of SP hiring and training in June 2022. Ultimately, a total of 131 individuals were hired to complete SP CC and teleconsultation visits.

**SP Fieldwork.** Before and after the field work period between June 15, 2022 and February 2, 2023, all SPs were tested for COVID-19 and malaria to confirm that SPs beginning fieldwork were COVID-free and malaria-negative. Malaria tests were based on malaria microscopy tests administered by a reliable, high-quality laboratory.

### 3.1.4 SP Analytic Sample

SP visits were done in two waves. The first wave completed conventional care visits; the second wave completed primarily Babyl visits and secondarily more conventional care visits. SPs visited a total of 81 health care facilities in Rwanda for the initial consultation and 134 facilities for follow-up care after a Babyl visit. These facilities were randomly sampled from the 506 health facilities approved by Babyl and were stratified by (1) the presence/absence of Babyl agents, (2) baseline Babyl penetration rate, (3) geographic location (rural or urban), and (4) average outpatients' workload in the 3 months prior to randomization. These 81 health facilities are distributed across 5 provinces and 16 districts.

Table 1 summarizes the samples sizes for each variant of the case presentation in both CC and Babyl. We had 2,677 total SP visits with complete presentation data. Of those, 1,459 were in CC and 1,218 were in Babyl. SPs conducted a total of 1,262 malaria cases, 1,270 URI cases, and 145 diarrhea cases.

Table 1: Sample Size: SP Visits by Presentation Type

| Case | Experiment | | Insurance | CC | Babyl | Total |
|---|---|---|---|---|---|---|
| Malaria | Suggestion: COVID | Request Bactrim | CBHI | 83 | 56 | 139 |
| | | | No Insurance | 11 | 10 | 21 |
| | | Not Requesting | CBHI | 77 | 64 | 141 |
| | | | No Insurance | 17 | 8 | 25 |
| | Suggestion: Malaria | Request Bactrim | CBHI | 78 | 58 | 136 |
| | | | No Insurance | 15 | 10 | 25 |
| | | Not Requesting | CBHI | 82 | 52 | 134 |
| | | | No Insurance | 11 | 10 | 21 |
| | No Suggestion | Request Bactrim | CBHI | 0 | 0 | 0 |
| | | | No Insurance | 0 | 0 | 0 |
| | | Not Requesting | CBHI | 286 | 234 | 520 |
| | | | No Insurance | 66 | 34 | 100 |
| | **Total** | | | **726** | **536** | **1262** |
| URI | Suggestion: Pneumonia | Request Cipro | CBHI | 79 | 54 | 133 |
| | | | No Insurance | 17 | 15 | 32 |
| | | Not Requesting | CBHI | 81 | 55 | 136 |
| | | | No Insurance | 15 | 8 | 23 |
| | Suggestion: URI | Request Cipro | CBHI | 72 | 60 | 132 |
| | | | No Insurance | 16 | 4 | 20 |
| | | Not Requesting | CBHI | 73 | 55 | 128 |
| | | | No Insurance | 21 | 10 | 31 |
| | No Suggestion | Request Cipro | CBHI | 0 | 0 | 0 |
| | | | No Insurance | 0 | 0 | 0 |
| | | Not Requesting | CBHI | 267 | 236 | 503 |
| | | | No Insurance | 92 | 40 | 132 |
| | **Total** | | | **733** | **537** | **1270** |
| **Total Malaria and URI** | | | | **1459** | **1073** | **2532** |
| Diarrhea | | | CBHI | 0 | 125 | 125 |
| | | | No Insurance | 0 | 20 | 20 |
| **Total** | | | | **1459** | **1218** | **2677** |

*Notes:* Number of SP visits by Type (CC or Babyl), case (malaria, URI, or diarrhea), whether the SP requested an antibiotic, whether the SP suggested a diagnosis, and whether the SP paid with state-sponsored health insurance (CBHI) or paid out of pocket.

### 3.2 Provider Survey Data

We attempted to survey all providers who saw our SPs. For providers who had since left the facility where they saw the SP, we made several attempts to reach them either at their new place of business or over the phone. In terms of conventional care providers, 357 were successfully matched to patient interactions. Of these 357, 328 (92%) were successfully interviewed, while 29 (8%) were not able to be interviewed. Reasons for incomplete interviews include: refusals, incarceration, tracking difficulties, and lack of professional certifications. Additionally, 88% of interviewed providers had remained working at the facility where the patient interaction occurred. In regard to Babyl providers, 148 were successfully matched to patient interactions. Of these 148, 132 were interviewed (89%) and 16 (11%) were not. Incomplete Babyl interviews were due to providers being out of the country, unreachable, or having refused. From the time of the patient interactions to completion of the survey, 93% of the Babyl providers interviewed had remained working for Babyl.

While the SP methodology addresses patient selection, to isolate the impact of the platform on care outcomes, we must also address potential selection of providers across platforms. We conduct a survey of providers who were seen by SPs to measure and control for differences in experience, demographics, and attitudes of providers across platforms.

Provider surveys were conducted independently of SP encounters at least four months after the conclusion of SP fieldwork. There was no mention of the SP encounters during the provider survey. Providers were told that the survey was meant to study health workforce environment.

Prior to fieldwork, survey enumerators participated in a 12-day classroom training on the provider survey. A provider survey pilot was conducted from March 6 2023 to March 11 2023. During the pilot, enumerators surveyed 33 providers in CC who treated SPs during the SP pilot and 6 Babyl providers who had not seen our SPs during fieldwork.

To identify the sample of providers to survey (those that treated our SPs), the field team in Rwanda matched the provider names as reported in the SP debriefs to rosters obtained from Babyl and CC facilities. To match Babyl visits, Babyl management provided a duty roster with all the names and provider shifts during the period that SP data was being collected. Provider names were matched to interactions where the names provided by the SPs matched the names from Babyl and also matched the shifts when the providers were working. Provider names from the SP debriefs that were not successfully matched during the first round were shared with Babyl management so that they could help identify the providers. From this exercise, 148 Babyl providers were identified. To match CC visits, the field team conducted a health facility scoping activity to obtain rosters of providers working in the visited facilities during SP fieldwork. The following information was requested: full names of providers working in the sample health facilities from June 2022-January 2023, provider gender, professional qualification, department, phone contacts and their duty roster or work schedule from June 2022-January 2023. This information was obtained by

(1) a communication sent from the Director General of Health services contacting the titulaire(s), requesting for the above information via mail and (2) using survey enumerators to physically visit the health facility, showing approval letters and consents from the ministry of Health to the titulaire(s). From this exercise, 357 CC providers were identified.

Of the 148 Babyl providers identified, we were able to survey 132 (89%). Of the 357 CC providers identified, we were able to survey 328. One additional provider was surveyed who was not matched to any SP visit. In total, we surveyed 458 providers, and were able to match 457 of these to SP visits. Of these 457 providers, we classify 130 as Babyl providers, and 327 as CC providers.[4]

### 3.3 Matching the SP Surveys, SP Medicines, and Provider Data

To match across data sources, we rely on a combination of exact merges on identifying variables done in Stata and a manual matching process done by hand by the field team in Rwanda. There were two components of the matching process. First, we matched SP visit debrief data to the corresponding medicine follow-up survey. Second, we identify the provider who saw the SP during their visit and match the visit data (SP debrief and medicine) to the associated provider survey data.

We matched the majority of SP visits (2,219 out of 2,687) in the debrief data to the corresponding SP medicines follow-up using exact matches in Stata on the following identifier variables: Full Name, date of visit, and case presented. For 468 visits, typos or other errors in the data entry prohibited exact matches across datasets. For these, the field team in Rwanda attempted to hand match the observations using the same identifier variables while referring to field notes and the schedule of planned visits. This manual match process resulted in 245 additional matches.

[4]Two of the Babyl providers also saw SPs in CC and were surveyed at their CC facility. In Table 8, they are included with CC.

Table 2: Number and Consistency of Matched Visits

| **Surveys** | **Visits Matched** | | | **Consistency of Matched Data** | | |
|---|---|---|---|---|---|---|
| | **via Stata** | **By Hand** | **Total** | **Variable** | **Number** | **Percent** |
| **Debrief to Medicine** | 2,219 | 245 | 2,464 | Type of Care | 2,462 | 99.9% |
| | | | | Visit Date | 2,433 | 99% |
| | | | | Case Presented | 2,382 | 97% |
| | | | | SPID | 2,350 | 95% |
| **Debrief to Provider** | 0 | 2,295 | 2,295 | Facility | 2,223 | 97% |
| | | | | Provider Gender | 2,206 | 96% |
| | | | | Name Exactly as Written | 161 | 7% |
| | | | | Part of Name Exactly as Written | 1,137 | 50% |

*Notes:* The table shows the number of visits that were matched across data sources by Stata with exact matches in combinations of Facility, Date, Full Name, and the number matched by hand. The combinations of the listed variables are: Facility Date Full Name; Facility, Date, Alternative Name ordering; Date, Full Name; Date, Alternative name spelling. The second set of columns describes the consistency of identifier variables (Type of care, visit date, case, and SPID) across datasets for the set of matched surveys. All provider surveys were matched by hand due to differences in provider name spellings across the debrief and provider surveys.

Table 2 displays these sample sizes as well as summary statistics for the consistency of the identifier variables across these matched observations. For each identifier, the values are consistent across data sources in more than 95% of matches. In the case of discrepancies, we use the value in the SP debrief in analyses.

During their visit, SPs were trained on discrete methods to try to elicit provider names and reported them in the visit debrief. Using Babyl and CC facility rosters, the field team in Rwanda manually matched the provider names as reported by the SPs to the names on the roster. As shown in Table 2, across our matches, 7% had exact matches in name and 50% had an exact match on one name (first or last). For the remainder, minor misspellings were matched by hand. When the provider name was missing or otherwise unable to be matched to the provider roster, we used the rosters and provider survey data to attempt to match on provider characteristics such as gender and approximate age.

Table 3, shows the number of observations that were matched across each of the three datasets. For 223 observations, we were unable to match the SP debrief to the SP medicine follow-up. We exclude these visits from analyses of outcomes that involve medicines. For 392 visits, were either unable to match the SP visit with a provider or the (known) provider chose not to participate in the survey. We exclude these visits from analyses that control for provider characteristics.

Table 3: Observations Matched Per Survey Combination

| **Surveys Matched Across** | **Observations** | **Percent** |
|---|---|---|
| Debrief, Medicine, Provider | 2,115 | 78% |
| Debrief, Medicine | 349 | 13% |
| Debrief, Provider | 180 | 7% |
| Medicine, Provider | 0 | 0% |
| Debrief Only | 43 | 2% |
| Medicine Only | 20 | 1% |
| **Total** | **2,707** | **100%** |

*Notes:* This table shows how many surveys were matched in each category of combinations. This includes observations matched across all three surveys, two surveys, or none.

# 4 Measurement

In this section, we define and summarize the key variables constructed from the SP visit and provider survey data.

## 4.1 SP Characteristics

Table 4 summarizes the demographics of our 131 SPs and the types of cases that they performed. At the time of fieldwork, our SPs ranged in age from 25-42. 47% are under 30, 45% are aged 30-34, and the remaining 8% are 35+. 37% of our SPs are female. 27% have a private insurer other than CBHI (such as RAMA). Focusing on malaria and URI case presentations, the majority of SPs (81%) conducted cases with both presentations. 11% presented only URI and 8% presented only malaria. All of our SPs conducted Babyl visits. 85% also conducted visits in-person at a CC facility.

Table 4: SP Demographics and Case Presentations

| | Mean | N |
|---|---|---|
| *Age* | | |
| 25-29 | 0.47 | 131 |
| 30-34 | 0.45 | 131 |
| 35-42 | 0.08 | 131 |
| Female | 0.37 | 131 |
| No Insurance | 0.27 | 131 |
| *Cases Performed* | | |
| Only Malaria | 0.08 | 131 |
| Only URI | 0.11 | 131 |
| Both Malaria and URI | 0.81 | 131 |
| *Visits Performed* | | |
| Only CC Visits | 0.00 | 131 |
| Only Babyl Visits | 0.15 | 131 |
| Both CC and Babyl Visits | 0.85 | 131 |

*Notes:* Table summarized SP demographics including age, gender, and whether the SP has a private insurer other than CBHI (e.g., RAMA). Table also summarizes the types of cases presented.

### 4.2 SP Visit Data

In this section, we describe the variables constructed from the SP visit data. This includes all key outcome variables for the main analyses, defined in Table 5.

Many of the definitions are dependent on the classifications of lab tests and prescription drugs into categories of "Correct," "Unnecessary," and "Optional." Correct drugs are those necessary for the treatment of an illness; an example is prescribing an anti-malaria drug after a positive malaria test. An example of an unnecessary drug is prescribing an antibiotic for URI. Optional medicines are those used to alleviate symptoms and home remedies, such as paracetamol and vitamins. These may be helpful, but are not clinically necessary. In terms of labs, the same criteria applies. A correct lab test for malaria would be a malaria test, while an unnecessary test would be a stool test, and an optional test would be a COVID-19 test. A team of medical doctors in Rwanda classified the medicines and labs into these three categories based on the case presented by the SP, show in Appendix Tables A2 and A3.

Table 6 summarizes the SP outcome variables separately for malaria and URI, including our key SP outcome, correct case management (CCM). For malaria, this is defined as ordering a malaria test, which was correctly done in 92% of SP visits. For URI, we define CCM as not prescribing or dispensing any unnecessary medicines and not ordering any unnecessary labs. Correct care was much less common for URI; only 29% of SP visits satisfied our definition of CCM.

The next set of outcomes break down these components to measure the types of medicines prescribed and labs ordered.[5] In almost all visits, SPs receive some kind of medicine. SPs are prescribed or dispensed optional medicines in 96% of malaria and 97% of URI visits, on average receiving 1.5 (malaria) and 2.2 (URI) optional medicines. The share of SPs receiving unnecessary medicines is also high. SPs are prescribed or dispensed unnecessary medicines in 46% of malaria and 70% of URI visits, on average receiving 0.5 (malaria) and 0.8 (URI) of these unnecessary medicines. In terms of labs, malaria SPs receive on average 0.14 optional labs and 0.12 unnecessary labs. URI SPs receive 0.24 optional labs and 0.02 unnecessary labs.

During the consultation, providers asked SPs 6.3 questions from the pre-specified list of history questions for malaria and 7.8 for URI (see Appendix Section A). The SP spent an average of 4.3 minutes with the provider with the malaria presentation and 5.0 minutes with the provider for URI. The time spent waiting for these brief consultations was substantial, about 70 minutes for both cases.

SPs paid an average of 893 Rwandan Francs out of pocket for malaria visits and 814 Rwandan Francs for URI visits. The distribution of payments is right-skewed, so in our main analyses we employ a log transformation of the data to minimize the impact of outliers.

[5]For all outcomes that involve medicines (indicators and counts of optional and unnecessary medicines, CCM for URI) are missing for the 282 SP visits that were not matched to a medicines survey.

The second panel of the table summarizes our case presentations by type, which are similar across conditions. Almost 45% of SP visits were to Babyl, with the remainder to conventional care. In 25% of visits, the SP request an antibiotic. In 25% of visits, SPs suggested the correct diagnosis at the start of the consultation. In 26% of visits, SPs suggested an incorrect diagnosis and in the remaining 49% did not make any suggestion. In 15-20% of visits, SPs did not use CBHI to pay for the visit and instead paid out of pocket. See Table 1 for the complete list of sample sizes by presentation type.

Table 5: SP outcomes

| Category | Variable | Description |
|---|---|---|
| Correct Case Management | CCM, Malaria | Indicator equal to 1 if the provider ordered a malaria test, 0 otherwise. |
| | CCM, URI | Indicator equal to 1 if the provider did not prescribe any unnecessary medicines or order any unnecessary labs. Categorization of medicines and labs shown in Appendix Tables A2 and A3. Missing if SP visit was not matched to a medicine file. |
| Medicine | Any Optional Medicine | Indicator equal to 1 if provider prescribes or dispenses any optional medicines (see Appendix Table A2 for categorization). Missing if SP visit was not matched to a medicine file. |
| | Number Optional Medicine | Count of optional medicines prescribed or dispensed. Missing if SP visit was not matched to a medicine file. |
| | Any Unnecessary Medicine | Indicator equal to 1 if provider prescribes or dispenses any unnecessary medicines (see Appendix Table A2 for categorization). Missing if SP visit was not matched to a medicine file. |
| | Number Unnecessary Medicines | Count of unnecessary medicines prescribed or dispensed. Missing if SP visit was not matched to a medicine file. |
| Labs | Number Optional Labs | Count variable which counts the number of labs ordered in the "Unnecessary" category. Lab categorizations can be found in the appendix, section B. Medical professionals were consulted for these categorizations. |
| | Number Unnecessary Labs | Count variable which counts the number of labs ordered in the "Unnecessary" category. |
| Consultation | History Questions Asked | Count of history questions (from the list of pre-specified questions in Appendix Section A) that the SP was asked by the provider. |
| | Time with Provider (Minutes) | Time spent with the provider in the initial consultation. For Babyl, this is duration of the phone call when the provider calls. For CC, this is time spent with the provider during the consultation. |
| | Time Waiting for Provider (Minutes) | Time spent waiting for the provider to begin the initial consultation. For Babyl, this is the time from first calling Babyl to receiving a call back from a provider. For CC, this is the time from arriving at the facility to the start of the consultation with the provider. |
| Payment | Total Patient Out of Pocket Payment (RWF) | Total amount of Rwandan Francs (RWF) paid out of pocket by the SP for the interaction, including cost of all medicines and labs. Missing if SP visit was not matched to a medicine file. |
| | Log of Total Patient Payment (RWF) | Log transformation of the total patient out of pocket payment plus 1. |
| Visit Type | Babyl | Indicator equal to 1 if the SP executed the visit over the phone via Babyl (instead of in-person at a CC facility). |
| | Request | Indicator equal to 1 if the SP was assigned to request a specific drug (Bactrim for malaria cases and Ciprofloxacin for URI). |
| SP Experiments | Suggest Correct | Indicator equal to 1 if the SP was assigned to suggest the correct diagnosis to the provider at the beginning of the interaction. For Malaria, "Do you think this is malaria?" For URI, "Do you think this is a common cold" |
| | Suggest Incorrect | Indicator equal to 1 if the SP was assigned to suggest an incorrect diagnosis to the provider at the beginning of the interaction. For Malaria, "Do you think this is COVID?" For URI, "Do you think this is pneumonia?" |
| Insurance | No Insurance | Indicator equal to one if the SP pays without insurance for the consultation (i.e., does not pay with the state-sponsored CBHI insurance). |

*Notes:* This table defines the SP outcomes summarized in Table 6.

Table 6: Summary of Outcomes from Malaria & URI SP Visits

| | Malaria | | | URI | | |
|---|---|---|---|---|---|---|
| | Mean | SD | N | Mean | SD | N |
| Correct Case Management | 0.92 | | 1266 | 0.29 | | 1241 |
| Any Optional Medicine | 0.96 | | 1225 | 0.97 | | 1241 |
| Number Optional Medicine | 1.51 | 0.62 | 1225 | 2.15 | 0.75 | 1241 |
| Any Unnecessary Medicine | 0.46 | | 1225 | 0.70 | | 1241 |
| Number Unnecessary Medicine | 0.54 | 0.64 | 1225 | 0.76 | 0.55 | 1241 |
| Number Optional Labs | 0.14 | 0.37 | 1266 | 0.24 | 0.51 | 1275 |
| Number Unnecessary Labs | 0.12 | 0.39 | 1266 | 0.02 | 0.12 | 1275 |
| History Questions Asked | 6.32 | 3.25 | 1266 | 7.84 | 4.50 | 1275 |
| Time with Provider (Minutes) | 4.34 | 4.55 | 1266 | 4.99 | 5.10 | 1275 |
| Time Waiting for Provider (Minutes) | 69.97 | 65.73 | 1266 | 68.43 | 65.18 | 1275 |
| Total Patient Out of Pocket Payment (RWF), win 99th | 892.59 | 1562.02 | 1225 | 813.76 | 1308.69 | 1221 |
| Log Total Patient Out of Pocket Payment | 5.90 | 1.34 | 1225 | 5.88 | 1.36 | 1221 |
| *Case Presentation* | | | | | | |
| Babyl | 0.43 | | 1266 | 0.42 | | 1275 |
| Request | 0.25 | | 1266 | 0.25 | | 1275 |
| Suggest Correct | 0.25 | | 1263 | 0.25 | | 1272 |
| Suggest Incorrect | 0.26 | | 1263 | 0.26 | | 1272 |
| No Insurance | 0.15 | | 1266 | 0.19 | | 1275 |

*Notes:* Data collected during standardized patient visits. Outcomes include correct case management defined for malaria as ordering a malaria test and for URI as no unnecessary medicines or labs, prescribing of optional and unnecessary medicines, ordering or optional or unnecessary labs, history questions asked during the consultation, time spent with the provider during the consultation, time waiting for the consultation with the provider, and total patient out of pocket payments after insurance if used. Total costs in Rwandan Francs are winsorized at the 99th percentile. Optional and unnecessary medicine and lab categorization shown in Appendix Tables A2 and A3. Case presentation summarizes the share of SP visits when the SP requests an antibiotic, suggests a diagnosis, and pays out of pocket (not using CBHI).

### 4.3 Provider Knowledge, Background Characteristics, and Work Environment

In Table 7, we define the variables constructed from the provider survey data. Table 8 summarizes these variables for providers in Conventional Care (CC) and Babyl.[6] To maximize the sample in our main analyses, we impute missing values for these variables using the average across providers from the same setting (Babyl or CC).

Table 8 shows that the characteristics, experience, and work environment differ substantially between Babyl and CC. Relative to CC, Babyl has more doctors and more men. Providers tend to be younger and correspondingly have less experience in the health sector and at the particular facility. Providers also differ in their altruism towards patients. When playing a (real) dictator game with an unidentified patient, providers in CC gave 27% of their endowments to the patient while provider in Babyl only gave 22%.

There are also differences in the work environment between Babyl and CC which may affect providers' ability to provide quality care. CC providers tend to work full time at the facility (6 days/week), while providers work at Babyl only part-time (3 days/week). Perhaps in part due to the different work environment, providers at Babyl reported feeling less overwhelmed, less rushed, and less emotional exhaustion than CC providers.

In several categories, we do not find big differences between providers at Babyl and CC. In terms of the nature of the patient interaction, providers at both Babyl and CC reported similar beliefs about being persuaded by patients. On average, responses were similar to questions about pressure to agree with a patient's self-diagnosis and to prescribe drugs that patients request. Providers in Babyl and CC also scored similarly on most of the Big Five personality traits.

When given vignettes consistent with our SP cases, 99% of providers in both settings knew the correct case management (CCM) for malaria and reported that they would (correctly) order a malaria test. For the URI vignette, knowledge differed substantially, with only 48% of providers responding to the vignette with CCM in CC compared to 84% in Babyl. The discrepancy in knowledge of CCM is not explained by differences in experience; providers in both settings report that they frequently see patients consistent with the presentation in the vignettes. In CC, providers report that 48% of their patients have symptoms consistent with the malaria vignette and 61% with the URI vignette. In Babyl, providers report that 42% of their patients have symptoms consistent with the malaria vignette and 56% with the URI vignette.

[6]Two providers treated SPs in both CC and Babyl. This affects a total of 27 SP matches. These providers are classified in Table 8 according to the location where they took the provider survey.

Table 7: Provider Controls, Part 1

| **Category** | **Variable** | **Definition** |
|---|---|---|
| Provider Qualifications | Doctor | Indicator equal to 1 if provider is a doctor, 0 otherwise. |
| | Nurse | Indicator equal to 1 if provider is a nurse, 0 otherwise. |
| | Other | Indicator equal to 1 if provider is not a nurse or doctor, 0 otherwise. |
| Provider Background | Female | Indicator equal to 1 if provider is female, 0 otherwise. |
| | Age | Count variable showing age of provider, in years. |
| | Years in Health Sector | Provider reported years spent in health sector. |
| | Years at Health Facility | Provider reported years spent at current health facility/Babyl. |
| Workplace Environment | Overwhelmed | Provider reported number on a scale of 1-5 of how overwhelmed they feel, with 1 being least and 5 being most. |
| | Rushed | Provider reported number on a scale of 1-5 of how rushed they feel, with 1 being least and 5 being most. |
| Patient Persuasion | Others Feel Pressured to Agree with Patient Suggestions | Provider reported number on a scale of 1 to 5 of how often they think their colleagues are pressured to agree with patient suggestions for diagnosis, with 1 being none of the time and 5 being all of the time. |
| | I Feel Pressured to Agree with Patient Suggestions | Provider reported number on a scale of 1 to 5 of how often they are pressured to agree with patient suggestions for diagnosis, with 1 being none of the time and 5 being all of the time. |
| | Others Comply with Requests | Variable representing the percent of time the provider thinks their colleagues comply with patient requests for prescriptions. |
| | I Comply with Requests | Variable representing the percent of time the provider says they comply with patient requests for prescriptions. |

*Notes:* Part 1 of provider controls and their definitions. Provider qualifications are split up into indicators for whether the provider is a doctor, nurse, or neither. Other background characteristics include indicators for if the provider is female, and count variables for age, how long the provider has been in the health sector, and how long the provider has been at their current facility. Workplace environment variables measure how overwhelmed or pressured providers feel at work, while compliance variables measure how frequently providers report themselves or colleagues to comply with patient requests.

Table 7: Provider Controls, Part 2

| Category | Variable | Definition |
|---|---|---|
| Work Time and Location | Works in Other Facility | Indicator equal to 1 if the provider states they work in another facility. |
| | Hours Per Week at This Facility | Provider reported number of hours worked per week at facility in interview. |
| | Days Per Week at This Facility | Provider reported count variable measuring how many days a provider works at the specified facility. |
| | Works Full Time (5+ days per week) | Indicator equal to 1 if the provider states they work 5 or more days per week. |
| | Hours Per Shift | Provider reported count variable measuring how many hours a provider works per shift. |
| Maslach Burnout Inventory | MBI Emotional Exhaustion | Average of Maslach Burnout Inventory questions used to measure emotional exhaustion. |
| | MBI Depersonalization | Average of Maslach Burnout Inventory questions used to measure depersonalization. |
| | MBI Professional Accomplishment | Average of Maslach Burnout Inventory questions used to measure professional accomplishment. |
| Big Five Personality Traits | Extraversion | Average of Big Five Personality test questions measuring extraversion. Responses are measured on a scale of 1 to 5, with 1 being least and 5 being most. |
| | Agreeableness | Average of Big Five Personality test questions measuring agreeableness. |
| | Conscientiousness | Average of Big Five Personality test questions measuring conscientiousness. |
| | Neuroticism | Average of Big Five Personality test questions measuring neuroticism. |
| | Openness | Average of Big Five Personality test questions measuring openness. |
| Frequency / Correct Case Management | Percent Similar Patients, Malaria | Provider reported number of how many patients they think out of 100 present symptoms similar to those presented in the provider survey malaria vignette. |
| | Case Knowledge, Malaria | Provider knowledge of malaria correct case management, based on responses of how they would treat malaria. An indicator of 1 flags they would order a malaria test, indicating correct case management. |
| | Percent Similar Patients, URI | Provider reported number of how many patients they think out of 100 present symptoms similar to those presented in the provider survey URI vignette. |
| | Case Knowledge, URI | Provider knowledge of URI correct case management, based on responses of how they would treat URI; An indicator of 1 flags they would not prescribe or order any unnecessary medicines or labs, indicating correct case management. |
| Altruism | Dictator Game: Percent Given to Patient | Average percent of endowment given to patient by provider in the dictator games. |

*Notes:* Part 2 of provider controls and their definitions. These include variables such as if the provider works in another facility, how many hours per week they work, averages for Maslach Burnout Inventory questions, and averages for Big Five Personality Trait questions. Additionally we include variables measuring correct case management (Knowledge of correct case management: malaria/URI), an estimate of how many patients per 100 present malaria/URI symptoms, and an altruism measurement constructed by the average percent given by the provider to a patient across dictator games.

Table 8: Provider Characteristics in Conventional Care and Babyl

| | CC Mean | SD | N | Babyl Mean | SD | N | P-value of Difference |
|---|---|---|---|---|---|---|---|
| *Provider Qualifications* | | | | | | | |
| Doctor | 0.00 | | 327 | 0.22 | | 130 | <0.01 |
| Nurse | 0.93 | | 327 | 0.78 | | 130 | <0.01 |
| Other | 0.07 | | 327 | 0.00 | | 130 | <0.01 |
| *Provider Demographics* | | | | | | | |
| Female | 0.66 | | 327 | 0.39 | | 130 | <0.01 |
| Age | 40.12 | 8.48 | 327 | 35.48 | 5.79 | 130 | <0.01 |
| *Workplace experience* | | | | | | | |
| Years in Health Sector | 13.72 | 8.84 | 327 | 8.99 | 4.97 | 130 | <0.01 |
| Years at Health Facility | 7.58 | 6.60 | 327 | 3.12 | 1.42 | 130 | <0.01 |
| Overwhelmed | 3.29 | 1.36 | 326 | 2.47 | 1.32 | 129 | <0.01 |
| Rushed | 3.44 | 1.31 | 327 | 2.68 | 1.40 | 130 | <0.01 |
| *Patient Persuasion* | | | | | | | |
| Colleagues feel pressured to agree with patient suggestions | 1.94 | 0.96 | 327 | 1.73 | 0.95 | 126 | 0.04 |
| I feel pressured to agree with patients suggestions | 1.59 | 0.85 | 327 | 1.68 | 1.02 | 129 | |
| Others Comply with Requests | 7.07 | 16.99 | 317 | 10.22 | 22.62 | 121 | |
| I Comply with Requests | 6.51 | 18.15 | 327 | 9.70 | 23.81 | 130 | |
| *Work Time and Location* | | | | | | | |
| Works in Other Facility | 0.05 | 0.21 | 327 | 0.88 | 0.32 | 130 | <0.01 |
| Days per Week at This Facility | 5.73 | 0.69 | 327 | 2.87 | 0.81 | 130 | <0.01 |
| Works Full time (5+ days per week) | 0.99 | | 327 | | 0.21 | 130 | <0.01 |
| Hours per Week at this Facility | 52.49 | 8.90 | 327 | 15.21 | 6.39 | 129 | <0.01 |
| Hours per Shift | 9.14 | 0.92 | 327 | 5.17 | 0.79 | 130 | <0.01 |
| *Maslach Burnout Inventory* | | | | | | | |
| MBI Emotional Exhaustion | 2.33 | 1.03 | 327 | 1.73 | 1.15 | 130 | <0.01 |
| MBI Depersonalization | 0.41 | 0.63 | 327 | 0.51 | 0.77 | 130 | |
| MBI Professional Accomplishment | 5.47 | 0.52 | 327 | 5.35 | 0.74 | 130 | 0.06 |
| *Big Five Personality Traits* | | | | | | | |
| Extraversion | 0.03 | 0.99 | 327 | -0.09 | 1.00 | 130 | |
| Agreeableness | -0.02 | 0.99 | 327 | 0.05 | 1.00 | 130 | |
| Conscientiousness | 0.08 | 0.91 | 327 | -0.19 | 1.19 | 130 | 0.01 |
| Neuroticism | -0.06 | 0.92 | 327 | 0.15 | 1.16 | 130 | 0.04 |
| Openness | 0.03 | 0.99 | 327 | -0.07 | 1.00 | 130 | |
| *Frequency/Correct Case Management* | | | | | | | |
| Percent Similar Patients, Malaria | 48.01 | 26.19 | 327 | 41.48 | 22.92 | 130 | 0.01 |
| Case Knowledge, Malaria | 0.99 | | 327 | 0.99 | | 130 | |
| Percent Similar Patients, URI | 60.50 | 24.27 | 327 | 56.07 | 21.42 | 130 | 0.07 |
| Case Knowledge, URI | 0.48 | | 327 | 0.84 | | 130 | <0.01 |
| *Altruism* | | | | | | | |
| Dictator Game: Percent Given to Patient | 27.40 | 21.21 | 327 | 31.35 | 21.97 | 130 | 0.08 |

*Notes:* This table reports the mean and standard deviation of provider characteristics, separately for Conventional Care (first three columns) and Babyl (second three columns). The right most column shows the P-value of the difference in means between CC and Babyl using a proportion test for binary measures and a t-test for non-binary measures. P-values greater than 0.1 not displayed. All measures are defined in Section 4.3.

# 5 Identification and Estimation

To assess the effect of having the patient provider encounter via telemedicine, we estimate the following model by OLS:

$$Y_{ijk} = \beta_0 + \beta_1 * Babyl_i + \beta_2 * Provider_k + SP_j + \epsilon_{ijk}$$

Where:

$Y_{ijk}$ = Care outcome of encounter $i$ by SP $j$ with provider $k$

$Babyl_i$ = Encounter $i$ was a visit to Babyl

$Provider_k$ = Provider $k$ characteristics

$SP_j$ = SP $j$ fixed effects

$\epsilon_{ijk}$ = error term

There are two main threats to identifying the causal relationship between care outcomes and telemedicine: (i) patient selection and (ii) provider heterogeneity. In the first case, patients with characteristics that are correlated with better care outcomes, such as severity of illness or a demanding personality, could select telemedicine over conventional care. The use of SPs presenting a standardized case to providers to generate the data controls for selection based on illness type, and the inclusion of SP fixed effects controls for selection based on SP actor personality and any other unobservable characteristics.

In the second case, bias would be introduced if, for example, providers more skilled in the management of malaria or URI choose to practice at Babyl. To control for provider heterogeneity correlated with the care setting and care outcomes, we include a set of provider and clinic characteristics. The potential set of controls are described in section 3c above. Rather than just include all the possible control variables, we utilized double-selection lasso linear regression to identify the most appropriate controls (Belloni et al., 2014).

# 6 Results

## 6.1 Babyl vs. Conventional Care

To evaluate quality of care in telehealth compared to conventional care, we ask: How do quality of care, time spent, and patient costs differ across Babyl and CC? How much of these differences are explained by differences in provider characteristics across platforms?

Tables 9 and 10 summarize the key findings for malaria and URI, respectively. The tables show the coefficients on an indicator for Babyl (relative to CC) in a regression of the outcome from the SP visit, listed in the rows, on an indicator for Babyl and controls as listed. In Column (1) of each

table, the model is a simple OLS regression with no additional controls. We begin by describing the results of these models.

In malaria cases, there is no difference in correct case management (CCM), or ordering a malaria test, between Babyl and CC visits. CCM is very high (93% in CC); providers in both settings recognize the need for a malaria test and correctly order one. Almost all SPs receive at least one optional medicine (97% in CC), though Babyl SPs receive 0.18 (13%) more optional medicines than CC. There is no difference between Babyl and CC in the prescribing of unnecessary medicines. Babyl SPs receive 0.07 (41%) fewer optional labs and 0.18 (89%) fewer unnecessary labs.

Babyl providers are able to get more information out of patients in a shorter period of time; Babyl providers ask SPs 3 (62%) more history questions in consultations that are 1.3 minutes (27%) shorter. SPs also waited about an hour less (68%) for Babyl consultations. Babyl SPs pay roughly 13% less out of pocket than CC SPs, but the estimate is noisy and statistically insignificant in the benchmark OLS regression in Column (1).

In URI cases, providers have more discretion in how they treat patients. We define correct case management (CCM) as not prescribing any unnecessary medicines and not ordering any unnecessary labs. CCM for URI is much less common than for malaria with only 29% of SPs receiving CCM. For this empirically more difficult case, we find that SPs receive significantly better clinical care at Babyl. CCM is 28pp (165%) higher in Babyl than conventional care, largely coming from a reduction in the prescriptions of unnecessary medicines. Babyl SPs are 28pp (34%) less likely to receive an unnecessary medicine and receive 0.30 (34%) fewer of these medicines. This reduction in unnecessary prescribing is offset by the prescribing of optional medicines; Babyl SPs receive 0.31 (15%) more optional medicines which may be helpful to patients. As with malaria cases, Babyl URI SPs are ordered significantly fewer labs than CC. Babyl SPs receive 0.22 (67%) fewer optional labs and 0.02 (100%) fewer unnecessary labs.

Patient consultations for URI are also more efficient in Babyl than CC. After waiting an hour (68%) less for their consultation , Babyl providers ask SPs 5.7 (105%) more history questions in consultations that are 1.8 minutes (32%) shorter. Finally, in terms of costs, SPs pay about 42% less out of pocket for their URI consultations at Babyl than they do at the CC facilities.

To summarize across malaria and URI vists, we find that the quality of care on Babyl is at least as good as CC. SPs receive the same level of (high-quality) care for malaria and better care for URI, a condition when providers have more discretion. These telehealth visits are also more efficient; patient spend less time waiting and providers are able to extract more information during shorter consultations. These telehealth visits are also less costly for patients.

Next, we explore how these results change when we control for experimental variation in the case presentations, differences across providers, and features of the workplace.

Table 9: Malaria Outcomes in Babyl (vs. CC)

| Dependent Variable | CC Avg | (1) Babyl | (2) Babyl | (3) Babyl |
|---|---|---|---|---|
| Correct Case Management | 0.93 | -0.01 | -0.01 | 0.00 |
| | | (0.01) | (0.02) | (0.01) |
| Observations | | 1266 | 1257 | 1046 |
| Any Optional Medicine | 0.97 | -0.01 | -0.01 | -0.00 |
| | | (0.01) | (0.01) | (0.01) |
| Observations | | 1225 | 1222 | 1017 |
| Number Optional Medicines | 1.44 | 0.18*** | 0.17*** | 0.16*** |
| | | (0.04) | (0.04) | (0.04) |
| Observations | | 1225 | 1222 | 1017 |
| Any Unnecessary Medicine | 0.45 | 0.02 | 0.04 | 0.05 |
| | | (0.03) | (0.03) | (0.03) |
| Observations | | 1225 | 1222 | 1017 |
| Number Unnecessary Medicines | 0.53 | 0.01 | 0.01 | 0.02 |
| | | (0.04) | (0.04) | (0.04) |
| Observations | | 1225 | 1222 | 1017 |
| Number Optional Labs | 0.17 | -0.07*** | -0.05* | -0.07*** |
| | | (0.02) | (0.02) | (0.02) |
| Observations | | 1266 | 1257 | 1043 |
| Number Unnecessary Labs | 0.18 | -0.16*** | -0.15*** | -0.14*** |
| | | (0.02) | (0.03) | (0.02) |
| Observations | | 1266 | 1257 | 1046 |
| Questions Asked | 5.01 | 3.09*** | 3.24*** | 3.12*** |
| | | (0.16) | (0.18) | (0.17) |
| Observations | | 1266 | 1257 | 1046 |
| Time with Provider (Min) | 4.90 | -1.31*** | -1.24*** | -1.18*** |
| | | (0.26) | (0.30) | (0.19) |
| Observations | | 1266 | 1257 | 1046 |
| Time Waiting for Provider (Min) | 98.43 | -66.83*** | -66.78*** | -68.52*** |
| | | (3.23) | (3.86) | (2.80) |
| Observations | | 1266 | 1257 | 1046 |
| Log Total Patient Out of Pocket Payment | 5.96 | -0.13 | -0.27*** | -0.19** |
| | | (0.08) | (0.06) | (0.07) |
| Observations | | 1225 | 1220 | 1016 |
| SP Fixed Effects | | | X | X |
| Experimental Treatment | | | X | X |
| Provider Characteristics | | | | X |

*Notes:* This table reports the coefficient on an indicator for Babyl (vs. CC) from OLS regressions in Columns (1) and (2) and a Double/Debiased Machine Learning Model (DDML) with LASSO in Column (3). Experimental treatment includes indicators for suggestion and request treatment conditions. DDML selects controls from experimental treatments, an indicator for insurance, provider experience (qualification, age, experience in the health sector and facility, knowledge of correct case management, how often providers say patients present similar symptoms), provider characteristics (gender, big 5 personality traits, percent of endowment given to patients in a dictator game, self and other compliance with patient requests and suggestions), and work environment (indicators for SP visit happening in the morning and on the weekend; measures of how overwhelmed, rushed, and burned out providers feel). Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 10: URI Outcomes in Babyl (vs. CC)

| Dependent Variable | CC Avg | (1) Babyl | (2) Babyl | (3) Babyl |
|---|---|---|---|---|
| Correct Case Management | 0.17 | 0.28*** | 0.29*** | 0.29*** |
| | | (0.02) | (0.03) | (0.02) |
| Observations | | 1241 | 1237 | 1023 |
| Any Optional Medicine | 0.98 | -0.01 | -0.03** | -0.01 |
| | | (0.01) | (0.01) | (0.01) |
| Observations | | 1241 | 1237 | 1023 |
| Number Optional Medicines | 2.02 | 0.31*** | 0.25*** | 0.31*** |
| | | (0.04) | (0.05) | (0.04) |
| Observations | | 1241 | 1237 | 1022 |
| Any Unnecessary Medicine | 0.82 | -0.28*** | -0.29*** | -0.29*** |
| | | (0.03) | (0.03) | (0.02) |
| Observations | | 1241 | 1237 | 1023 |
| Number Unnecessary Medicines | 0.88 | -0.30*** | -0.29*** | -0.32*** |
| | | (0.03) | (0.04) | (0.03) |
| Observations | | 1241 | 1237 | 1023 |
| Number Optional Labs | 0.33 | -0.22*** | -0.22*** | -0.22*** |
| | | (0.03) | (0.03) | (0.02) |
| Observations | | 1275 | 1266 | 1045 |
| Number Unnecessary Labs | 0.02 | -0.02* | -0.02 | -0.02* |
| | | (0.01) | (0.01) | (0.01) |
| Observations | | 1275 | 1266 | 1043 |
| Questions Asked | 5.43 | 5.68*** | 5.95*** | 6.08*** |
| | | (0.20) | (0.21) | (0.18) |
| Observations | | 1275 | 1266 | 1048 |
| Time with Provider (Min) | 5.77 | -1.84*** | -1.77*** | -1.69*** |
| | | (0.28) | (0.33) | (0.22) |
| Observations | | 1275 | 1266 | 1048 |
| Time Waiting for Provider (Min) | 96.22 | -65.49*** | -66.75*** | -69.65*** |
| | | (3.21) | (3.78) | (2.80) |
| Observations | | 1275 | 1266 | 1048 |
| Log Total Patient Out of Pocket Payment | 6.05 | -0.42*** | -0.56*** | -0.39*** |
| | | (0.08) | (0.07) | (0.06) |
| Observations | | 1221 | 1215 | 1003 |
| SP Fixed Effects | | | X | X |
| Experimental Treatment | | | X | X |
| Provider Characteristics | | | | X |

*Notes:* This table reports the coefficient on an indicator for Babyl (vs. CC) from OLS regressions in Columns (1) and (2) and a Double/Debiased Machine Learning Model (DDML) with LASSO in Column (3). Experimental treatment includes indicators for suggestion and request treatment conditions. DDML selects controls from experimental treatments, an indicator for insurance, provider experience (qualification, age, experience in the health sector and facility, knowledge of correct case management, how often providers say patients present similar symptoms), provider characteristics (gender, big 5 personality traits, percent of endowment given to patients in a dictator game, self and other compliance with patient requests and suggestions), and work environment (indicators for SP visit happening in the morning and on the weekend; measures of how overwhelmed, rushed, and burned out providers feel). Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In Column (2), we add controls for potential sources of variation introduced in the SP framework, namely SP fixed effects and controls for any experimental treatment variation. Though all SPs were trained to present the same script, there may be differences across SPs that lead to systematically different outcomes (e.g., men may be treated differently than women). We include SP fixed effects to control for these potential differences and identify the effect of Babyl from differences in outcomes *within* SP. We also control for experimental variation in the presentation of the case including whether the SP suggests their diagnosis at the start of the interaction, whether the SP requests an antibiotic, and whether the SP pays out of pocket (instead of using CBHI).

Including these experimental controls and SP fixed effects has little impact on the results. While the coefficients in most models are almost identical, the one exception is patient out of pocket costs. For both malaria and URI, Babyl SPs pay more out of pocket than CC when we include SP fixed effects and experimental treatment controls.

In the models in Columns (1) and (2), we identify the difference in outcomes when the same patient seeks care from Babyl compared to a CC facility. This is the total effect, including the impact of the platform (telehealth vs. in-person) on provider behavior, as well as other differences across platforms, including the selection of providers who choose to work at Babyl vs. CC, and features of the work environment that may differ across platforms.

As shown in Table 8, providers in CC and Babyl differ quite significantly in their characteristics, experience, and the workplace environment. In Column (3), we attempt to isolate the impact of the platform (Babyl vs. CC) from these differences in the providers across platforms. Ideally, to isolate the impact of the platform, we would compare patient outcomes for the same patient visiting the same provider in both Babyl vs. CC. Because we can't experimentally vary where providers choose to treat patients, we instead use the battery of measures from our provider survey to try to control for these differences in provider experience, characteristics, and impact of the workplace environment. To avoid over-fitting the data with the many potential controls, we use double/debiased machine learning with lasso to select from the following controls:

- Provider is a doctor
- Provider is female
- Provider age (bins of under 30, 30-34, 35-39, 40-44, 45-49, 50+)
- Provider years of experience in the health sector (bins of under 4, 4-5.9, 6-7.9, 8-9.9, 10-14.9, 15-19.9, 20-24.9, 25+)
- Provider years of experience at the health facility (bins of under 2, 2-2.9, 3-3.9, 4-4.9, 5-9.9, 10-14.9, 15)
- Provider's percent of patients with symptoms similar to the case (bins of under 20, 20-39, 40-59, 60-79, 80-100)
- Provider knowledge of CCM as measured by the vignettes
- Provider feels overwhelmed (bins of 1, 2, 3, 4, 5)

- Provider feels rushed (categorical variable of values 1-5)
- Provider feels rushed (bins of 1, 2, 3 ,4, 5)
- Big five personality traits: Extraversion, Agreeableness, Conscientiousness, Neuroticism, Openness (standardized across providers)
- Average percent of endowment the provider gives to the patient in the dictator game
- Provider perception of pressure to agree with patient self-diagnosis (indicators for ratings 1 to 5)
- Provider perception of whether colleagues agree with patient self-diagnosis (indicators for ratings 1 to 5)
- Percent of time provider prescribes drugs that are medically unnecessary when the patient requests (above median across providers)
- Percent of time provider thinks their colleagues prescribe drugs that are medically unnecessary when the patient requests (above median across providers)
- SP visit in the morning (7-11am)
- SP visit on a weekend (Saturday and Sunday)

Column (3) reports the Babyl coefficient from each of these models. Appendix Table A4 reports the selected controls for each model. The results change very little when we also allow the model to control for differences across providers. Again, the one exception is patient out of pocket costs, where the estimates look more similar to those in Column (1) without any controls.

As seen in Appendix Table A4, despite the large number of potential controls to be selected from, the lasso model selects very few. While we observe many differences across Babyl and CC providers, these differences don't appear to have a big impact on quality of care. We explore this in more depth in Section 6.3. The experimental treatment control that is most consistently selected by the lasso model is whether the SP pays out of pocket (vs. using CBHI). In all subsequent analyses, we include an indicator for whether the SP pays out of pocket as a control.

In Table 11, we further explore whether there is a difference between Babyl and CC in the importance of insurance status for total patient out of pocket payments. Specifically, we regress log total patient out of pocket payments on an indicator for Babyl, paying out of pocket, and their interaction. The first three Columns are for malaria cases and the second three are for URI cases.

Parallel to the models in Tables 9 and 10, Columns (1) and (4) are OLS regressions with no additional controls, Columns (2) and (5) include SP fixed effects and controls for suggestion and request experiments, and Columns (3) and (6) show the coefficients from the DDML model using lasso to select from the same set of controls in Tables 9 and 10, excluding paying out of pocket.

Across all specifications, SPs pay about 20-45% less on Babyl than in CC. Patients pay more out of pocket when they don't use CBHI. This captures both a mechanical effect as SPs paying out of pocket would pay more for the same interaction and a behavioral effect if they receive different labs or treatments. For malaria, the difference in total payments between SPs with and without

insurance is significantly larger in the specifications in Columns (1) and (2) and is large, but noisy and statistically insignificant, in Column (3). For URI cases, the models in Columns (4) and (5) suggest that SPs paying out of pocket pay roughly 30% more than those using CBHI, but the estimates are noisy and statistically insignificant and disappear completely when we estimate the DDML model in Column (6).

Table 11: Patient Costs When Paying Without Insurance (vs. CBHI)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Malaria | | | URI | | |
| | Log of Total Patient Out of Pocket Payment (RWF) | | | | | |
| Babyl | -0.18** | -0.37*** | -0.28*** | -0.30*** | -0.45*** | -0.37*** |
| | (0.06) | (0.06) | (0.08) | (0.07) | (0.07) | (0.09) |
| No Insurance | 2.12*** | 0.92*** | 2.17*** | 2.12*** | 1.57*** | 2.17*** |
| | (0.10) | (0.14) | (0.11) | (0.09) | (0.14) | (0.10) |
| No Insurance × Babyl | 0.76*** | 1.01*** | 0.39 | 0.29 | 0.37 | 0.00 |
| | (0.16) | (0.16) | (0.21) | (0.16) | (0.20) | (0.22) |
| Babyl + No Insurance X Babyl | 0.58*** | 0.64*** | 0.10 | -0.01 | -0.08 | -0.36 |
| | (0.15) | (0.15) | (0.21) | (0.15) | (0.18) | (0.22) |
| No Insurance + No Insurance X Babyl | 2.87*** | 1.93*** | 2.55*** | 2.41*** | 1.94*** | 2.17*** |
| | (0.13) | (0.16) | (0.18) | (0.13) | (0.17) | (0.20) |
| Observations | 1225 | 1220 | 1016 | 1221 | 1215 | 1001 |
| $R^2$ | 0.436 | 0.655 | | 0.430 | 0.557 | |
| Mean Dependent Variable in CC | 5.96 | 5.96 | 5.94 | 6.05 | 6.05 | 6.06 |
| SP Fixed Effects | | X | X | | X | X |
| Experimental Treatment | | X | X | | X | X |
| Provider Characteristics | | | X | | | X |

*Notes:* This table reports the coefficients from OLS regressions in Columns (1) and (4) and a Double/Debiased Machine Learning Model (DDML) with LASSO in Columns (2), (3), (5), and (6). The dependent variable in all models is log total out of pocket cost (plus 1) that patients paid for their visit. Pay Out of Pocket indicates the patient was paying out of pocket (instead of using CBHI). Experimental treatment includes indicators for suggestion and request treatment conditions. DDML selects controls from indicators for suggestion and request treatment conditions, provider experience (qualification, age, experience in the health sector and facility, knowledge of correct case management, how often providers say patients present similar symptoms), provider characteristics (gender, big 5 personality traits, percent of endowment given to patients in a dictator game, self and other compliance with patient requests and suggestions), and work environment (indicators for SP visit happening in the morning and on the weekend; measures of how overwhelmed, rushed, and burned out providers feel). Standard errors are reported in parentheses. Standard errors for the combination of variables are computed via the delta method. $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$.

### 6.1.1 Babyl-Only Outcomes

**Diarrhea Cases** Malaria and URI are the focus of this report, as this is where we are able to compare the SP visit outcomes across Babyl and CC. These conditions were selected to capture both potential under- and over-treatment across platforms. Babyl providers have the authorization to treat both of these conditions on the platform, and thus we can compare SP outcomes from visits in both settings.

Another aspect of quality in telehealth is what happens when providers are faced with a case that they cannot treat over the phone. Do providers recognize when they should refer a patient to in person care?

We selected a case of severe diarrhea to test whether Babyl providers would refer the patient. Out of 145 SP visits, only 2 (1.4%) were correctly referred to a health facility for further care.

The deviation from the Babyl protocols for these visits is concerning, but without the comparison of SP outcomes in CC, the ultimate impact on patients is not clear. We cannot say whether the care patients received on Babyl was worse than what they would have received had they been correctly referred to CC. Future work could explore whether providers deviate from their protocols when it is beneficial for patients, as in Boone (2024).

**Babyl Agents** In the main analyses, we focus on SP outcomes through the end of the initial consultation with the provider. After this initial consultation over the phone, Babyl SPs were given a code and directed to the closest health facility to take any ordered labs and pick up any prescribed medicines. At the facility, a Babyl Agent was responsible for decoding the code to let the lab tech or pharmacist know what the SP needed.

In 24% of Babyl visits, there was no Babyl Agent to help the SP when they visited the facility. It was often a time-consuming process for SPs to look for an Agent, call back Babyl to ask what to do, and wait for a Babyl Agent who may or may not arrive. While looking for the Agent, SPs were often encouraged by CC staff to have another consultation at the facility. SPs who did find an Agent spent an average of 11 min (SD = 23) waiting for their help.

The ability of a patient to follow-through with taking any ordered labs and picking up prescribed medicines is critical to the success of a telehealth platform. In the Rwandan context, the necessity of the Babyl Agents to facilitate this next step is a potential barrier to the widespread successful use of telehealth.

## 6.2 Suggestion & Request Experiments

In this section, we describe the results from the suggestion and request experiments. These experiments are designed to answer the following research questions: Are providers influenced

by patient suggestion of their diagnosis or request of a treatment? Does this vary whether treated over the phone or in-person? Does this vary by SP characteristics like gender, age, or insurance status?

With the suggestion experiments, we explore whether providers treat patients differently when a diagnosis is suggested at the start of the interaction. In Table 12 we report the results of OLS regressions of SP treatment outcomes on indicators for Babyl (vs. CC), the suggestion experimental treatment, and their interaction. All regressions control for whether the SP pays out of pocket (vs. using CBHI).

In Column (1), we find that correctly suggesting a malaria diagnosis has no impact on CCM (ordering a malaria test). This is unsurprising given the very high rate of CCM in malaria visits; there is not much room for improvement when the SP suggests a malaria diagnosis.

In Column (2), we find that suggesting COVID at the start of the malaria case does significantly increase the likelihood of receiving a COVID test by 24pp. There is no difference in the effect whether the SP suggests COVID in Babyl or CC; however, we do find that the baseline rate of COVID tests administered in Babyl (without a suggestion) is 5pp lower. The normative interpretation of this difference is unclear.

In Column (3), we find that suggesting a common cold has no impact on CCM. Suggesting Pneumonia reduces CCM by 6pp. The results in Column (4) suggest that part of this comes from an increase in medications that can be used to treat Pneumonia, but the estimated coefficient is noisy and statistically insignificant. As with malaria, we find no strong evidence that providers in Babyl are more or less responsive to patients' suggestions than providers in CC.

In Appendix Table A5, we interact the suggestion experiment indicators with SP characteristics (age, gender, and insurance). We do not find any evidence that suggestions are systematically more effective for any particular type of SP.

Table 12: Suggestion Experiments

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Malaria Cases | | URI Cases | |
| | CCM | Ordered COVID Test | CCM | Prescribed Pneumonia Medicine |
| Babyl | -0.01 | -0.05* | 0.27*** | -0.11** |
| | (0.02) | (0.02) | (0.03) | (0.03) |
| Suggest Malaria | 0.01 | -0.00 | | |
| | (0.02) | (0.02) | | |
| Babyl × Suggest Malaria | 0.02 | | | |
| | (0.03) | | | |
| Suggest COVID | -0.02 | 0.24*** | | |
| | (0.02) | (0.02) | | |
| Babyl × Suggest COVID | | -0.00 | | |
| | | (0.04) | | |
| Suggest URI | | | 0.01 | -0.02 |
| | | | (0.04) | (0.03) |
| Babyl × Suggest URI | | | 0.03 | |
| | | | (0.06) | |
| Suggest Pneumonia | | | -0.06* | 0.05 |
| | | | (0.03) | (0.04) |
| Babyl × Suggest Pneumonia | | | | -0.00 |
| | | | | (0.07) |
| No Insurance | -0.08*** | 0.02 | -0.05 | 0.11** |
| | (0.02) | (0.02) | (0.03) | (0.04) |
| Babyl + Babyl X Suggest | 0.01 | -0.05 | 0.30*** | -0.11* |
| | (0.03) | (0.03) | (0.05) | (0.06) |
| Observations | 1263 | 1263 | 1240 | 1240 |
| $R^2$ | 0.016 | 0.134 | 0.100 | 0.023 |
| Mean Dependent Variable in CC | 0.93 | 0.12 | 0.17 | 0.51 |

*Notes:* This table reports estimates from OLS regressions of care outcomes on the suggestion experimental treatments, an indicator for Babyl (vs. CC), and their interactions. Pay out of pocket indicates the patient was not using CBHI. Columns (1) and (2) are limited to malaria cases. Columns (3) and (4) are limited to URI cases. Standard errors are reported in parentheses. Standard errors for the combination of variables are computed via the delta method. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 13: Request Experiments

| | (1) Prescribed Bactrim Malaria | (2) Prescribed Ciprofloxacin URI |
|---|---|---|
| Babyl | -0.06*** | -0.00 |
| | (0.02) | (0.01) |
| Request Bactrim | 0.18*** | |
| | (0.02) | |
| Babyl × Request Bactrim | -0.15*** | |
| | (0.03) | |
| Request Ciprofloxacin | | 0.06*** |
| | | (0.01) |
| Babyl × Request Ciprofloxacin | | -0.03 |
| | | (0.02) |
| No Insurance | 0.06** | 0.01 |
| | (0.02) | (0.01) |
| Constant | 0.06*** | 0.00 |
| | (0.01) | (0.01) |
| Babyl + Babyl X Request | -0.21*** | -0.03* |
| | (0.03) | (0.01) |
| Request + Babyl X Request | 0.04 | 0.03* |
| | (0.03) | (0.01) |
| Observations | 1225 | 1241 |
| $R^2$ | 0.101 | 0.032 |
| Mean Dependent Variable in CC | 0.11 | 0.02 |

*Notes:* This table reports estimates from OLS regressions of prescribing behavior on the request experimental treatments, an indicator for Babyl (vs. CC), and their interactions. Request is an indicator for whether the SP requested an antibiotic during the interaction (Bactrim for malaria cases and Ciprofloxacin for URI). Pay out of pocket indicates the patient was not using CBHI. Column (1) is limited to malaria cases, Column (2) to URI, and Column (3) includes both. Dependent variable is whether the provider prescribed Bactrim from malaria and Ciprofloxacin (Cipro) for URI. Standard errors in parentheses. $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$.

In Table 13, we summarize the results of our request experiments. We regress indicators for prescriptions of Bactrim (for malaria) and Ciprofloxacin (for URI) on indicators for Babyl (vs. CC), whether the SP requested the antibiotic, and their interaction. Both regressions control for whether the SP pays out of pocket. Relative to CC, Babyl providers are 6pp less likely to prescribe Bactrim without a request. When an SP request Bactrim, they are 18pp more likely to get it from CC and 4pp more likely to get it from Babyl. We see a similar pattern for prescribing of Ciprofloxacin in URI in Column (2). When an SP requests Ciprofloxacin, they are 6pp more likely to get it in CC, but only 3pp more likely to get it in Babyl.

We find that providers are susceptible to patient requests for drugs and will over-prescribe some antibiotics when asked. At least one possible explanation for this is that providers feel pressure to say yes when a patient asks for something. In this interpretation, our results suggest that it may be easier to say no to a patient over the phone rather than in a face-to-face interaction. If so, telehealth may be welfare improving in these types of interactions: reducing the prescriptions of unnecessary antibiotics without requiring doctors to say no in costly face-to-face interactions.

In Appendix Table A6, we also explore whether requests are more or less effective for particular types of patients. In malaria cases, we find that requests are more effective for older SPs and those paying out of pocket, but we don't see the same pattern in URI cases.

### 6.3 Provider Experience, Characteristics, & Work Environment

In Section 6.1, we used lasso to select from a large set of potential controls in our main regression analyses. In this section, we explore in more depth controls for provider experience, characteristics, and work environment. Specifically, we address the following research questions: What characteristics of providers predict quality of care? How does care differ when providers are tired at the end of their shift? When they are busy? When they are burnt-out?

To answer these questions, in this section we present a condensed version of the OLS regressions in Column (1) of Tables 9 and 10 adding various sets of controls in each table. The outcomes in each table are CCM for malaria, CCM for URI, and pooled outcomes for the number of optional medicines, unnecessary medicines, optional labs, unnecessary labs, history questions asked. We also report pooled outcomes for time spent with the provider during the initial consultation, time spent waiting for the consultation, and the log of total patient out of pocket costs.

In Table 14, we include controls that measure provider experience: whether the provider is a doctor (vs. nurse or other), above median age, above median experience in the health sector, above median experience in the facility, the percent of patients the provider sees with symptoms similar to the case, and case knowledge measured in the vignettes. We also control for Babyl (vs. CC),

whether the SP pays out of pocket (vs. using CBHI), and whether the case was malaria (vs. URI) for pooled regressions in Columns (3) to (10).

Consistent with the results described in Section 6.1, we see little evidence that provider experience systematically predicts SP outcomes. Doctors prescribe more unnecessary medicines and have higher patient out of pocket costs. Younger providers prescribe more unnecessary medicines, order more optional labs, and have shorter wait times. Providers with more experience in the health sector have better CCM for malaria, order more unnecessary labs, and ask more questions during the consultation. Providers with more experience at the health facility ask fewer questions. Providers who see more patients similar to the case presentation ask more questions and have a shorter wait time. Providers with knowledge of the correct case management (as measured in the vignettes) prescribed fewer unnecessary medicines.

Though we report the significant associations here, we caution the reader from over-interpreting these results as these may be spurious correlations. Out of 60 coefficients on provider experience measures, 12 are statistically significant. Only one control is selected in our preferred ML approach (described in Section 6.1): that SPs who see doctors have significantly different out of pocket costs.

Table 14: Provider Experience

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| Doctor | -0.02 | -0.11 | -0.01 | 0.15* | 0.03 | 0.04 | 0.31 | -0.37 | 6.88 | 0.74*** |
| | (0.03) | (0.06) | (0.07) | (0.06) | (0.04) | (0.03) | (0.32) | (0.51) | (5.69) | (0.11) |
| Above Median Age | -0.03 | 0.05 | -0.01 | -0.11** | -0.05 | -0.05** | -0.01 | 0.52 | 7.54* | 0.03 |
| | (0.02) | (0.04) | (0.04) | (0.04) | (0.03) | (0.02) | (0.20) | (0.32) | (3.63) | (0.07) |
| Above Median Health Experience | 0.05* | 0.01 | -0.02 | 0.03 | 0.01 | 0.06** | 0.52* | 0.32 | -2.26 | -0.01 |
| | (0.02) | (0.04) | (0.04) | (0.04) | (0.03) | (0.02) | (0.20) | (0.32) | (3.63) | (0.07) |
| Above Median Facility Experience | -0.01 | 0.07 | -0.07 | -0.04 | 0.04 | 0.01 | -1.26*** | -0.43 | -0.20 | 0.02 |
| | (0.03) | (0.04) | (0.05) | (0.04) | (0.03) | (0.02) | (0.22) | (0.35) | (3.91) | (0.07) |
| Percent Similar Patients | 0.01 | 0.02 | -0.03 | -0.03 | 0.04 | -0.01 | 0.29* | -0.00 | -5.62* | -0.01 |
| | (0.02) | (0.03) | (0.03) | (0.03) | (0.02) | (0.01) | (0.14) | (0.22) | (2.50) | (0.05) |
| Case Knowledge | -0.07 | 0.06 | 0.02 | -0.11** | -0.04 | 0.02 | 0.26 | -0.33 | 6.79 | -0.12 |
| | (0.09) | (0.03) | (0.04) | (0.04) | (0.03) | (0.02) | (0.20) | (0.32) | (3.61) | (0.07) |
| Babyl | -0.00 | 0.31*** | 0.24*** | -0.17*** | -0.15*** | -0.11*** | 4.75*** | -1.11*** | -68.34*** | -0.30*** |
| | (0.02) | (0.03) | (0.04) | (0.03) | (0.02) | (0.02) | (0.16) | (0.26) | (2.94) | (0.06) |
| No Insurance | -0.09*** | -0.02 | -0.00 | 0.10* | -0.06* | 0.00 | 0.19 | 0.60 | -15.87*** | 2.12*** |
| | (0.02) | (0.04) | (0.04) | (0.04) | (0.03) | (0.02) | (0.20) | (0.31) | (3.52) | (0.06) |
| Malaria | | | -0.64*** | -0.18*** | -0.08*** | 0.09*** | -1.57*** | -0.50* | -2.12 | 0.14** |
| | | | (0.03) | (0.03) | (0.02) | (0.01) | (0.16) | (0.25) | (2.80) | (0.05) |
| Constant | 1.01*** | 0.04 | 2.14*** | 0.96*** | 0.30*** | 0.04 | 6.28*** | 5.57*** | 96.97*** | 5.60*** |
| | (0.09) | (0.04) | (0.05) | (0.05) | (0.03) | (0.02) | (0.24) | (0.39) | (4.36) | (0.08) |
| Observations | 1091 | 1049 | 2111 | 2111 | 2166 | 2166 | 2166 | 2166 | 2166 | 2088 |
| $R^2$ | 0.025 | 0.125 | 0.209 | 0.068 | 0.042 | 0.058 | 0.373 | 0.032 | 0.262 | 0.425 |
| Mean Dependent Variable in CC | 0.94 | 0.16 | 1.73 | 0.71 | 0.25 | 0.11 | 5.12 | 5.31 | 97.87 | 6.00 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on measures of provider experience including whether the provider is a doctor, above median aged, has above median years working in the health sector, has above median years working in the facility, the percent of patients they typically see with symptoms similar to the case presentation, knowledge of correct case management for the case presentation. All regressions control for whether the visit is at Babyl (vs. CC), whether the case is malaria (vs. URI), and whether the SP pays out of pocket (vs. using CBHI). Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Table 15, we conduct a similar exercise including as controls provider characteristics including gender, Big Five personality traits, and the average percent of endowments given to the patient in the dictator game. As with the provider experience measures, there are no clear systematic differences. None of the measures were selected in the ML models of Section 6.1. Providers who measure high in extraversion have lower CCM for URI, higher wait times, and lower patient out of pocket costs. Providers high in agreeableness prescribe more optional medicines. Providers high in conscientiousness have higer CCM for URI, fewer unnecessary medicines, and fewer questions asked. Providers high in neuroticism have longer wait times. Providers high in openness prescribe fewer optional medicines and ask more questions. Providers who share more of their endowments with the patient in the dictator game have lower out of pocket costs.

Table 15: Provider Characteristics

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| Female | -0.01 | -0.00 | -0.10** | -0.04 | -0.05* | -0.00 | 0.16 | 0.05 | 5.55* | -0.02 |
| | (0.02) | (0.03) | (0.03) | (0.03) | (0.02) | (0.01) | (0.14) | (0.18) | (2.50) | (0.05) |
| Big Five: Extraversion | -0.00 | -0.03* | -0.03 | 0.02 | -0.01 | 0.01 | 0.06 | -0.13 | 7.10*** | -0.08** |
| | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.01) | (0.08) | (0.10) | (1.32) | (0.03) |
| Big Five: Agreeableness | -0.01 | 0.01 | 0.04* | -0.02 | 0.02 | 0.01 | -0.03 | 0.13 | 1.09 | 0.02 |
| | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.01) | (0.07) | (0.10) | (1.29) | (0.02) |
| Big Five: Conscientiousness | -0.01 | 0.03* | -0.03 | -0.04* | -0.00 | -0.00 | -0.21* | -0.13 | -1.19 | -0.04 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.01) | (0.01) | (0.08) | (0.11) | (1.48) | (0.03) |
| Big Five: Neuroticism | -0.00 | -0.00 | 0.02 | 0.01 | 0.01 | 0.00 | 0.00 | 0.05 | 4.53*** | 0.02 |
| | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.01) | (0.07) | (0.09) | (1.28) | (0.02) |
| Big Five: Openness | -0.01 | -0.01 | -0.04* | 0.02 | 0.02 | 0.00 | 0.15* | 0.11 | 2.05 | -0.03 |
| | (0.01) | (0.02) | (0.02) | (0.01) | (0.01) | (0.01) | (0.08) | (0.10) | (1.36) | (0.03) |
| Dictator Game: Percent Given to Patient | -0.00 | 0.00 | 0.00 | 0.00 | -0.00 | -0.00 | -0.00 | -0.00 | -0.17** | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.06) | (0.00) |
| Babyl | -0.02 | 0.30*** | 0.21*** | -0.15*** | -0.15*** | -0.08*** | 4.60*** | -1.46*** | -65.09*** | -0.23*** |
| | (0.02) | (0.03) | (0.03) | (0.03) | (0.02) | (0.01) | (0.14) | (0.19) | (2.53) | (0.05) |
| No Insurance | -0.10*** | -0.05 | -0.01 | 0.14*** | -0.06* | 0.00 | 0.27 | 0.17 | -14.97*** | 2.28*** |
| | (0.02) | (0.03) | (0.04) | (0.04) | (0.03) | (0.02) | (0.19) | (0.24) | (3.27) | (0.06) |
| Malaria | | | -0.65*** | -0.21*** | -0.10*** | 0.10*** | -1.51*** | -0.51** | 0.93 | 0.10* |
| | | | (0.03) | (0.03) | (0.02) | (0.01) | (0.14) | (0.18) | (2.42) | (0.05) |
| Constant | 0.97*** | 0.16*** | 2.09*** | 0.81*** | 0.34*** | 0.07*** | 5.75*** | 5.40*** | 101.10*** | 5.51*** |
| | (0.02) | (0.03) | (0.04) | (0.03) | (0.02) | (0.02) | (0.18) | (0.23) | (3.18) | (0.06) |
| Observations | 1075 | 1038 | 2084 | 2084 | 2139 | 2139 | 2139 | 2139 | 2139 | 2061 |
| $R^2$ | 0.029 | 0.117 | 0.222 | 0.061 | 0.044 | 0.052 | 0.364 | 0.037 | 0.274 | 0.414 |
| Mean Dependent Variable in CC | 0.94 | 0.16 | 1.73 | 0.71 | 0.25 | 0.11 | 5.11 | 5.20 | 97.33 | 6.00 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on provider characteristics including whether the provider is female, Big Five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness) normalized to mean of 0 and standard deviation of 1, and the average percent of endowment shared with a patient in the dictator game. All regressions control for whether the visit is at Babyl (vs. CC), whether the case is malaria (vs. URI), and whether the SP pays out of pocket (vs. using CBHI). Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Finally, in Table 16, we include controls for features of the work environment. These include proxies for how busy the facility was at the time of the visit (indicators for morning visits from 7-11am, visits on a weekend, and the SP's wait time (normalized to mean 0 and standard deviation 1 for Babyl and CC visits separately), indicators for whether the provider was above median on ratings of feeling overwhelmed and rushed, as well as the provider's Maslach Burnout Inventory subscale averages for emotional exhaustion, depersonalization, and professional accomplishment.

SPs who visited in the morning have lower CCM for URI, more unnecessary medicines, and a lower wait time. Weekend visits have shorter wait time. SP visits with a longer wait time (thus visiting the facility or Babyl at a busier time) have lower CCM for malaria and fewer optional labs. Providers who feel more overwhelmed have lower CCM for malaria. Providers who feel more rushed have more unnecessary labs. Providers high in MBI depersonalization prescribe more optional medicines, ask more questions, and have higher patient out of pocket costs. In the ML models of Section 6.1, MBI depersonalization was selected in the model of time spent with provider for malaria. Morning was selected in the models of wait time for both URI and malaria. Weekend was selected in the model of wait time for malaria.

Table 16: Work Environment

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| Morning | 0.02 | -0.11*** | 0.02 | 0.08** | 0.04 | 0.02 | -0.02 | -0.16 | -33.81*** | -0.00 |
| | (0.02) | (0.03) | (0.03) | (0.03) | (0.02) | (0.01) | (0.16) | (0.26) | (2.66) | (0.05) |
| Weekend | -0.01 | -0.03 | 0.01 | -0.02 | 0.01 | -0.01 | -0.33 | 0.37 | -16.64*** | 0.03 |
| | (0.02) | (0.04) | (0.04) | (0.04) | (0.03) | (0.02) | (0.21) | (0.34) | (3.61) | (0.07) |
| Normalized Wait Time | -0.03** | 0.00 | 0.02 | 0.01 | -0.02* | 0.00 | -0.11 | -0.07 | | -0.04 |
| | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.01) | (0.07) | (0.12) | | (0.02) |
| Above Median Overwhelmed | -0.07** | -0.02 | -0.03 | 0.06 | 0.00 | -0.02 | -0.15 | 0.01 | 7.94 | -0.08 |
| | (0.03) | (0.05) | (0.05) | (0.04) | (0.03) | (0.02) | (0.24) | (0.39) | (4.11) | (0.08) |
| Above Median Rushed | 0.02 | -0.07 | -0.01 | -0.02 | -0.00 | 0.05* | 0.04 | -0.18 | -6.40 | 0.06 |
| | (0.02) | (0.04) | (0.05) | (0.04) | (0.03) | (0.02) | (0.23) | (0.37) | (3.93) | (0.08) |
| MBI Emotional Exhaustion | -0.00 | -0.00 | -0.01 | -0.02 | -0.02 | 0.00 | -0.07 | 0.09 | 0.64 | -0.02 |
| | (0.01) | (0.01) | (0.02) | (0.01) | (0.01) | (0.01) | (0.07) | (0.12) | (1.26) | (0.02) |
| MBI Depersonalization | 0.01 | 0.01 | 0.08** | 0.01 | 0.01 | -0.02 | 0.32** | 0.34 | -3.59 | 0.10** |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.11) | (0.18) | (1.94) | (0.04) |
| MBI Professional Accomplishment | -0.01 | -0.02 | 0.05 | 0.01 | -0.01 | -0.00 | -0.09 | -0.03 | -2.30 | -0.02 |
| | (0.01) | (0.02) | (0.03) | (0.02) | (0.02) | (0.01) | (0.12) | (0.19) | (2.06) | (0.04) |
| Babyl | -0.01 | 0.25*** | 0.24*** | -0.12*** | -0.16*** | -0.08*** | 4.51*** | -1.53*** | -73.73*** | -0.23*** |
| | (0.02) | (0.03) | (0.03) | (0.03) | (0.02) | (0.01) | (0.16) | (0.25) | (2.68) | (0.05) |
| No Insurance | -0.10*** | -0.04 | 0.01 | 0.14*** | -0.06* | 0.01 | 0.21 | 0.57 | -13.39*** | 2.30*** |
| | (0.02) | (0.04) | (0.04) | (0.04) | (0.03) | (0.02) | (0.19) | (0.31) | (3.24) | (0.06) |
| Malaria | | | -0.64*** | -0.22*** | -0.10*** | 0.10*** | -1.56*** | -0.68** | 2.08 | 0.08 |
| | | | (0.03) | (0.03) | (0.02) | (0.01) | (0.14) | (0.23) | (2.41) | (0.05) |
| Constant | 0.98*** | 0.37** | 1.77*** | 0.73*** | 0.37*** | 0.03 | 6.49*** | 5.47*** | 140.85*** | 5.62*** |
| | (0.07) | (0.14) | (0.15) | (0.13) | (0.10) | (0.07) | (0.70) | (1.14) | (12.10) | (0.24) |
| Observations | 1041 | 1008 | 2020 | 2020 | 2074 | 2074 | 2074 | 2074 | 2074 | 1999 |
| $R^2$ | 0.041 | 0.122 | 0.212 | 0.057 | 0.047 | 0.053 | 0.372 | 0.031 | 0.321 | 0.416 |
| Mean Dependent Variable in CC | 0.93 | 0.16 | 1.73 | 0.71 | 0.25 | 0.11 | 5.12 | 5.33 | 98.52 | 6.00 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on work environment including proxies for how busy the facility was at the time of the visit (morning visits from 7-11am, visits on a weekend, and the SP's wait time (normalized to mean 0 and standard deviation 1 for Babyl and CC visits separately), indicators for whether the provider was above median on ratings of feeling overwhelmed and rushed, as well as the provider's Maslach Burnout Inventory subscale averages for emotional exhaustion, depersonalization, and professional accomplishment. All regressions control for whether the visit is at Babyl (vs. CC), whether the case is malaria (vs. URI), and whether the SP pays out of pocket (vs. using CBHI). Standard errors in parentheses. $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Controlling for these measures of provider experience, characteristics, and work environment has minimal impact on the estimated Babyl coefficients. Across all three tables, the coefficients on Babyl remain quite stable and consistent with the results from Section 6.1.

In the Appendix Section B, we report the estimates from these tables separately for malaria and URI as well as for Babyl and CC.

### 6.4 SP Characteristics

In Section 6.1, we find that our main results are robust to the inclusion of SP fixed effects. This rules out any observed or unobservable differences across our SPs driving the estimated differences between Babyl and CC. In this section, we instead focus on these characteristics of SPs to understand whether SPs receive different care because of these characteristics. Specifically, we ask the following research questions: How does care differ across SPs with different characteristics, such as gender, age, and insurance status? Does this vary across Babyl and Conventional Care?

Table 17 has the same structure as those in Section 6.3. We regress each of the key SP visit outcomes on an indicator for Babyl (vs. CC), an indicator for whether the SP paid out of pocket, and their interaction, as well as indicators for SP age and gender. For regressions with a pooled sample of malaria and URI visits, we include an indicator for malaria.

We begin with SP insurance status, where we estimate the difference between SPs paying out of pocket and those using CBHI separately in CC and Babyl. In CC, SPs without insurance have lower CCM for malaria, receive more unnecessary medicines, recieve fewer optional labs, spend more time with the provider, wait less for the consultation, and pay higher out of pocket costs than insured SPs. In Babyl, SPs without insurance receive more unnecessary medicines and pay higher out of pocket costs than insured SPs. Again, we caution from over-interpretation of these individual results. In the ML models estimated in Section 6.1, SP insurance status was selected for inclusion in the models of CCM for malaria, the number of unnecessary medicines for malaria, and in patient out of pocket costs for both malaria and URI.

We find little evidence on a systematic impact of SP age on outcomes, perhaps due to the rather narrow age range with SPs aged 25-42 years old. Realtive to the youngest SPs (aged 25-29), SPs aged 30-34 receive fewer optional labs, spend less time with the provider, and pay less out of pocket. Older SPs aged 35-42 are asked more questions during the consultation. Looking at gender, female SPs have lower CCM for URI, are asked more questions, and pay more out of pocket. Neither age nor gender are selected in any of the ML models estimated in Section 6.1.

In the Appendix Section B, we report the estimates separately for malaria and URI as well as for Babyl and CC.

Table 17: SP Characteristics

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| Babyl | -0.02 | 0.29*** | 0.23*** | -0.14*** | -0.16*** | -0.09*** | 4.45*** | -1.37*** | -70.31*** | -0.24*** |
| | (0.02) | (0.03) | (0.03) | (0.03) | (0.02) | (0.01) | (0.14) | (0.21) | (2.48) | (0.05) |
| No Insurance | -0.12*** | -0.04 | -0.01 | 0.11** | -0.07* | -0.01 | 0.32 | 0.87** | -24.62*** | 2.11*** |
| | (0.03) | (0.04) | (0.05) | (0.04) | (0.03) | (0.02) | (0.22) | (0.32) | (3.75) | (0.07) |
| Babyl × No Insurance | 0.08* | -0.06 | 0.06 | 0.03 | 0.08 | 0.06 | -0.09 | -1.19* | 21.93*** | 0.52*** |
| | (0.04) | (0.07) | (0.08) | (0.07) | (0.05) | (0.03) | (0.36) | (0.53) | (6.23) | (0.11) |
| Age 30-34 | -0.02 | -0.04 | 0.04 | 0.00 | -0.04* | -0.00 | 0.06 | -0.44* | 0.96 | -0.14** |
| | (0.02) | (0.03) | (0.03) | (0.03) | (0.02) | (0.01) | (0.14) | (0.20) | (2.38) | (0.04) |
| Age 35-42 | -0.02 | -0.05 | -0.07 | 0.07 | -0.04 | 0.01 | 0.64** | -0.20 | 5.17 | 0.02 |
| | (0.03) | (0.04) | (0.05) | (0.04) | (0.03) | (0.02) | (0.23) | (0.34) | (3.97) | (0.07) |
| Female | 0.02 | -0.08** | 0.02 | 0.02 | -0.02 | 0.01 | 0.26* | -0.04 | 0.94 | 0.18*** |
| | (0.02) | (0.03) | (0.03) | (0.02) | (0.02) | (0.01) | (0.13) | (0.20) | (2.31) | (0.04) |
| Malaria | | | -0.63*** | -0.22*** | -0.10*** | 0.10*** | -1.52*** | -0.61** | 0.78 | 0.09* |
| | | | (0.03) | (0.02) | (0.02) | (0.01) | (0.13) | (0.19) | (2.24) | (0.04) |
| Constant | 0.95*** | 0.24*** | 2.03*** | 0.78*** | 0.34*** | 0.05*** | 5.71*** | 5.70*** | 100.30*** | 5.53*** |
| | (0.02) | (0.03) | (0.03) | (0.03) | (0.02) | (0.01) | (0.15) | (0.22) | (2.61) | (0.05) |
| No Insurance + Babyl X No Insurance | -0.04 | -0.10 | 0.04 | 0.14** | 0.01 | 0.04 | 0.23 | -0.33 | -2.69 | 2.63*** |
| | (0.03) | (0.05) | (0.06) | (0.05) | (0.04) | (0.03) | (0.29) | (0.42) | (4.96) | (0.09) |
| Observations | 1263 | 1241 | 2466 | 2466 | 2536 | 2536 | 2536 | 2536 | 2536 | 2442 |
| $R^2$ | 0.019 | 0.106 | 0.202 | 0.056 | 0.042 | 0.052 | 0.335 | 0.036 | 0.263 | 0.440 |
| Mean Dependent Variable in CC | 0.93 | 0.17 | 1.73 | 0.71 | 0.25 | 0.10 | 5.22 | 5.34 | 97.32 | 6.00 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on SP characteristics including whether the whether the SP pays out of pocket (vs. using CBHI), SP age (bins relative to SPs aged 25-29), and SP gender. All regressions control for whether the visit is at Babyl (vs. CC) and whether the case is malaria (vs. URI). Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

# 7 Conclusion

Our findings suggest three key insights on the nature of telemedicine compared to conventional in-person care. First, the quality of care is no worse, and likely better, in telemedicine compared to CC. The likelihood of CCM is higher for URI and no worse for malaria. Providers in telemedicine consultations ask more medical history questions as suggested by clinical practice guidelines. They also prescribe more optional medicines, such as analgesics, which may help to alleviate patient symptoms. Second, telemedicine appears to be more efficient. Patients wait significantly less for consultations. Providers are able to achieve the same or even higher quality of care while spending less time with the patient. In the case of URI, providers prescribed fewer unnecessary medicines. In both cases, providers order fewer labs in telemedicine visits. In total, telemedicine patients pay less out of pocket for the visit. Third, telemedicine changes the nature of the patient-provider interaction. We find that telemedicine providers are less likely to be persuaded by patient requests for unnecessary antibiotics.

Overall, telemedicine seems to improve quality of care, lower costs, and reduce bias from patient requests. At least for the uncomplicated medical conditions in our setting, telemedicine seems to be superior to clinic care. However, these results don't necessary translate to all medical conditions, especially more serious ones than those considered in our study.

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# A SP Case Scripts

This section includes the SP scripts used in the field work. The order they are presented is: malaria, URI, and diarrhea.

# *Evaluation of Integrated Digital Primary Health Care in Rwanda*

*SP Scripts for Conventional Care and Babyl*

## Case 1: Malaria

**Notes:**
**HIGHLIGHTS indicate elements that must be adapted to the SP's true identity.**
**HIGHLIGHTS indicate elements that might be adapted in REGIONAL case presentations.**

**Context and background (female):**

**NAME** is 32 years old, married to Jean Pierre who is a carpenter, with two children (Prince and Rebecca). She lives in the nearest town and she is a momo agent in her village. Two weeks ago, she traveled upcountry to visit her sister called [e.g., Mukantwali in Gisagara district]. During her stay, she did not sleep under a treated mosquito net because it was old and had holes. Three days after returning home, she started having headaches and a moderate fever. She hasn't had much of an appetite lately.

Yesterday she woke up with a headache and was feeling cold and fatigued, and she had joint pain. In the afternoon, her husband went to the nearest pharmacy and bought paracetamol, but it did not help. Further, she vomited the previous night a few minutes after starting to eat dinner. No one else from her family seems to be showing symptoms like hers. Today, she visits a health facility to see if her condition can be helped (For Babyl: Today, she calls into Babyl to see if her condition can be helped).

*Indwara ya: MALARIYA*

***(Amazina)*** afite imyaka 32, yashakanye na Jean Pierre ukora akazi k'ububaji, akaba afite abana babiri (Prince na Rebecca). Atuye mu mujyi uri hafi acuruza mobiyileo mani na mituyu yo mu mudugudu w'iwabo. Mu byumweru bibiri bishize, yagiye mu ntara gusura murumuna we [urugero, Mukantwali mu Karere ka Gisagara]. Ubwo yari ariyo, ntiyigeze aryama mu nzitiramibu ikoranye umuti kubera ko yari ishaje kandi icitse. Nyuma y'iminsi itatu agarutse mu rugo, yatangiye kubabara umutwe ndetse ahinda umuriro udakabije cyane. Amaze iminsi mike atabasha kurya neza (adafite apeti)

Ejo, yabyutse arwaye umutwe, yumva afite imbeho ndetse afite umunaniro, kandi yababaraga mu ngingo zose. Nyuma ya saa sita, umugabo we yagiye kuri farumasi ibegereye agura ibinini bya paracetamol, ariko ntacyo byamumariye. Ikindi ni uko, mu ijoro ryakeye amaze iminota mike

atangiye gufata amafunguro ya nimugoroba, yararutse. Nta wundi wo mu muryango we uri kugaragaza ibimenyetso nk'ibye. Uyu munsi, yagiye kwa muganga kugirango bamufashe ku kibazo cye (kuri Babyl : Uyu munsi, yahamagaye ku murongo wa Babyl kugirango bamufashe ku kibazo afite).

**Context and background (male):**

**NAME** is 28 years old and lives with his wife. He has been working at a bakery in the nearest town as a cashier for the last 4 years. Two weeks ago, he traveled upcountry to visit his parents who live in [e.g., Nyamasheke district close to the lake Kivu]. During his stay, he did not sleep under a treated mosquito net because it was old and had holes. Three days after returning home, he started having headaches and a moderate fever. He hasn't had much of an appetite lately.

Yesterday he woke up with a headache and was feeling cold and fatigued, and he had joint pain. In the afternoon, he went to the nearest pharmacy and bought paracetamol, but it did not help. Further, he vomited the previous night a few minutes after starting to eat dinner. No one else from his family seems to be showing symptoms like his. Today, he visits a health facility to see if his condition can be helped (For Babyl: Today, he calls into Babyl to see if his condition can be helped).

*KINYARWANDA: [need translation]*

**(Amazina)** Afite imyaka 28, akaba abana n'umugore we. Amaze imyaka 4 akora mu ruganda rukora imigati n'amandazi ruri mu mujyi uri hafi yabo. Mu byumweru bibiri bishize, yagiye mu ntara gusura ababyeyi be batuye [urugero., mu karere ka Nyamasheke hegereye ikiyaga cya Kivu]. Ubwo yari ariyo, ntiyigeze aryama mu nziritamibu ikoranye umuti kubera ko yari ishaje kandi yaracitse. Nyuma y'iminsi itatu asubiye mu rugo, yatangiye kurwara umutwe no guhinda umuriro udakabije. Amaze iminsi mike atabasha kurya neza (adafite apeti)

Ejo hashize, yabyutse ababara umutwe,yumvaga afite imbeho ndetse afite umunaniro, kandi yababaraga mu ngingo zose. Nyuma ya saa sita, yagiye kuri farumasi imwegereye agura ibinini bya paracetamol, ariko ntacyo byamumariye. Ibirenzeho, mu ijoro ryashize yararutse nyuma y'iminota mike atangiye gufata amafunguro y'umugoroba. Nta wundi mu muryango we uri kugaragaza ibimenyetso nk'ibye. Uyu munsi, yagiye kwa muganga kureba niba hari icyo bamufasha ku kibazo afite (kuri Babyl: Uyu munsi, yahamagaye ku murongo wa Babyl kugira ngo arebe niba bamufasha ku kibazo afite).

**Opening Statement:** *[Doctor/Nurse], I felt cold with headache and joint pain the last few days, and now I'm worse. I have come to you for help.*
**Interuro itangira:** *[Muganga], maze iminsi numva mfite imbeho nyinshi mu mubiri ndetse mbabara umutwe no mu ngingo. None ndumva nakomeje kuremba. Naje kubareba kugira ngo mumfashe.*

***Focus on chief complaints***

***Suggestion experiment as assigned version adds to the opening statement:***

- *Do you think this is malaria?*
  *Urumva yaba ari malariya?*

***OR***
***CYANGWA***

- *Do you think this is COVID?*
  *Urumva yaba ari COVID?*

**Standardized responses to potential questions from provider:**

| | **Question**<br>**Ikibazo** | **Response**<br>**Igisubizo** |
|---|---|---|
| **1** | Which symptom started first?<br>Nikihe kimenyetso wibonyeho bwa mbere? | *First I had headache followed by fever.*<br>*Nabanje kumva mbabara umutwe nyuma ngira umuriro.* |
| **2** | Do you live with someone who have/had recently similar symptoms?<br>Hari umuntu mubana waba ufite cyangwa yaragize ibimenyetso nk'ibi? | *No*<br>*Oya* |
| **3** | How long have you had fever?<br>Umaze igihe kingana iki ufite umuriro? | *Last three days*<br>*Maze iminsi itatu* |
| **4** | When did you start vomiting?<br>Watangiye kuruka ryari? | *Yesterday night/ early morning*<br>*Ejo nijoro/mu gitondo kare* |
| **5** | Is the fever constant or does it come and go?<br>Ese umuriro urawuhorana cyangwa uraza nyuma ukagenda? | *It comes and goes. The first day, it started in the evening but in the last two days it was all the day with a high increase in the evening.*<br>*Uraza ukongera ukagenda. Umunsi wa mbere , watangiye nimugoroba ariko mu minsi ibiri ishize nawumaranye umunsi wose ndetse ku mugoroba uriyongera* |
| **6** | Does the fever go up and down?<br>Ese umuriro uriyongera ukongera akagabanuka? | *Yes – It increases more in the evening but still moderate*<br>*Yego –wiyongera cyane nimugoroba ariko nabwo udakabije* |
| **7** | When you have a fever is it very high?<br>Ese iyo ufite umuriro, uba ari mwinshi cyane? | *Sometimes its high, sometimes its low*<br>*Rimwe na rimwe, uba uri mwinshi, ikindi gihe uri muke* |
| **8** | Have you been able to eat and drink?<br>Ese washoboye kurya no kunywa? | *No, in the morning I have failed to take the breakfast as I was feeling nausea.* |

| | | |
|---|---|---|
| | | *Oya, mu gitondo ntakintu nashoboye gufata kuko numvaga nshaka kuruka (mfite isesemi).* |
| **9** | Have you had any vomiting or diarrhea?<br>Ese wigeze uruka cyangwa ngo ucibwemo? | *Yes, just vomiting*<br>*Yego, narutse gusa* |
| | How frequent is your vomiting since you started feeling unwell?<br>Kuva wafatwa, umaze kuruka inshuro zingahe? | *Two times*<br>*Maze kuruka inshuro ebyiri* |
| **10** | Have you taken any medicines? For how long?<br>Ese hari imiti wigeze ufata? Umaze igihe kingana iki? | *I started to take Paracetamol yesterday but it did not help.*<br>*Nari natangiye gufata Paracetamol ejo hashize ariko ntacyahindutse* |
| **11** | Have you taken a malaria test?<br>Wigeze wipimisha malariya? | *No*<br>*Oya* |
| **12** | When was the last time you had malaria?<br>Uheruka kurwara malariya ryari? | *Two years ago*<br>*Hashije imyaka 2* |
| **13** | Have you travelled recently?<br>Hari urugendo uheruka gukora vuba aha? | *Yes – give details only if asked*<br>*Yego – utange amakuru arambuye ari uko gusa ubisabwe* |
| **14** | Have you had difficulty breathing?<br>Wigeze ugorwa no guhumeka? | *No*<br>*Oya* |
| **15** | Have you had any wheezing?<br>Wigeze usemeka? | *No*<br>*Oya* |
| **16** | Have you had any muscle or joint pain?<br>Wigeze wumva ubabara mu mubiri cyangwa mu ngingo? | *Yes, joints ache.*<br>*Yego, nagize ububabare mu ngingo* |
| **17** | Do you have chest pain?<br>Waba uri kubabara mu gituza? | *No*<br>*Oya* |
| **18** | Do you have a cough?<br>Waba ufite inkorora? | *No*<br>*Oya* |
| **19** | Have you had a cold, sneezing, sore throat or stuffiness in the last few days?<br>Mu minsi ishize, waba warigeze ugira ibicurane, guhumeka nabi cyangwa kubabara mu muhogo cyangwa gufungana ? | *No*<br>*Oya* |
| **20** | Have you had any fainting or convulsions?<br>Wigeze ugira kugwa igihumure (ikirabira) cyangwa kugagara? | *No*<br>*Oya* |
| | Have you had any shivering ?<br>Waba wigeze ugire ikibazo cyo gutengurwa cyane (igitengo)? | *No*<br>*Oya* |
| **21** | Do you feel dizzy?<br>Urumva ufite isereri? | *Yes*<br>*Yego* |
| **22** | Are you allergic to any medicines?<br>Hari imiti ijya igutera aleriji (ikugwa nabi)? | *No*<br>*Oya* |

| | | |
|---|---|---|
| **23** | Do you have any other problems?<br>Hari ibindi bibazo ufite? | *No*<br>*Oya* |
| **24** | [**For female case**] When was your last period? Are you/could you be pregnant?<br>**[Ku bagore]** ni ryari uheruka kujya mu mihango? Ese waba utwite? | *About a week ago. No*<br>*Hashize icyumweru.*<br>*Oya, ntabwo ntwite.* |
| **25** | Do you feel pain while swallowing?<br>Ujya wumva ubabara igihe uri kumira? | *No*<br>*Oya* |
| **26** | **Where is the location of the headache?**<br>**Ni ikihe gice wumva ubabara umutwe?** | - *Front upper part of the head.*<br>- *Back of the head*<br>- *Ndibwa mu gahanga*<br>- *Ndibwa Umutwe w'inyuma* |
| **27** | **What is the severity/intensity of the headache?**<br>**Ese urumva umutwe ukurya bingana iki?** | - *Moderate*<br>- *but sometimes exacerbated/worsens in the evenings*<br>- *Ubu ntibikabije,*<br>- *Ariko rimwe na rimwe biba bikabije ni mugoroba* |
| **28** | Have you ever had typhoid?<br>Wigeze urwara tifoyide? | *Never*<br>*Nta na rimwe* |
| **29** | (Related to suggestion experiment) **Why do you ask if this is [malaria/typhoid]?**<br>**Kubera iki uri kubaza niba urwaye malariya cyangwa tifoyide?** | *I don't know, I am just wondering*<br>*Simbizi, ndi kwibaza gusa* |

# *Evaluation of Integrated Digital Primary Health Care in Rwanda*

*SP Scripts for Conventional Care and Babyl*

## Case 2: Upper Respiratory Infection (Viral)

**Notes:**
**HIGHLIGHTS indicate elements that must be adapted to the SP's true identity.**
**HIGHLIGHTS indicate elements that might be adapted in REGIONAL case presentations.**

**Context and background (Female):**

**NAME from Kagugu (nearest town)** is 27 years old and has no children. She is recently married (only 2 months ago) and lives with her husband. He does not smoke, but the flooring materials of their house are made of earthsand. She is a tailor in Kagugu(nearest town). In her sewing business, they are 10 tailors in the room. Last week, almost all her fellow tailors experienced stuffy nose, and some other tailors could not come to work. This situation happens often during rainy season.

4 days ago, she started coughing and sneezing. Her cough has been dry, with a runny nose, fatigue, and mild headache. Last two days, she started having fever and decided to rest at home instead of working. Her husband prepared some home remedies including hot water mixed with honey and lemon. Last night, she felt weak and her cough and headache intensified in the night. Today morning, she developed a sore throat and she decided to consult a provider at the health center/Babyl. She suspects it is because of her fellow tailors who have been ill.

Her husband is well and not portraying any of her symptoms. She does not have any history of asthma, hypertension or any other respiratory illnesses in her family. She is fully vaccinated against Covid-19 and has neither lost her sense of smell/taste nor lost any significant weight at all.

*KINYARWANDA: [need translation]*

**(Amazina)** w'i Kagugu afite imyaka 27 akaba nta bana agira. Amaze amezi abiri ashatse kandi abana n`umugabo we. Ntanywa itabi, ariko inzu yabo hasi nta sima irimo ni ibitaka. Ni umudozi i Kagugu(isanteri ibegereye). Aho adodera, bahakorera ari 10. Mu cyumweru gishize, abo bakorana hafi ya bose bagize ikibazo cyo gufungana mu mazuru, ndetse bamwe muri bo ntibabashije kuza ku kazi. Ibi bikunze kubaho kenshi mu gihe cy'imvura.

Muminsi 4 ishize, yatangiye gukorora no kwitsamura. Inkorora ye yari akayi, afite ibimyira mu mazuru, umunaniro ndetse n'umutwe umurya bidakabije cyane. Mu minsi ibiri ishize, yatangiye kugira umuriro maze yiyemeza kuguma mu rugo aho kujya ku kazi. Umugabo we yamuteguriye umuti ugizwe n'amazi ashyushye avanze n'ubuki n'indimu. Mu ijoro ryakeye, yumvise afite intege nke ndetse inkorora ye no kubabara umutwe byiyongereye. Uyu munsi mu gitondo, yatangiye kubabara mu muhogo nuko yiyemeza kureba umuganga ku kigo nderabuzima/ku murongo wa Babyl. Arakeka ko ari ukubera abatayeri bagenzi be bamaze igihe barwaye.

Umugabo we ameze neza nta bimenyetso nk'ibye agaragaza. Nta muntu mu muryango we wigeze arwara asima, umuvuduko w'amaraso cyangwa indi ndwara ifata imyanya y'ubuhumekero. Yakingiwe covid-19 mu buryo bwuzuye ndetse ntiyigeze atakaza guhumurirwa/kuryoherwa cyangwa ngo agire ibiro na bike atakaza.

**Context and background (male):**

**NAME** is [20-35] years old is a motorcycle rider in Kigali/(nearest town) since 2020. Since the new release of Covid-19 measures, he is working tirelessly from 6:00am to 12:00am, with frequent travels to different areas within town e.g. to clients' homes/hotels/markets, mostly located in Kigali (nearest town). Last week, he had frequent travels to a dusty place whereby street is under construction and some of his customers were coughing, sneezing and had stuffy nose.

4 days ago, he started coughing and sneezing. His cough has been dry, with a runny nose, fatigue, and mild headache. Last two days, he started having fever and decided to rest at his home instead of working. His wife prepared some home remedies including hot water mixed with honey and lemon. Last night, he felt weak, and his cough and headache intensified in the night. Today morning, he developed a sore throat and he decided to consult a provider at the health center/Babyl. He suspects it is because of his frequent travels to dusty places.

His wife is well and not portraying any of his symptoms. He does not have any history of asthma, hypertension or any other respiratory illnesses in his family. He is fully vaccinated against Covid-19 and has neither lost his sense of smell/taste nor lost any significant weight at all.

*KINYARWANDA:*
**(Amazina)** afite imyaka hagati ya 20-35, akaba ari umumotari muri Kigali (umujyi uri hafi cyane) kuva muri 2020. Kuva hatangazwa ingamba nshya zo kurwanya covid-19, ubu akora ubutaruhuka kuva saa kumi n'ebyiri za mu gitondo kugera saa sita z'ijoro, agakora ingendo kenshi zijya ahantu hatandukanye mu mujyi. Urugero, mu ngo z'abakiriya, amahoteli, amasoko akenshi bihereye muri Kigali (Umujyi uri hafit cyane). Mu cyumweru gishize, yagize ingendo nyinshi ahantu hari ivumbi ryinshi aho bari kubaka umuhanda kandi bamwe mubagenzi yatwaraga barakororaga, bitsamura kandi bafunganye mu mazuru.

Mu minsi ine ishize, yatangiye gukorora no kwitsamura. Inkorora ye yari akayi, afite ibimyira mu mazuru, umunaniro ndetse n'umutwe umubabaza bidakabije cyane. Mu minsi ibiri ishize, yatangiye kugira umuriro maze yiyemeza kuruhukira mu rugo aho kujya mu kazi. Umugore we yamuteguriye umuti ugizwe n'amazi ashyushye avanze n'ubuki n'indimu. Mu ijoro ryakeye, yumvise afite intege nke ndetse inkorora ye no kubabara umutwe byiyongereye nijoro. Uyu munsi mu gitondo, yatangiye kubabara mu muhogo nuko yiyemeza kujya kureba umuganga ku kigo nderabuzima/ku murongo wa Babyl. Arakeka ko ari ukubera ahantu yagiye cyane hari ivumbi ryinshi.

Umugore we ameze neza nta n'ibimenyetso nk' ibye agaragaza. Nta muntu mu muryango we wigeze arwara asima, umuvuduko w'amaraso cyangwa indi ndwara ifata imyanya y'ubuhumekero. Yakingiwe covid-19 mu buryo bwuzuye ndetse ntiyigeze atakaza guhumurirwa/kuryoherwa cyangwa ngo agire ibiro na bike atakaza.

**Opening Statement:** *[Doctor/Nurse], I have been coughing the last few days and have been experiencing some fever. I have come to you/called you for help.*
**Interuro ifungura:** *[Muganga], maze iminsi mike mfite inkorora ndetse mfite umuriro. Naje hano/ mbahamagaye kugira ngo mumfashe.*

***Suggestion experiment (as assigned) adds**:*

- *Do you think this is pneumonia?*

  *Urumva mfite umusonga?*

  ***OR/Cyangwa***

- *Do you think this is a common cold?*

  *Urumva ari ibicurane?*

**Standardized responses to potential questions from provider:**

| | **Question**<br>**Ikibazo** | **Response**<br>**Igisubizo** |
|---|---|---|
| 1 | How can i help you today?<br>Ni iki cyakuzanye uyu munsi? | [ Opening Statement]<br>[koresha interuro ifungura] |
| 2 | Which symptom started first?<br>Ni ikihe kimenyetso wagize bwa mbere? | *First I started sneezing and had stuffy nose* |
| 3 | Have you been in contact with someone who have/had recently similar symptoms?<br>Wigeze uhura n'umuntu ufite/wari ufite ibimenyetso bisa nkibyo? | *Yes, the nature of my work exposes me to meet people/clients.*<br>*Yego, akazi nkora gatuma mpura n'abantu/abakiriya batandukanye* |
| 4 | How long have you had fever?<br>Umaze igihe kingana iki ufite umuriro? | *Last two days*<br>*Iminsi ibiri* |
| 5 | When did you start coughing?<br>Ni ryari watangiye gukorora? | *Last four days*<br>*Iminsi ine ishize* |
| 6 | How was the cough at the beginning? (Was it dry or productive)<br>Ni gute inkorora yari imeze bigitangira? (Yari akayi cyangwa isohora igikororwa ?) | *It was dry with no mucus*<br>*Yari akayi nta gikororwa izana* |
| 7 | How is your cough today?<br>Inkorora yawe imeze ite uyu munsi? | It has intensified since yesterday night. |

| | | |
|---|---|---|
| | | Yiyongereye guhera ejo nijoro. |
| 8 | What else has changed since you started coughing?<br>Ni iki kindi cyahindutse kuva watangira gukorora? | I started having sore throat<br>Natangiye kubabara mu muhogo |
| 9 | When did you start having sore throat?<br>Ni ryari watangiye kubabara mu muhogo? | *Today morning.*<br>*Uyu munsi mu gitondo.* |
| 10 | Have you been able to eat and drink?<br>Wigeze ubasha kurya no kunywa? | *Not very well, as I have sore throat*<br>*Si neza cyane, kuko ndi kubabara mu muhogo* |
| 11 | Have you had any vomiting or diarrhea?<br>Wigeze uruka cyangwa ngo ucibwemo? | *No*<br>*Oya* |
| 12 | Have you taken any home remedies? Which home remedies?<br>Wigeze ufata/ukoresha ubuvuzi bwo mu rugo? Ni ubuhe buvuzi bwo mu rugo wahawe? Hashize igihe kingana iki? | *Yes, I took home remedies (*hot water, mixed with honey and lemon).<br>*yego, nageragеje kwivura nkoresheje* amazi ashyushye avanze n'ubuki n'indimu. |
| 13 | Have you had any difficulty swallowing?<br>Wigeze ugorwa no kugira icyo umira? | *Yes,My throat is slightly painful,*<br>*Yego,Ndababara mu muhogo buhoro* |
| **14** | Do you have nasal congestion?<br>Hari ubwo uri gufungana mu mazuru? | *Yes, my nose has stayed stuffy*<br>*Yego, amazuru yanjye aracyafunganye* |
| **15** | Is your nose running?<br>Ese uripfuna buri kanya? | *Yes, very frequently*<br>*Yego, kenshi cyane* |
| **16** | Do you have pain in your chest/lungs?<br>Waba ubabara mu gatuza/mu bihaha? | *No*<br>*Oya* |
| **17** | Do you have difficulty in breathing?<br>Ese waba ugorwa no guhumeka? | *Yes,very light breathing difficulties, because of the congestion*<br>*Yego, ndahumeka bingoyeho gake kubera gufungana* |
| **18** | Are you feeling tired?<br>Urumva ufite umunaniro? | *Slightly tired.*<br>*Ndananiweho gake.* |
| **19** | Have you taken any medication or treatment?<br>Hari imiti wafashe cyangwa ubuvuzi wahawe? | *No*<br>*Oya* |
| **20** | Does your family have any history of asthma?<br>Ese mu muryango wawe hari umuntu warwaye asima? | *No*<br>*Oya* |
| **21** | Do you have red eyes? Watery eyes?<br>Ese amaso yawe aratukuye? Waba uzenga amarira mu maso? | *No*<br>*Oya* |

| | | |
|---|---|---|
| **22** | Have you had any discharge from your ears?<br>Hari ibintu wigeze uzana mu matwi? | *No*<br>*Oya* |
| **23** | Do you have pains in your joints?<br>Hari uburibwe ufite mu ngingo ? | *No*<br>*Oya* |
| **24** | Have you been in close contact with people with any respiratory infections like TB<br>Wigeze uhura n'abantu bafite indwara z'ubuhemekero zandura, nk'igituntu? | *No- I don't know*<br>*Oya- ntabwo mbizi* |
| **25** | Have you been in close contact with people with any respiratory infections like COVID19<br>Wigeze uhura n'abantu bafite indwara z'ubuhemekero zandura, nka covid-19? | *No/ I don't know*<br>*Oya- ntabwo mbizi* |
| **26** | Do you live with a person who is/was COVID 19+?<br>Waba ubana n'umuntu urwaye cyangwa wigeze kurwara covid-19? | *No*<br>*Oya* |
| **27** | When was the last time you had COVID-19 test<br>Ni ryari uheruka kwipimisha covid-19? | *I did the test 3/4 days ago, it was negative*<br>*Nipimishije mu minsi 3/4 ishize kandi nasanze ntayo ndwaye.* |
| **28** | For Babyl: I recommend you to go to your nearest HC for a COVID- 19 test<br>Kuri Babyl: Ndagushishikariza kujya ku kigo nderabuzima kikwegereye ukipimisha covid-19 | *Thank you.*<br>*Urakoze.* |
| **29** | Have you ever had COVID-19?<br>Wigeze urwara covid-19? | *No*<br>*Oya* |
| **30** | Have you ever had pneumonia?<br>Wigeze urwara umusonga? | *No*<br>*Oya* |
| **31** | (Related to suggestion experiment) Why do you ask if this is [COVDI-19/pneumonia/a cold]?<br>Kubera iki ubaza niba ari COVID-19/umusonga/cyangwa/ibicurane? | *I don't know, I am just wondering*<br>*Simbizi, ndi kwibaza gusa* |

# *Evaluation of Integrated Digital Primary Health Care in Rwanda*

*SP Scripts for Conventional Care and Babyl*

## Case 3. Gastroenteritis (Diarrhea, Viral/Non-specific)/ Indwaza zifata mu myanya y'ubuhumekero

**Notes:**
**HIGHLIGHTS indicate elements that must be adapted to the SP's true identity.**
**HIGHLIGHTS indicate elements that might be adapted in REGIONAL case presentations.**

**Context and background (Female):**

27-year-old **NAME** lives in Kagugu with her husband. They are recently married with no children. She sells fruits and vegatebles in the market close by.

The day before yesterday, she felt weak after she returned home from the market. That night, she ran to the bathroom 3 times because she had diarrhea. Yesterday, she could not do her household chores and felt weak. In the evening, she took ginger tea and lemon to calm her stomachache, but it did not help very much. She normally drinks boiled water.

At breakfast this morning, she could not finish her food and started vomiting. During the day she started feeling stomach cramping and pain and passed liquid stools 2 times.
Since waking up, she has felt thirsty and very dizzy. She has a slight fever, a headache and experiences blurred vision. Her mouth is also dry. Her husband is concerned about her and insisted that she seek medical help as her symptoms could worsen tonight.

*KINYARWANDA:*
**(Amazina)** w'imyaka 27 atuye i Kagugu hamwe n'umugabo we. Bashakanye vuba kandi nta bana bafite. Acuruza Acuruza imboga n'imbuto mu isoko aturanye naryo.

Ejo bundi, yumvise afite intege nke ubwo yari asubiye mu rugo avuye gucuruza. Iryo joro, yagiye mu bwiherero inshuro eshatu kubera ko yari ari gucibwamo. Ejo, ntiyabashije gukora imirimo yo mu rugo ndetse yumvaga acitse intege. Ku mugoroba, yafashe icyayi kirimo tangawizi n'indimu kugira ngo yoroshye uburibwe bwo mu nda, ariko ntibyamufashije cyane. Ubusanzwe anywa amazi atetse.

Ubwo yafataga amafunguro ya mu gitondo, ntiyabashije kumara ibyo kurya nuko atangira kuruka. Ku manywa, yatangiye kumva aribwa mu nda, guhitwa ndetse yituma umusarani w'amazi inshuro ebyiri.
Kuva aho yabyukiye, yumvise afite inyota ndetse afite isereri cyane. Afite umuriro utari mwinshi, ababara umutwe ndetse afite ibicyezicyezi mu maso kandi yumye no mu kanwa. Umugabo we

ahangayikishijwe na we ndetse yamuhatiye kujya kwa muganga kuko ibimenyetso bye bishobora kuba bibi kurushaho iri joro.

**Context and background (Male):**

27-year-old **NAME** lives in Kagugu with his wife. They are recently married with no children. They own a small shop near the house.

The day before yesterday, he felt weak after he returned home. That night, he ran to the bathroom 3 times because he had diarrhea. Yesterday, he could not go to work as he felt weak, so he stayed home to rest. In the evening, his wife gave him ginger tea and lemon to calm his stomachache, but it did not help very much. He normally drinks boiled water.

At breakfast this morning, he could not finish his food and started vomiting. During the day he started feeling stomach cramping and pain and passed liquid stools 2 times.
Since waking up, he has felt thirsty and very dizzy. He has a slight fever, a headache and experiences blurred vision. His mouth is also dry. His wife is concerned about him and insisted that he seek medical help as his symptoms could worsen tonight.

*KINYARWANDA:*
(Amazina)w'imyaka 27 atuye i Kagugu hamwe n'umugore we. Bashakanye vuba kandi nta bana bafite. Bafite aka butiki hafi y'inzu yabo.

Ejo bundi, yumvise afite intege nke ubwo yari avuye gucuruza. Iryo joro, yagiye mu bwiherero inshuro eshatu kubera ko yari ari gucibwamo. Ejo, ntiyabashije kujya mu kazi kuko yumvaga acitse intege, yagumye mu rugo ngo aruhuke. Ku mugoroba, umugore we yamuhaye icyayi kirimo tangawisi n'indimu kugira ngo yoroshye uburibwe bwo mu nda, ariko ntibyamufashije cyane. Ubusanzwe anywa amazi atetse .

Ubwo yafataga amafunguro ya mu gitondo, ntiyabashije kumara ibyo kurya nuko atangira kuruka. Ku manywa, yatangiye kumva aribwa mu nda, guhitwa ndetse yituma umusarani w'amazi inshuro ebyiri.
Kuva aho yabyukiye, yumvise afite inyota ndetse afite isereri cyane. Afite umuriro utari mwinshi, ababara umutwe ndetse afite ibicyezicyezi mu maso kandi yumye no mu kanwa. Umugore we ahangayikishijwe na we ndetse yamuhatiye kujya kwa muganga kuko ibimenyetso bye bishobora kuba bibi kurushaho iri joro.

**Other script details:**

**Dress:**
*To be determined in training.*

**Opening Statement:** *[Doctor/Nurse] Hello, I have had a stomachache, vomiting, and diarrhea since the day before yesterday. I decided to call you for help.*
**Interuro ifungura:** *[Muganga] Muraho, kuva ejobundi, ndi kuribwa mu nda, ndaruka ndetse ngacibwamo. Narimbahamagaye kugira ngo mumfashe.*

**Standardized responses to potential questions from provider:**

**++ blurred vision, dry mouth**

| | **Question**<br>**Ikibazo** | **Response**<br><br>**Igisubizo** |
|---|---|---|
| **1** | What brings you today<br>Ni iki cyakuzanye uyu munsi? | *I have diarrhea, and vomited since last 2 days and have a stomachache*<br>*Maze iminsi ibiri mfite ikibazo cyo gucibwamo, kuruka ndetse no kuribwa munda.* |
| **2** | Have you eaten something unusual?<br>Hari ikintu kidasanzwe wariye? | *Not that I can think of*<br>*Ndumva ntacyo* |
| **3** | Which symptom started first?<br>Ni ikihe kimenyetso wabanje kugaragaza? | *Stomach ache*<br>*Kubabara mu nda* |
| **4** | Duration of the pain<br>Uburibwe bumaze igihe kingana iki? | *Since last 2 days*<br>*Bumaze iminsi ibiri* |
| **5** | How long have you had these symptoms for?<br>Umaze igihe kingana iki ugaragaza ibi bimenyetso? | *For 2 days.*<br>*Maze iminsi 2.* |
| **6** | Is the pain constant or does it come and go?<br>Ese uburibwe buhoraho cyangwa buraza nyuma bukongera bukagenda? | *The first day, it started in the evening and disappeared but yesterday it appeared again and has not gone away*<br>*Umunsi wa mbere, bwatangiye nijoro maze buragenda ariko ejo hashize bwaragarutse ariko ntibwongeye kugenda.* |
| **7** | Where is the pain located<br>Uburibwe buherereye hehe?/ Urababara hehe? | *Around the belly button*<br>*Mu gice cyo ku nda hafi y'umukondo* |
| **8** | Do you have any other symptoms?<br>Ese hari ibindi bimenyetso ufite? | *(Paraphrase/repeat the symptoms that you have already given)*<br>*(mu magambo yawe/subiramo ibimenyetso wari wamaze gutanga)* |
| **9** | What kind of symptoms<br>Ni ibimenyetso by'ubuhe bwoko? | *In addition to the pain, I vomited and had liquid stool* |

| | | |
|---|---|---|
| | | *Uretse uburibwe, narutse kandi nituma umusarani w'amazi (ndahitwa)* |
| **10** | Do you feel dizzy<br>Ese urumva ufite isereri | *Yes*<br>*Yego* |
| **11** | Do you have a headache<br>Urumva ubabara umutwe? | *Yes*<br>*Yego* |
| **12** | Have you been urinating<br>Ese ujya wihagarika | *A little*<br>*gake* |
| **13** | Has your urine been dark or colored<br>Inkari zawe zirijimye cyangwa zifite ibara risa gute? | *Yes, dark*<br>*Yego, zirijimye* |
| **14** | Any blood in urine<br>Hari amaraso uzana mu nkari? | *No*<br>*Oya* |
| **15** | Are you tired or fatigued<br>Waba wumva unaniwe cyangwa ucitse intege? | *Yes, since yesterday*<br>*Yego, guhera ejo* |
| **16** | Are you thirsty<br>Hari inyota ufite? | *Yes, even though I try to take water*<br>*Yego, nubwo ngerageza kunywa amazi* |
| **17** | How many times did you pass stools<br>Witumye inshuro zingahe? | *About 3-4 times yesterday and the day before /*<br>*About four episodes in last night and two this morning*<br>*Ejo n'ejo bundi nitumye inshuro hagati y'eshatu n'enye/ hafi inshuro enye mu ijoro ndetse inshuro ebyiri mugitondo* |
| **18** | How is the stool ? any blood in the stool<br>Umusarani uba umeze ute? Hari amaraso ari mu musarani? | *I have Liquid stool but there was no blood*<br>*Ngira umusarani urekuye cyane w'amazi (ndahitwa) ariko nta maraso arimo* |
| **19** | Did you have any fever?<br>Wigeze ugira umuriro? | *Yes, I have a little fever*<br>*Yego, mfite umuriro mukeya* |
| **20** | Have you been able to eat and drink?<br>Wigeze ubasha kurya no kunywa? | *Today morning, I had a little breakfast but ended up vomiting it.*<br>*Uyu munsi, nafashe ifunguro rya mu gitondo ariko ndabiruka* |
| **21** | Have you taken any medicines? For how long?<br>Hari imiti wigeze ufata? hashize igihe kingana iki? | *No… but I took ginger tea and lemon last night*<br>*Oya…. Ariko nafashe tangawizi n'indimu mu ijoro ryakeye* |
| **22** | Have you taken a malaria test?<br>Hari ibizamini bya malariya wigeze ukora? | *No*<br>*Oya* |
| **23** | When was the last time you had malaria?<br>Ni ryari uheruka kurwara malariya? | *About 2 years ago**Hashize imyaka ibiri* |

| | | |
|---|---|---|
| **24** | Have you travelled recently?<br>Uherutse gukora urugendo? | *No, / yes*<br>*Oya,/ Yego* |
| **25** | Have you had any joint pain?<br>Wigeze ugira ikibazo cyo kuribwa mu ngingo? | *Yes, my muscles and joints ache a bit.*<br>*Yego, ndababara mu ngingo gake (buhoro)* |
| **26** | Are you allergic to any medicines?<br>Hari imiti ijya igutera aleriji (ikugwa nabi)? | *No*<br>*Oya* |
| **27** | Do you have any other problems?<br>Hari ibindi bibazo waba ufite? | *No*<br>*Oya* |
| **28** | [**For female case**] When was your last period? Are you/could you be pregnant?<br>[**ku bagore**] ni ryari uheruka kujya mu mihango? Ese waba utwite? | *About one week ago. No*<br>*Oya. Hashije icyumweru kimwe* |
| **29** | Have you consulted a doctor for this problem? Why not?<br>Wigeze ujya kureba muganga kubw'iki kibazo? Kubera iki utagiyeyo? | *No. It wasn't so bad until this morning*<br>*Oya. Ntabwo byari bikabije kugeza iki gitondo* |
| **30** | I would recommend you to do stool exam and malaria test at your nearest HC<br>Ndagushishikariza kujya gukoresha ikizamini cy'umusarani n'icya malariya ku kigo nderabuzima kikwegereye | *Yes*<br>*Yego* |
| **31** | As treatment, in meantime- use BRAT (banana- rice- apple sauce- toast/bread)<br>Hagati aho, ukoreshe (umuneke – umuceri – umutobe wa pome – umugati) nk'umuti | *Yes- thank you*<br>*Yego- urakoze* |

# B Appendix Tables

Table A1: Grouping of Individual Medicines into Drug Classes

| **Drug Categories** | **Medicines** |
|---|---|
| Fever Reducer/Analgesic/anti-inflammatory | Paracetamol (Dolomol, Karemol, Sidmol, Africure/Ufricure), Aspirin (Acetylsalicylic acid), Ibuprofen (Brufen), Diclofenac, Indocide/Indo25gm (Indomethacin), Paratal, Betapyn (betpyn), Gofen, Lofnac, Zeruprofene, Efferalgan, Febrilex (contains a combination of drugs) |
| Decongestant | Phenylephrine, coldarest, dacold, Cold Cap |
| Anti-Parasite | Albendazole (ALDAZ), Vermox, Mebendazole |
| Anti-Parasite and Antibiotic | Tinidazole (SEVATO) |
| Antibiotic | Amoxicillin, Co-trimoxazole (Bactrim), Ciprofloxacin (Cipro), Doxycycline, Erythromycin (Erythin), Lecotrim (Sulfamethoxazole and Trimethoprim), Metronidazole (Flagyl), Penicillin, Penicillin V (Phenoxymethylpenicillin, Penylv), Septrin or Bactrim, Ciprofloxacin, Cloxacillin, Trimethoprim/Sulfamethoxaz, augmentin, penioral, Clamoxyl, Nitrofurantoin, furoate 1s (Entamizole), Chloramphenicol, Cotmizox, Cotrinox |
| Anti-malarial | Coartem (Artemether/Lumefantrine) |
| Vitamins/home remedies | Iron (Fer, ferrousulfate), Folic Acid, Fefol, multivitamin, polyvitamin, Thiamine (Vitamin B), Vitamin C (Ascorbic Acid), Zinc |
| Anti-histamine | Paralamine/Chlorpheniramine (Chorephin, Chlorophene), Pheniramine, Chronade, Promethazine, Promethazine Hydrochloride, Dexchlropheniramine/polaramine, piriton (priton), Phelalamine, Phenylalamine, Phenylalanine, Fervex, Desloratidine |
| Anti-fungal | Griseofulvin (agofulvin) |
| Anti-spasmodic | Butylscopolamine, Biscopan (buscopan) |
| Weight Gain | Dynamogene |
| Steroid | Pediapred, Predmizole, prednizone, prednisolone |
| Anti-Depressant | Amitriptyline, Mirtazapine |
| Antiemetic | Metoclopramide (emeton), Moltium (motilium) |
| Antacid | Hydroxide Aluminum |
| Bronchospasms | Salbutamol (Salbitamol) |
| Expectorant | Sekrol, Ascoril, Rhinathiol, Rhinathiol Promethazine Bronchodilator mucolytic (Ascoril), Mycolin |
| Diuretic | HCTZ (Hydrochlorothiazide) |
| Mouth Ulcers | Anginovag |
| Diarrhea treatment | Ultra Levure |
| Oral rehydration | Infulyte, Ultra Levure |
| Topical Ointment | Onguentemulsifiant |
| Unknown | Zenfallogen, UX, PCIV, Uy, U, I, C+7, Chl, A, Chi, Cf |

*Notes:* This table classifies prescribed medicines into drug classes for later categorization into correct, optional, and unnecessary medicines. Unknown drugs could not be classified.

Table A2: Categorization of Medicines

| Disease | Correct + Necessary | Unnecessary | Optional |
|---|---|---|---|
| Malaria | • Anti-Malarial, if tested positive for malaria | • Anti-malarial if negative or no malaria test<br>• Bronchospasms<br>• Anti-Parasite<br>• Antibiotic<br>• Antibiotic / Antiparasite (Tinidazole)<br>• Anti-spasmodic<br>• Anti-histamine<br>• Anti-fungal<br>• Steroid<br>• Anti-Depressant<br>• Weight Gain<br>• Anti-inflammatory for mouth ulcers<br>• Antacid<br>• Expectorant<br>• Diarrhea treatment/Probiotic<br>• Diuretic<br>• Topical Ointment<br>• Decongestant<br>• Unknown Drugs<br>• Any combination of two different Fever Reducer/Analgesic/anti-inflammatory<br>• Betapyn & Febrilex<br>• If brand and generic are in two different drug classes, counted as a single unnecessary drug. | • At most one Fever Reducer/Analgesic/anti-inflammatory<br>• Vitamins<br>• Antiemetic<br>• Oral rehydration |
| URI | • None | • Anti-Parasite<br>• Bronchospasms<br>• Anti-spasmodic<br>• Antibiotic<br>• Antibiotic / Antiparasite (Tinidazole)<br>• Anti-malarial<br>• Anti-fungal<br>• Steroid<br>• Anti-Depressant<br>• Antacid<br>• Weight Gain<br>• Diarrhea treatment/Probiotic<br>• Diuretic<br>• Topical Ointment<br>• Unknown Drugs<br>• Any combination of two different Fever Reducer/Analgesic/anti-inflammatory<br>• Betapyn, & Febrilex<br>• If brand and generic are in two different drug classes, counted as a single unnecessary drug. | • At most one Fever Reducer/Analgesic/anti-inflammatory<br>• Vitamins<br>• Anti-histamine<br>• Expectorant<br>• Anti-inflammatory for mouth ulcers<br>• Oral Rehydration<br>• Decongestant |

*Notes:* This table shows the categorization of medicines into correct, optional, and unnecessary for malaria and URI.

Table A3: Categorization of Labs

| Disease | Correct + Necessary | Unnecessary | Optional |
|---|---|---|---|
| Malaria | • Microscopy or RDT | • Nasal swab (COVID-19 PCR)<br>• Typhoid Test (Widal Test)<br>• Blood Sugar Test/Glycemia<br>• Stool test, general<br>• Urine Tests<br>• Pregnancy Test<br>• Hepatitis/HCV Tests (B, C) (Could be part of a screening)<br>• HIV Test (Could be part of a screening)<br>• ECBU | • COVID-19 test (Rapid)<br>• Full Blood Count/NFS<br>• Other blood test-non specific<br>• Erythrocyte Sedimentation Rate (ESR)/VS<br>• C-Reactive Protein Test (CRP)<br>• Check Hemoglobin<br>• SRV, Liver Function test, RPR<br>• TB Test |
| URI | • None | • Chest X-Ray<br>• Lung CT Scan<br>• Nasal swab (COVID-19 PCR)<br>• Sputum Test<br>• Urine Tests:<br>– Glucosuria<br>– Albuminuria<br>• Blood Test, not specific<br>• Blood Tests:<br>– Albumin<br>– HCC<br>– Hepatitis/HCV Tests (B, C)<br>– HIV Test<br>• Hepatitis/HIV (could be part of a screening)<br>• Pregnancy Test | • Nasal swab (COVID-19 Rapid)<br>• Other Nasal Swab<br>• Throat Swab<br>• Malaria Testing<br>• Full Blood Count/NFS<br>• Crachat (by checking the TB)<br>• Hemoglobin test<br>• SRV<br>• Mucus test<br>• Lung Pulmonary Function Test<br>• Malaria Test<br>• Pulse Oximetry<br>• C-Reactive Protein Test (CRP)<br>• Check Hemoglobin<br>• RPR (Rapid Plasma Reagin)<br>• TB test<br>• Glycemia Test<br>• Mucus Test |

*Notes:* This table shows the categorization of exams and labs into correct, optional, and unnecessary by condition.

Table A4: Controls Variables Selected by ML

| **Outcomes From Tables 9 & 10** | **Selected Controls** | |
|---|---|---|
| | **Malaria** | **URI** |
| Correct Case Management | No Insurace | Provider Feels Pressured to Agree (5) |
| Any Optional Medicine | None | None |
| Number Optional Medicines | None | None |
| Any Unnecessary Medicine | None | Provider Feels Pressured to Agree (5) |
| Number Unnecessary Medicines | No Insurace | None |
| Number Optional Labs | Suggest Incorrect | Colleagues are Pressured to Agree (4) |
| Number Unnecessary Labs | None | None |
| Questions Asked | None | None |
| Time with Provider (Min) | MBI Depersonalization | None |
| Time Waiting for Provider (Min) | AM Visit<br>Weekend Visit | AM Visit |
| Log Total Patient Out of Pocket Payment | Doctor<br>No Insurance | Doctor<br>No Insurance |
| **Outcomes From Table 11** | | |
| Log Total Patient Out of Pocket Payment | Doctor | Doctor |

*Notes:* This table shows the control variables selected by lasso in the double/debiased machine learning models in Column 3 of Table 9 (malaria), Column 3 of Table 10 (URI), and Columns 3 (malaria) and 6 (URI) of Table 11.

Table A5: Suggestion Experiments by SP Characteristics

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Malaria Cases | | URI Cases | |
| | CCM | Ordered COVID Test | CCM | Prescribed Pneumonia Medicine |
| Suggest Malaria | 0.01 | -0.00 | | |
| | (0.03) | (0.02) | | |
| Age 30-34 × Suggest Malaria | 0.03 | | | |
| | (0.04) | | | |
| Age 35-42 × Suggest Malaria | -0.02 | | | |
| | (0.06) | | | |
| Female × Suggest Malaria | 0.01 | | | |
| | (0.03) | | | |
| No Insurance × Suggest Malaria | -0.04 | | | |
| | (0.05) | | | |
| Suggest COVID | -0.02 | 0.28*** | | |
| | (0.02) | (0.03) | | |
| Age 30-34 × Suggest COVID | | -0.02 | | |
| | | (0.04) | | |
| Age 35-42 × Suggest COVID | | -0.01 | | |
| | | (0.06) | | |
| Female × Suggest COVID | | -0.04 | | |
| | | (0.04) | | |
| No Insurance × Suggest COVID | | -0.05 | | |
| | | (0.05) | | |
| Suggest URI | | | -0.12* | -0.03 |
| | | | (0.06) | (0.03) |
| Age 30-34 × Suggest URI | | | 0.16* | |
| | | | (0.06) | |
| Age 35-42 × Suggest URI | | | 0.08 | |
| | | | (0.10) | |
| Female × Suggest URI | | | 0.17** | |
| | | | (0.06) | |
| No Insurance × Suggest URI | | | 0.04 | |
| | | | (0.08) | |
| Suggest Pneumonia | | | -0.05 | 0.12 |
| | | | (0.03) | (0.06) |
| Age 30-34 × Suggest Pneumonia | | | | -0.11 |
| | | | | (0.07) |
| Age 35-42 × Suggest Pneumonia | | | | 0.03 |
| | | | | (0.14) |
| Female × Suggest Pneumonia | | | | -0.07 |
| | | | | (0.07) |
| No Insurance × Suggest Pneumonia | | | | 0.03 |
| | | | | (0.08) |
| Age 30-34 | -0.03 | -0.02 | -0.08** | 0.06 |
| | (0.02) | (0.02) | (0.03) | (0.04) |
| Age 35-42 | -0.01 | -0.05 | -0.09 | 0.11* |
| | (0.03) | (0.03) | (0.05) | (0.06) |
| Female | 0.01 | -0.01 | -0.12*** | 0.08* |
| | (0.02) | (0.02) | (0.03) | (0.03) |
| No Insurance | -0.07** | 0.04 | -0.07* | 0.11** |
| | (0.02) | (0.03) | (0.04) | (0.04) |
| Babyl | -0.00 | -0.05** | 0.27*** | -0.11*** |
| | (0.01) | (0.02) | (0.03) | (0.03) |
| Observations | 1260 | 1260 | 1240 | 1240 |
| $R^2$ | 0.020 | 0.138 | 0.117 | 0.033 |
| Mean Dependent Variable in CC | 0.93 | 0.12 | 0.17 | 0.51 |

*Notes:* This table shows results from OLS regressions. The outcomes are as follows: (1) Malaria CCM, (2) Ordered a COVID Test, (3) URI CCM, and (4) Prescribed Pneumonia Medicine. Each outcome is regressed on the relevant suggestion case, as well as Female, Pay Out of Pocket, and age. All of these characteristics are interacted with the relevant suggestion indicators. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A6: Request Experiments by SP Characteristics

| | (1) Prescribed Bactrim | (2) Prescribed Ciprofloxacin |
|---|---|---|
| Babyl | -0.06*** | -0.00 |
| | (0.02) | (0.01) |
| Request Bactrim | 0.16*** | |
| | (0.03) | |
| Babyl × Request Bactrim | -0.14*** | |
| | (0.03) | |
| Age 30-34 | 0.02 | 0.01 |
| | (0.02) | (0.01) |
| Age 35-42 | -0.01 | -0.00 |
| | (0.03) | (0.01) |
| Age 30-34 × Request Bactrim | -0.09* | |
| | (0.03) | |
| Age 35-42 × Request Bactrim | 0.17** | |
| | (0.05) | |
| Female | -0.01 | -0.00 |
| | (0.02) | (0.01) |
| Female × Request Bactrim | 0.02 | |
| | (0.03) | |
| No Insurance | 0.02 | 0.01 |
| | (0.02) | (0.01) |
| No Insurance × Request Bactrim | 0.12** | |
| | (0.05) | |
| Request Cipro | | 0.03 |
| | | (0.02) |
| Babyl × Request Cipro | | -0.03* |
| | | (0.02) |
| Age 30-34 × Request Cipro | | 0.07*** |
| | | (0.02) |
| Age 35-42 × Request Cipro | | 0.02 |
| | | (0.03) |
| Female × Request Cipro | | 0.01 |
| | | (0.02) |
| No Insurance × Request Cipro | | -0.02 |
| | | (0.02) |
| Observations | 1225 | 1241 |
| $R^2$ | 0.129 | 0.053 |
| Mean Dependent Variable in CC Request + Babyl X Request | 0.11 | 0.02 |

*Notes:* This table shows results from OLS regressions. The outcomes are as follows: (1)Prescribed Bactrim, and (2) Prescribed Ciprofloxacin. Each outcome is regressed on the relevant request case, as well as Female, Pay Out of Pocket, and age. All of these characteristics are interacted with the relevant suggestion indicators. * $p < 0.05$, ** $p < 0.01$, ***

Table A7: Provider Experience, Malaria

| | (1) CCM | (2) Optional Medicines | (3) Unnecessary Medicines | (4) Optional Labs | (5) Unnecessary Labs | (6) Questions Asked | (7) Time with Provider | (8) Wait Time | (9) Log Pay |
|---|---|---|---|---|---|---|---|---|---|
| Babyl | -0.00 | 0.17*** | -0.00 | -0.06* | -0.18*** | 3.39*** | -0.96** | -67.94*** | -0.22** |
| | (0.02) | (0.04) | (0.05) | (0.03) | (0.03) | (0.20) | (0.34) | (3.95) | (0.07) |
| Doctor | -0.02 | 0.06 | 0.13 | 0.04 | 0.07 | 0.66 | -0.37 | 3.64 | 0.89*** |
| | (0.03) | (0.09) | (0.09) | (0.05) | (0.05) | (0.39) | (0.66) | (7.75) | (0.14) |
| Above Median Age | -0.03 | 0.04 | -0.16** | -0.01 | -0.10** | 0.03 | 0.44 | 4.42 | -0.01 |
| | (0.02) | (0.06) | (0.06) | (0.03) | (0.04) | (0.25) | (0.43) | (5.01) | (0.09) |
| Above Median Health Experience | 0.05* | -0.09 | 0.07 | 0.03 | 0.10** | 0.53* | 0.23 | -1.92 | 0.05 |
| | (0.02) | (0.06) | (0.06) | (0.03) | (0.04) | (0.25) | (0.43) | (5.03) | (0.09) |
| Above Median Facility Experience | -0.01 | -0.12* | -0.01 | -0.02 | 0.02 | -1.40*** | -0.29 | 2.94 | -0.11 |
| | (0.03) | (0.06) | (0.06) | (0.04) | (0.04) | (0.28) | (0.48) | (5.58) | (0.10) |
| Percent Similar Patients | 0.01 | -0.03 | -0.02 | 0.06** | -0.03 | 0.25 | -0.04 | -8.94* | -0.03 |
| | (0.02) | (0.04) | (0.04) | (0.02) | (0.02) | (0.18) | (0.30) | (3.52) | (0.06) |
| Case Knowledge | -0.07 | -0.28 | 0.14 | -0.09 | 0.12 | -2.75** | -0.89 | -27.26 | -0.20 |
| | (0.09) | (0.22) | (0.23) | (0.13) | (0.14) | (0.99) | (1.69) | (19.80) | (0.36) |
| No Insurance | -0.09*** | -0.05 | 0.20*** | 0.04 | 0.03 | 0.21 | 0.60 | -10.66* | 2.18*** |
| | (0.02) | (0.06) | (0.06) | (0.03) | (0.04) | (0.26) | (0.44) | (5.14) | (0.09) |
| Constant | 1.01*** | 1.88*** | 0.41 | 0.23 | 0.05 | 8.36*** | 5.52** | 127.68*** | 5.88*** |
| | (0.09) | (0.23) | (0.24) | (0.14) | (0.14) | (1.03) | (1.75) | (20.57) | (0.37) |
| Observations | 1091 | 1062 | 1062 | 1091 | 1091 | 1091 | 1091 | 1091 | 1059 |
| $R^2$ | 0.025 | 0.033 | 0.027 | 0.019 | 0.053 | 0.269 | 0.022 | 0.267 | 0.441 |
| Mean Dependent Variable in CC | 0.94 | 1.45 | 0.52 | 0.18 | 0.19 | 4.94 | 4.86 | 98.68 | 5.95 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on measures of provider experience including whether the provider is a doctor, above median aged, has above median years working in the health sector, has above median years working in the facility, the percent of patients they typically see with symptoms similar to the case presentation, knowledge of correct case management for the case presentation. All regressions control for whether the visit is at Babyl (vs. CC) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to malaria visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A8: Provider Experience, URI

| | (1) CCM | (2) Optional Medicines | (3) Unnecessary Medicines | (4) Optional Labs | (5) Unnecessary Labs | (6) Questions Asked | (7) Time with Provider | (8) Wait Time | (9) Log Pay |
|---|---|---|---|---|---|---|---|---|---|
| Babyl | 0.31*** | 0.32*** | -0.36*** | -0.26*** | -0.02 | 6.30*** | -1.30** | -69.33*** | -0.38*** |
| | (0.03) | (0.06) | (0.04) | (0.04) | (0.01) | (0.26) | (0.41) | (4.41) | (0.08) |
| Doctor | -0.11 | -0.07 | 0.16* | 0.02 | -0.00 | -0.07 | -0.36 | 10.01 | 0.54*** |
| | (0.06) | (0.11) | (0.08) | (0.07) | (0.02) | (0.50) | (0.79) | (8.43) | (0.16) |
| Above Median Age | 0.05 | -0.05 | -0.09 | -0.10* | -0.01 | 0.07 | 0.56 | 9.76 | 0.05 |
| | (0.04) | (0.07) | (0.05) | (0.05) | (0.01) | (0.31) | (0.49) | (5.29) | (0.10) |
| Above Median Health Experience | 0.01 | 0.04 | 0.00 | 0.01 | 0.01 | 0.37 | 0.43 | -1.63 | -0.07 |
| | (0.04) | (0.07) | (0.05) | (0.05) | (0.01) | (0.31) | (0.49) | (5.29) | (0.10) |
| Above Median Facility Experience | 0.07 | -0.03 | -0.06 | 0.10* | -0.01 | -1.15*** | -0.57 | -3.32 | 0.15 |
| | (0.04) | (0.07) | (0.05) | (0.05) | (0.01) | (0.32) | (0.51) | (5.50) | (0.10) |
| Percent Similar Patients | 0.02 | -0.02 | -0.04 | 0.02 | 0.01 | 0.31 | 0.05 | -2.27 | 0.03 |
| | (0.03) | (0.05) | (0.03) | (0.03) | (0.01) | (0.21) | (0.33) | (3.58) | (0.07) |
| Case Knowledge | 0.06 | -0.00 | -0.06 | -0.01 | -0.01 | -0.20 | -0.24 | 8.29* | -0.08 |
| | (0.03) | (0.05) | (0.04) | (0.03) | (0.01) | (0.23) | (0.36) | (3.88) | (0.07) |
| No Insurance | -0.02 | 0.04 | 0.01 | -0.15*** | -0.01 | 0.22 | 0.59 | -20.53*** | 2.07*** |
| | (0.04) | (0.06) | (0.04) | (0.04) | (0.01) | (0.29) | (0.45) | (4.86) | (0.09) |
| Constant | 0.04 | 2.06*** | 1.04*** | 0.33*** | 0.03** | 5.86*** | 5.61*** | 97.06*** | 5.52*** |
| | (0.04) | (0.07) | (0.05) | (0.05) | (0.01) | (0.32) | (0.51) | (5.48) | (0.10) |
| Observations | 1049 | 1049 | 1049 | 1075 | 1075 | 1075 | 1075 | 1075 | 1029 |
| $R^2$ | 0.125 | 0.048 | 0.105 | 0.063 | 0.009 | 0.441 | 0.034 | 0.263 | 0.417 |
| Mean Dependent Variable in CC | 0.16 | 2.03 | 0.90 | 0.33 | 0.03 | 5.29 | 5.76 | 97.04 | 6.06 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on measures of provider experience including whether the provider is a doctor, above median aged, has above median years working in the health sector, has above median years working in the facility, the percent of patients they typically see with symptoms similar to the case presentation, knowledge of correct case management for the case presentation. All regressions control for whether the visit is at Babyl (vs. CC) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to URI visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A9: Provider Experience, CC

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| Above Median Age | -0.01 | -0.03 | -0.03 | -0.09 | -0.07 | -0.09** | 0.38 | 0.62 | 7.28 | 0.08 |
| | (0.03) | (0.05) | (0.05) | (0.05) | (0.04) | (0.03) | (0.25) | (0.55) | (6.07) | (0.06) |
| Above Median Health Experience | 0.03 | 0.08 | 0.00 | -0.04 | 0.03 | 0.08* | -0.17 | 0.35 | -1.88 | -0.01 |
| | (0.03) | (0.05) | (0.06) | (0.05) | (0.05) | (0.03) | (0.27) | (0.59) | (6.49) | (0.07) |
| Above Median Facility Experience | -0.01 | 0.03 | -0.11 | -0.00 | 0.06 | 0.03 | -1.04*** | -0.49 | -0.09 | -0.07 |
| | (0.03) | (0.05) | (0.06) | (0.05) | (0.05) | (0.03) | (0.27) | (0.59) | (6.45) | (0.07) |
| Percent Similar Patients | 0.02 | -0.00 | -0.02 | -0.01 | 0.04 | -0.02 | 0.35* | -0.05 | -9.23* | 0.03 |
| | (0.02) | (0.03) | (0.04) | (0.03) | (0.03) | (0.02) | (0.17) | (0.37) | (4.07) | (0.04) |
| Case Knowledge | -0.09 | 0.08** | -0.05 | -0.09 | -0.03 | 0.00 | -0.38 | -0.37 | 12.56* | -0.12* |
| | (0.11) | (0.03) | (0.05) | (0.05) | (0.04) | (0.03) | (0.24) | (0.52) | (5.70) | (0.06) |
| No Insurance | -0.11*** | -0.01 | -0.01 | 0.09* | -0.09* | -0.01 | 0.34 | 0.97* | -20.61*** | 2.09*** |
| | (0.03) | (0.04) | (0.05) | (0.04) | (0.04) | (0.03) | (0.21) | (0.48) | (5.20) | (0.05) |
| Malaria | | | -0.55*** | -0.33*** | -0.14*** | 0.16*** | -0.07 | -0.64 | -6.76 | 0.07 |
| | | | (0.05) | (0.04) | (0.04) | (0.03) | (0.21) | (0.47) | (5.09) | (0.05) |
| Constant | 1.03*** | 0.07 | 2.17*** | 1.00*** | 0.32*** | 0.02 | 5.94*** | 5.58*** | 97.58*** | 5.66*** |
| | (0.11) | (0.04) | (0.06) | (0.05) | (0.05) | (0.03) | (0.27) | (0.59) | (6.47) | (0.07) |
| Observations | 628 | 613 | 1233 | 1233 | 1245 | 1245 | 1245 | 1245 | 1245 | 1229 |
| $R^2$ | 0.033 | 0.025 | 0.177 | 0.112 | 0.033 | 0.056 | 0.026 | 0.012 | 0.023 | 0.564 |
| Mean Dependent Variable | 0.94 | 0.16 | 1.73 | 0.71 | 0.25 | 0.11 | 5.12 | 5.31 | 97.87 | 6.00 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on measures of provider experience including whether the provider is a doctor, above median aged, has above median years working in the health sector, has above median years working in the facility, the percent of patients they typically see with symptoms similar to the case presentation, knowledge of correct case management for the case presentation. All regressions control for whether the case is malaria (vs. URI) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to conventional care visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A10: Provider Experience, Babyl

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| Doctor | -0.05 | -0.11 | -0.02 | 0.15* | -0.01 | 0.02 | 0.55 | 0.27 | -0.50 | 0.70*** |
| | (0.04) | (0.09) | (0.09) | (0.07) | (0.04) | (0.02) | (0.38) | (0.17) | (2.76) | (0.16) |
| Above Median Age | -0.05 | 0.16* | 0.04 | -0.14* | -0.01 | -0.01 | -0.26 | 0.26 | 6.17** | -0.03 |
| | (0.04) | (0.07) | (0.07) | (0.06) | (0.03) | (0.02) | (0.33) | (0.14) | (2.39) | (0.14) |
| Above Median Health Experience | 0.07* | -0.05 | -0.05 | 0.11 | -0.01 | 0.02 | 1.10*** | 0.37** | -1.23 | -0.02 |
| | (0.04) | (0.07) | (0.07) | (0.06) | (0.03) | (0.01) | (0.30) | (0.13) | (2.18) | (0.13) |
| Above Median Facility Experience | -0.00 | 0.12 | -0.01 | -0.05 | 0.01 | -0.04* | -1.40*** | -0.44** | -0.24 | 0.16 |
| | (0.04) | (0.08) | (0.08) | (0.07) | (0.04) | (0.02) | (0.37) | (0.16) | (2.66) | (0.16) |
| Percent Similar Patients | 0.00 | 0.04 | -0.04 | -0.05 | 0.02 | 0.00 | 0.27 | 0.10 | -0.04 | -0.06 |
| | (0.03) | (0.05) | (0.05) | (0.04) | (0.02) | (0.01) | (0.23) | (0.10) | (1.67) | (0.10) |
| Case Knowledge | -0.05 | -0.02 | 0.08 | 0.05 | 0.03 | -0.02 | -0.09 | -0.01 | -4.00 | -0.01 |
| | (0.16) | (0.06) | (0.09) | (0.07) | (0.04) | (0.02) | (0.39) | (0.17) | (2.79) | (0.17) |
| No Insurance | -0.03 | -0.04 | 0.02 | 0.11 | -0.00 | 0.03 | -0.12 | -0.46** | -3.13 | 2.21*** |
| | (0.05) | (0.09) | (0.09) | (0.07) | (0.04) | (0.02) | (0.39) | (0.17) | (2.86) | (0.17) |
| Malaria | | | -0.73*** | -0.01 | -0.02 | 0.03** | -3.03*** | -0.33** | 1.83 | 0.21* |
| | | | (0.05) | (0.04) | (0.02) | (0.01) | (0.23) | (0.10) | (1.63) | (0.10) |
| Constant | 0.98*** | 0.36*** | 2.31*** | 0.56*** | 0.08 | 0.04 | 12.09*** | 4.15*** | 33.94*** | 5.06*** |
| | (0.16) | (0.09) | (0.11) | (0.09) | (0.05) | (0.02) | (0.49) | (0.22) | (3.57) | (0.21) |
| Observations | 463 | 436 | 878 | 878 | 921 | 921 | 921 | 921 | 921 | 859 |
| $R^2$ | 0.021 | 0.032 | 0.205 | 0.028 | 0.003 | 0.027 | 0.210 | 0.053 | 0.014 | 0.324 |
| Mean Dependent Variable | 0.92 | 0.47 | 1.99 | 0.57 | 0.11 | 0.02 | 9.69 | 3.77 | 31.60 | 5.67 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on measures of provider experience including whether the provider is a doctor, above median aged, has above median years working in the health sector, has above median years working in the facility, the percent of patients they typically see with symptoms similar to the case presentation, knowledge of correct case management for the case presentation. All regressions control for whether the case is malaria (vs. URI) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to Babyl visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A11: Provider Characteristics, Malaria

| | (1) CCM | (2) Optional Medicines | (3) Unnecessary Medicines | (4) Optional Labs | (5) Unnecessary Labs | (6) Questions Asked | (7) Time with Provider | (8) Wait Time | (9) Log Pay |
|---|---|---|---|---|---|---|---|---|---|
| Babyl | -0.02 | 0.15*** | 0.02 | -0.08** | -0.15*** | 3.14*** | -1.26*** | -65.23*** | -0.11 |
| | (0.02) | (0.04) | (0.04) | (0.02) | (0.03) | (0.18) | (0.31) | (3.52) | (0.07) |
| Female | -0.01 | -0.06 | -0.07 | -0.01 | 0.01 | -0.13 | 0.31 | 5.63 | -0.00 |
| | (0.02) | (0.04) | (0.04) | (0.02) | (0.02) | (0.18) | (0.30) | (3.47) | (0.07) |
| Big Five: Extraversion | -0.00 | -0.01 | 0.00 | -0.01 | 0.01 | -0.08 | -0.21 | 8.10*** | -0.08* |
| | (0.01) | (0.02) | (0.02) | (0.01) | (0.01) | (0.10) | (0.16) | (1.84) | (0.04) |
| Big Five: Agreeableness | -0.01 | 0.05* | -0.04 | 0.03* | 0.02 | 0.00 | 0.08 | 1.72 | 0.04 |
| | (0.01) | (0.02) | (0.02) | (0.01) | (0.01) | (0.09) | (0.16) | (1.80) | (0.03) |
| Big Five: Conscientiousness | -0.01 | -0.03 | -0.04 | -0.00 | -0.00 | -0.23* | -0.20 | -3.44 | -0.04 |
| | (0.01) | (0.02) | (0.03) | (0.01) | (0.02) | (0.11) | (0.19) | (2.12) | (0.04) |
| Big Five: Neuroticism | -0.00 | 0.03 | -0.00 | -0.00 | 0.01 | -0.10 | 0.07 | 4.82** | 0.02 |
| | (0.01) | (0.02) | (0.02) | (0.01) | (0.01) | (0.09) | (0.15) | (1.69) | (0.03) |
| Big Five: Openness | -0.01 | -0.02 | 0.03 | 0.01 | 0.00 | 0.14 | 0.07 | 0.92 | -0.01 |
| | (0.01) | (0.02) | (0.02) | (0.01) | (0.01) | (0.10) | (0.16) | (1.85) | (0.04) |
| Dictator Game: Percent Given to Patient | -0.00 | 0.00 | 0.00 | -0.00 | -0.00 | 0.00 | 0.00 | -0.24** | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.01) | (0.08) | (0.00) |
| No Insurance | -0.10*** | -0.02 | 0.23*** | 0.04 | 0.02 | 0.45 | 0.61 | -10.47* | 2.42*** |
| | (0.02) | (0.06) | (0.06) | (0.03) | (0.03) | (0.25) | (0.41) | (4.74) | (0.09) |
| Constant | 0.97*** | 1.47*** | 0.51*** | 0.17*** | 0.20*** | 4.86*** | 4.59*** | 103.43*** | 5.50*** |
| | (0.02) | (0.05) | (0.05) | (0.03) | (0.03) | (0.21) | (0.35) | (4.01) | (0.08) |
| Observations | 1075 | 1046 | 1046 | 1075 | 1075 | 1075 | 1075 | 1075 | 1043 |
| $R^2$ | 0.029 | 0.036 | 0.030 | 0.019 | 0.043 | 0.249 | 0.025 | 0.288 | 0.423 |
| Mean Dependent Variable in CC | 0.94 | 1.44 | 0.52 | 0.17 | 0.18 | 4.94 | 4.88 | 98.12 | 5.94 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on provider characteristics including whether the provider is female, Big Five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness) normalized to mean of 0 and standard deviation of 1, and the average percent of endowment shared with a patient in the dictator game. All regressions control for whether the visit is at Babyl (vs. CC) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to malaria visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A12: Provider Characteristics, URI

| | (1) CCM | (2) Optional Medicines | (3) Unnecessary Medicines | (4) Optional Labs | (5) Unnecessary Labs | (6) Questions Asked | (7) Time with Provider | (8) Wait Time | (9) Log Pay |
|---|---|---|---|---|---|---|---|---|---|
| Babyl | 0.30*** | 0.27*** | -0.33*** | -0.23*** | -0.02* | 6.05*** | -1.67*** | -65.40*** | -0.35*** |
| | (0.03) | (0.05) | (0.03) | (0.03) | (0.01) | (0.22) | (0.21) | (3.66) | (0.07) |
| Female | -0.00 | -0.14** | -0.01 | -0.09** | -0.01 | 0.39 | -0.21 | 5.31 | -0.03 |
| | (0.03) | (0.05) | (0.03) | (0.03) | (0.01) | (0.21) | (0.21) | (3.61) | (0.07) |
| Big Five: Extraversion | -0.03* | -0.05* | 0.03 | -0.02 | 0.01 | 0.22 | -0.06 | 5.99** | -0.09* |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.00) | (0.11) | (0.11) | (1.92) | (0.04) |
| Big Five: Agreeableness | 0.01 | 0.03 | 0.00 | 0.01 | -0.00 | -0.04 | 0.19 | 0.58 | 0.02 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.00) | (0.11) | (0.11) | (1.85) | (0.04) |
| Big Five: Conscientiousness | 0.03* | -0.02 | -0.03 | -0.00 | -0.00 | -0.19 | -0.10 | 0.53 | -0.05 |
| | (0.02) | (0.03) | (0.02) | (0.02) | (0.00) | (0.12) | (0.12) | (2.07) | (0.04) |
| Big Five: Neuroticism | -0.00 | 0.01 | 0.02 | 0.01 | -0.01 | 0.14 | 0.02 | 4.28* | -0.00 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.00) | (0.12) | (0.11) | (1.96) | (0.04) |
| Big Five: Openness | -0.01 | -0.06* | 0.01 | 0.02 | 0.00 | 0.15 | 0.13 | 3.17 | -0.05 |
| | (0.02) | (0.03) | (0.02) | (0.02) | (0.00) | (0.12) | (0.12) | (2.00) | (0.04) |
| Dictator Game: Percent Given to Patient | 0.00 | 0.00 | -0.00 | -0.00 | -0.00 | -0.00 | -0.00 | -0.10 | -0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.08) | (0.00) |
| No Insurance | -0.05 | 0.00 | 0.05 | -0.15*** | -0.01 | 0.26 | -0.20 | -18.24*** | 2.15*** |
| | (0.03) | (0.06) | (0.04) | (0.04) | (0.01) | (0.27) | (0.26) | (4.56) | (0.09) |
| Constant | 0.16*** | 2.07*** | 0.91*** | 0.43*** | 0.04*** | 5.13*** | 5.76*** | 100.01*** | 5.63*** |
| | (0.03) | (0.05) | (0.04) | (0.04) | (0.01) | (0.25) | (0.25) | (4.26) | (0.08) |
| Observations | 1038 | 1038 | 1038 | 1064 | 1064 | 1064 | 1064 | 1064 | 1018 |
| $R^2$ | 0.117 | 0.071 | 0.096 | 0.065 | 0.013 | 0.439 | 0.061 | 0.266 | 0.412 |
| Mean Dependent Variable in CC | 0.16 | 2.02 | 0.90 | 0.32 | 0.03 | 5.29 | 5.53 | 96.53 | 6.07 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on provider characteristics including whether the provider is female, Big Five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness) normalized to mean of 0 and standard deviation of 1, and the average percent of endowment shared with a patient in the dictator game. All regressions control for whether the visit is at Babyl (vs. CC) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to URI visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A13: Provider Characteristics, CC

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| Female | -0.01 | 0.06 | -0.10* | -0.20*** | -0.03 | -0.03 | 0.18 | 0.14 | 6.41 | 0.04 |
| | (0.02) | (0.03) | (0.04) | (0.03) | (0.03) | (0.02) | (0.18) | (0.32) | (4.24) | (0.04) |
| Big Five: Extraversion | -0.02 | -0.02 | -0.06** | 0.04* | -0.02 | 0.01 | 0.02 | -0.19 | 13.22*** | -0.09*** |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.10) | (0.17) | (2.25) | (0.02) |
| Big Five: Agreeableness | -0.01 | 0.03* | 0.05* | -0.06*** | 0.04* | 0.01 | -0.03 | 0.21 | 3.20 | 0.02 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.09) | (0.17) | (2.20) | (0.02) |
| Big Five: Conscientiousness | -0.01 | 0.00 | -0.00 | -0.00 | 0.01 | 0.00 | -0.27* | -0.17 | -3.41 | -0.00 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.12) | (0.21) | (2.76) | (0.03) |
| Big Five: Neuroticism | -0.02 | 0.01 | 0.05* | 0.02 | 0.00 | -0.00 | 0.16 | 0.14 | 7.79*** | -0.03 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.10) | (0.17) | (2.24) | (0.02) |
| Big Five: Openness | -0.02 | -0.02 | -0.08*** | 0.03 | 0.03 | 0.01 | 0.11 | 0.18 | 3.80 | -0.01 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.10) | (0.17) | (2.28) | (0.02) |
| Dictator Game: Percent Given to Patient | -0.00 | 0.00 | -0.00 | 0.00 | -0.00 | -0.00 | -0.00 | 0.00 | -0.24* | -0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.01) | (0.10) | (0.00) |
| No Insurance | -0.11*** | -0.02 | -0.00 | 0.09* | -0.09* | -0.02 | 0.37 | 0.45 | -22.42*** | 2.10*** |
| | (0.03) | (0.04) | (0.05) | (0.04) | (0.04) | (0.03) | (0.22) | (0.39) | (5.15) | (0.05) |
| Malaria | | | -0.59*** | -0.37*** | -0.16*** | 0.15*** | -0.31 | -0.64* | 0.22 | -0.00 |
| | | | (0.04) | (0.03) | (0.03) | (0.02) | (0.17) | (0.30) | (4.04) | (0.04) |
| Constant | 0.97*** | 0.11** | 2.10*** | 0.99*** | 0.37*** | 0.08** | 5.13*** | 5.29*** | 104.54*** | 5.57*** |
| | (0.02) | (0.04) | (0.05) | (0.04) | (0.04) | (0.03) | (0.22) | (0.39) | (5.21) | (0.05) |
| Observations | 612 | 602 | 1206 | 1206 | 1218 | 1218 | 1218 | 1218 | 1218 | 1202 |
| $R^2$ | 0.046 | 0.016 | 0.198 | 0.134 | 0.039 | 0.053 | 0.016 | 0.011 | 0.058 | 0.565 |
| Mean Dependent Variable | 0.94 | 0.16 | 1.73 | 0.71 | 0.25 | 0.11 | 5.11 | 5.20 | 97.33 | 6.00 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on provider characteristics including whether the provider is female, Big Five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness) normalized to mean of 0 and standard deviation of 1, and the average percent of endowment shared with a patient in the dictator game. All regressions control for whether the case is malaria (vs. URI) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to conventional care visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A14: Provider Characteristics, Babyl

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| Female | 0.00 | -0.07 | -0.11* | 0.15*** | -0.05* | 0.03** | 0.04 | -0.01 | 1.80 | -0.09 |
| | (0.03) | (0.05) | (0.05) | (0.04) | (0.02) | (0.01) | (0.23) | (0.10) | (1.64) | (0.10) |
| Big Five: Extraversion | 0.01 | -0.04 | 0.00 | 0.01 | -0.01 | 0.01 | 0.14 | -0.04 | -0.85 | -0.09 |
| | (0.01) | (0.03) | (0.03) | (0.02) | (0.01) | (0.01) | (0.12) | (0.05) | (0.85) | (0.05) |
| Big Five: Agreeableness | -0.01 | -0.01 | 0.02 | 0.01 | -0.00 | -0.00 | 0.00 | 0.03 | -1.23 | 0.02 |
| | (0.01) | (0.03) | (0.03) | (0.02) | (0.01) | (0.01) | (0.12) | (0.05) | (0.83) | (0.05) |
| Big Five: Conscientiousness | -0.01 | 0.06* | -0.06* | -0.06** | -0.00 | 0.00 | -0.20 | -0.11* | -0.03 | -0.06 |
| | (0.01) | (0.03) | (0.03) | (0.02) | (0.01) | (0.01) | (0.12) | (0.05) | (0.87) | (0.05) |
| Big Five: Neuroticism | 0.02 | 0.00 | -0.00 | 0.00 | 0.01 | 0.00 | -0.13 | -0.04 | 0.37 | 0.04 |
| | (0.01) | (0.03) | (0.02) | (0.02) | (0.01) | (0.01) | (0.11) | (0.05) | (0.79) | (0.05) |
| Big Five: Openness | -0.01 | -0.01 | 0.01 | 0.02 | 0.00 | 0.00 | 0.14 | -0.01 | -0.04 | -0.05 |
| | (0.01) | (0.03) | (0.03) | (0.02) | (0.01) | (0.01) | (0.12) | (0.05) | (0.88) | (0.05) |
| Dictator Game: Percent Given to Patient | -0.00 | 0.00 | 0.00** | -0.00 | -0.00 | -0.00 | -0.00 | -0.00 | -0.03 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.01) | (0.00) | (0.04) | (0.00) |
| No Insurance | -0.08* | -0.10 | -0.02 | 0.21*** | -0.02 | 0.05** | 0.30 | -0.28 | -3.07 | 2.58*** |
| | (0.04) | (0.07) | (0.07) | (0.06) | (0.03) | (0.01) | (0.32) | (0.14) | (2.32) | (0.14) |
| Malaria | | | -0.73*** | 0.01 | -0.02 | 0.03** | -3.08*** | -0.33*** | 1.54 | 0.22* |
| | | | (0.05) | (0.04) | (0.02) | (0.01) | (0.22) | (0.10) | (1.56) | (0.09) |
| Constant | 0.93*** | 0.50*** | 2.29*** | 0.48*** | 0.15*** | -0.01 | 11.19*** | 4.05*** | 31.41*** | 5.17*** |
| | (0.02) | (0.05) | (0.05) | (0.04) | (0.02) | (0.01) | (0.25) | (0.11) | (1.76) | (0.11) |
| Observations | 463 | 436 | 878 | 878 | 921 | 921 | 921 | 921 | 921 | 859 |
| $R^2$ | 0.024 | 0.030 | 0.219 | 0.039 | 0.009 | 0.027 | 0.190 | 0.025 | 0.011 | 0.316 |
| Mean Dependent Variable | 0.92 | 0.47 | 1.99 | 0.57 | 0.11 | 0.02 | 9.69 | 3.77 | 31.60 | 5.67 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on provider characteristics including whether the provider is female, Big Five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness) normalized to mean of 0 and standard deviation of 1, and the average percent of endowment shared with a patient in the dictator game. All regressions control for whether the case is malaria (vs. URI) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to Babyl visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A15: Work Environment, Malaria

| | (1) CCM | (2) Optional Medicines | (3) Unnecessary Medicines | (4) Optional Labs | (5) Unnecessary Labs | (6) Questions Asked | (7) Time with Provider | (8) Wait Time | (9) Log Pay |
|---|---|---|---|---|---|---|---|---|---|
| Babyl | -0.01 | 0.20*** | 0.03 | -0.07** | -0.13*** | 3.04*** | -1.32*** | -73.58*** | -0.15* |
| | (0.02) | (0.04) | (0.05) | (0.03) | (0.03) | (0.19) | (0.33) | (3.75) | (0.07) |
| Morning | 0.02 | 0.12** | 0.00 | 0.02 | 0.04 | -0.16 | -0.48 | -31.52*** | -0.15* |
| | (0.02) | (0.04) | (0.05) | (0.03) | (0.03) | (0.20) | (0.34) | (3.77) | (0.07) |
| Weekend | -0.01 | 0.08 | -0.05 | -0.00 | -0.01 | -0.73** | -0.18 | -18.11*** | 0.10 |
| | (0.02) | (0.06) | (0.06) | (0.04) | (0.04) | (0.27) | (0.46) | (5.13) | (0.10) |
| Normalized Wait Time | -0.03** | 0.01 | 0.03 | -0.02 | 0.01 | -0.11 | -0.17 | | -0.05 |
| | (0.01) | (0.02) | (0.02) | (0.01) | (0.01) | (0.09) | (0.15) | | (0.03) |
| Above Median Overwhelmed | -0.07** | 0.00 | 0.07 | -0.01 | -0.06 | -0.30 | 0.36 | 0.26 | -0.19 |
| | (0.03) | (0.07) | (0.07) | (0.04) | (0.04) | (0.30) | (0.51) | (5.78) | (0.11) |
| Above Median Rushed | 0.02 | -0.03 | -0.07 | 0.01 | 0.08 | 0.01 | -0.28 | 2.41 | -0.01 |
| | (0.02) | (0.06) | (0.07) | (0.04) | (0.04) | (0.29) | (0.49) | (5.53) | (0.11) |
| MBI Emotional Exhaustion | -0.00 | -0.01 | -0.04 | 0.00 | 0.02 | -0.07 | 0.15 | -1.31 | -0.03 |
| | (0.01) | (0.02) | (0.02) | (0.01) | (0.01) | (0.09) | (0.16) | (1.76) | (0.03) |
| MBI Depersonalization | 0.01 | 0.07* | 0.02 | 0.03 | -0.02 | 0.44** | 0.75** | 0.77 | 0.05 |
| | (0.01) | (0.03) | (0.03) | (0.02) | (0.02) | (0.14) | (0.23) | (2.62) | (0.05) |
| MBI Professional Accomplishment | -0.01 | 0.01 | 0.01 | 0.00 | -0.01 | -0.20 | -0.14 | 0.97 | -0.00 |
| | (0.01) | (0.03) | (0.03) | (0.02) | (0.02) | (0.15) | (0.25) | (2.81) | (0.05) |
| No Insurance | -0.10*** | 0.01 | 0.22*** | 0.03 | 0.05 | 0.41 | 0.52 | -10.50* | 2.44*** |
| | (0.02) | (0.05) | (0.06) | (0.03) | (0.03) | (0.24) | (0.42) | (4.69) | (0.09) |
| Constant | 0.98*** | 1.30*** | 0.53** | 0.13 | 0.17 | 6.23*** | 5.26*** | 124.79*** | 5.71*** |
| | (0.07) | (0.19) | (0.20) | (0.11) | (0.12) | (0.86) | (1.47) | (16.59) | (0.32) |
| Observations | 1041 | 1012 | 1012 | 1041 | 1041 | 1041 | 1041 | 1041 | 1011 |
| $R^2$ | 0.041 | 0.037 | 0.025 | 0.017 | 0.046 | 0.262 | 0.038 | 0.317 | 0.431 |
| Mean Dependent Variable in CC | 0.93 | 1.44 | 0.53 | 0.18 | 0.18 | 4.92 | 4.87 | 99.21 | 5.94 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on work environment including proxies for how busy the facility was at the time of the visit (morning visits from 7-11am, visits on a weekend, and the SP's wait time (normalized to mean 0 and standard deviation 1 for Babyl and CC visits separately), indicators for whether the provider was above median on ratings of feeling overwhelmed and rushed, as well as the provider's Maslach Burnout Inventory subscale averages for emotional exhaustion, depersonalization, and professional accomplishment. All regressions control for whether the visit is at Babyl (vs. CC) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to malaria visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A16: Work Environment, URI

| | (1) CCM | (2) Optional Medicines | (3) Unnecessary Medicines | (4) Optional Labs | (5) Unnecessary Labs | (6) Questions Asked | (7) Time with Provider | (8) Wait Time | (9) Log Pay |
|---|---|---|---|---|---|---|---|---|---|
| Babyl | 0.25*** | 0.29*** | -0.27*** | -0.24*** | -0.02* | 6.00*** | -1.71*** | -73.53*** | -0.31*** |
| | (0.03) | (0.05) | (0.04) | (0.03) | (0.01) | (0.23) | (0.38) | (3.83) | (0.08) |
| Morning | -0.11*** | -0.08 | 0.14*** | 0.06 | 0.00 | 0.22 | 0.12 | -35.73*** | 0.15* |
| | (0.03) | (0.05) | (0.04) | (0.03) | (0.01) | (0.24) | (0.38) | (3.77) | (0.08) |
| Weekend | -0.03 | -0.07 | 0.03 | 0.03 | -0.01 | 0.09 | 0.92 | -15.46** | -0.04 |
| | (0.04) | (0.07) | (0.05) | (0.05) | (0.01) | (0.31) | (0.50) | (5.06) | (0.10) |
| Normalized Wait Time | 0.00 | 0.03 | -0.01 | -0.03* | -0.00 | -0.10 | 0.04 | | -0.02 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.00) | (0.11) | (0.17) | | (0.03) |
| Above Median Overwhelmed | -0.02 | -0.06 | 0.06 | 0.01 | 0.03 | 0.05 | -0.33 | 15.35** | 0.03 |
| | (0.05) | (0.08) | (0.06) | (0.05) | (0.01) | (0.36) | (0.58) | (5.85) | (0.11) |
| Above Median Rushed | -0.07 | 0.01 | 0.05 | -0.00 | 0.02 | 0.02 | 0.09 | -14.38* | 0.12 |
| | (0.04) | (0.07) | (0.05) | (0.05) | (0.01) | (0.34) | (0.56) | (5.60) | (0.11) |
| MBI Emotional Exhaustion | -0.00 | -0.00 | 0.00 | -0.03 | -0.01** | -0.09 | 0.03 | 2.83 | -0.02 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.00) | (0.11) | (0.18) | (1.80) | (0.04) |
| MBI Depersonalization | 0.01 | 0.08* | -0.01 | 0.00 | -0.00 | 0.21 | -0.13 | -8.51** | 0.15** |
| | (0.02) | (0.04) | (0.03) | (0.03) | (0.01) | (0.18) | (0.29) | (2.88) | (0.06) |
| MBI Professional Accomplishment | -0.02 | 0.10* | 0.01 | -0.02 | 0.01 | -0.05 | 0.07 | -5.90 | -0.04 |
| | (0.02) | (0.04) | (0.03) | (0.03) | (0.01) | (0.18) | (0.30) | (3.02) | (0.06) |
| No Insurance | -0.04 | 0.03 | 0.04 | -0.16*** | -0.01 | 0.14 | 0.60 | -15.17*** | 2.16*** |
| | (0.04) | (0.06) | (0.04) | (0.04) | (0.01) | (0.28) | (0.45) | (4.50) | (0.09) |
| Constant | 0.37** | 1.53*** | 0.72*** | 0.50** | -0.00 | 5.49*** | 5.05** | 159.65*** | 5.63*** |
| | (0.14) | (0.23) | (0.17) | (0.16) | (0.04) | (1.07) | (1.74) | (17.48) | (0.35) |
| Observations | 1008 | 1008 | 1008 | 1033 | 1033 | 1033 | 1033 | 1033 | 988 |
| $R^2$ | 0.122 | 0.060 | 0.101 | 0.072 | 0.022 | 0.443 | 0.033 | 0.335 | 0.416 |
| Mean Dependent Variable in CC | 0.16 | 2.02 | 0.90 | 0.33 | 0.03 | 5.31 | 5.80 | 97.81 | 6.05 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on work environment including proxies for how busy the facility was at the time of the visit (morning visits from 7-11am, visits on a weekend, and the SP's wait time (normalized to mean 0 and standard deviation 1 for Babyl and CC visits separately), indicators for whether the provider was above median on ratings of feeling overwhelmed and rushed, as well as the provider's Maslach Burnout Inventory subscale averages for emotional exhaustion, depersonalization, and professional accomplishment. All regressions control for whether the visit is at Babyl (vs. CC) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to URI visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A17: Work Environment, CC

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| Morning | 0.04 | -0.07 | -0.03 | 0.06 | 0.06 | 0.02 | 0.11 | -0.44 | -66.04*** | -0.04 |
| | (0.03) | (0.04) | (0.05) | (0.04) | (0.04) | (0.03) | (0.22) | (0.50) | (4.52) | (0.05) |
| Weekend | -0.03 | -0.03 | 0.02 | -0.02 | 0.01 | 0.00 | -0.27 | 0.54 | -18.19*** | 0.08 |
| | (0.03) | (0.04) | (0.05) | (0.05) | (0.04) | (0.03) | (0.24) | (0.54) | (5.33) | (0.06) |
| Normalized Wait Time | -0.03* | 0.01 | 0.02 | 0.00 | -0.02 | 0.02 | -0.07 | -0.13 | | -0.08*** |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.09) | (0.21) | | (0.02) |
| Above Median Overwhelmed | -0.10** | -0.03 | -0.04 | 0.13** | 0.02 | -0.02 | -0.19 | 0.10 | 13.53* | -0.17** |
| | (0.03) | (0.04) | (0.05) | (0.05) | (0.04) | (0.03) | (0.25) | (0.57) | (5.62) | (0.06) |
| Above Median Rushed | 0.02 | -0.05 | 0.02 | -0.07 | -0.02 | 0.06* | -0.07 | -0.02 | -9.68 | 0.11 |
| | (0.03) | (0.04) | (0.05) | (0.05) | (0.04) | (0.03) | (0.25) | (0.57) | (5.62) | (0.06) |
| MBI Emotional Exhaustion | -0.01 | 0.01 | 0.02 | -0.04* | -0.04* | 0.01 | 0.06 | 0.14 | 1.91 | 0.04 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.09) | (0.21) | (2.06) | (0.02) |
| MBI Depersonalization | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | -0.02 | 0.27 | 0.48 | -9.84** | 0.05 |
| | (0.02) | (0.03) | (0.03) | (0.03) | (0.03) | (0.02) | (0.15) | (0.34) | (3.34) | (0.04) |
| MBI Professional Accomplishment | -0.02 | -0.02 | 0.06 | 0.01 | -0.04 | -0.01 | -0.40* | 0.15 | -4.76 | 0.04 |
| | (0.02) | (0.03) | (0.04) | (0.03) | (0.03) | (0.02) | (0.17) | (0.39) | (3.87) | (0.04) |
| No Insurance | -0.11*** | -0.00 | 0.02 | 0.10* | -0.09* | -0.00 | 0.33 | 1.01* | -17.77*** | 2.07*** |
| | (0.03) | (0.04) | (0.05) | (0.04) | (0.04) | (0.03) | (0.22) | (0.49) | (4.85) | (0.05) |
| Malaria | | | -0.59*** | -0.37*** | -0.16*** | 0.16*** | -0.38* | -0.90* | 1.57 | -0.02 |
| | | | (0.04) | (0.03) | (0.03) | (0.02) | (0.17) | (0.38) | (3.80) | (0.04) |
| Constant | 1.05*** | 0.34 | 1.68*** | 0.84*** | 0.62*** | 0.06 | 7.22*** | 4.47 | 179.57*** | 5.30*** |
| | (0.12) | (0.18) | (0.22) | (0.20) | (0.18) | (0.13) | (1.02) | (2.30) | (22.67) | (0.25) |
| Observations | 608 | 594 | 1194 | 1194 | 1206 | 1206 | 1206 | 1206 | 1206 | 1190 |
| $R^2$ | 0.070 | 0.018 | 0.179 | 0.105 | 0.039 | 0.052 | 0.019 | 0.014 | 0.187 | 0.575 |
| Mean Dependent Variable | 0.93 | 0.16 | 1.73 | 0.71 | 0.25 | 0.11 | 5.12 | 5.33 | 98.52 | 6.00 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on work environment including proxies for how busy the facility was at the time of the visit (morning visits from 7-11am, visits on a weekend, and the SP's wait time (normalized to mean 0 and standard deviation 1 for Babyl and CC visits separately), indicators for whether the provider was above median on ratings of feeling overwhelmed and rushed, as well as the provider's Maslach Burnout Inventory subscale averages for emotional exhaustion, depersonalization, and professional accomplishment. All regressions control for whether the case is malaria (vs. URI) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to conventional care visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A18: Work Environment, Babyl

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| Morning | -0.01 | -0.15** | 0.08 | 0.08* | 0.02 | 0.02* | -0.06 | -0.02 | 0.15 | -0.03 |
| | (0.02) | (0.05) | (0.05) | (0.04) | (0.02) | (0.01) | (0.23) | (0.10) | (1.62) | (0.10) |
| Weekend | 0.01 | -0.03 | -0.01 | -0.01 | -0.00 | -0.02 | -0.49 | 0.07 | -1.94 | -0.12 |
| | (0.04) | (0.08) | (0.08) | (0.07) | (0.04) | (0.02) | (0.38) | (0.17) | (2.70) | (0.16) |
| Normalized Wait Time | -0.02 | 0.01 | -0.00 | 0.01 | -0.03** | -0.01 | -0.13 | -0.02 | | 0.02 |
| | (0.01) | (0.02) | (0.02) | (0.02) | (0.01) | (0.01) | (0.11) | (0.05) | | (0.05) |
| Above Median Overwhelmed | 0.05 | -0.01 | -0.02 | -0.15 | -0.07 | -0.03 | -0.33 | -0.29 | -12.90*** | 0.28 |
| | (0.06) | (0.13) | (0.12) | (0.10) | (0.05) | (0.03) | (0.54) | (0.24) | (3.87) | (0.24) |
| Above Median Rushed | 0.02 | -0.11 | -0.12 | 0.14 | 0.01 | 0.00 | 0.07 | -0.27 | 0.14 | -0.09 |
| | (0.05) | (0.10) | (0.10) | (0.08) | (0.04) | (0.02) | (0.46) | (0.20) | (3.27) | (0.20) |
| MBI Emotional Exhaustion | 0.01 | -0.02 | -0.04 | 0.01 | 0.01 | 0.00 | -0.27* | 0.02 | -0.19 | -0.08 |
| | (0.01) | (0.03) | (0.03) | (0.02) | (0.01) | (0.01) | (0.11) | (0.05) | (0.81) | (0.05) |
| MBI Depersonalization | -0.00 | 0.02 | 0.14*** | -0.00 | 0.01 | -0.01 | 0.38* | 0.26*** | 2.75* | 0.12 |
| | (0.02) | (0.04) | (0.04) | (0.03) | (0.02) | (0.01) | (0.17) | (0.07) | (1.19) | (0.07) |
| MBI Professional Accomplishment | -0.00 | -0.00 | 0.04 | 0.00 | 0.01 | 0.01 | 0.14 | -0.05 | -1.33 | -0.07 |
| | (0.02) | (0.04) | (0.04) | (0.03) | (0.02) | (0.01) | (0.16) | (0.07) | (1.17) | (0.07) |
| No Insurance | -0.08* | -0.11 | -0.02 | 0.20** | -0.02 | 0.05** | 0.11 | -0.28 | -3.26 | 2.69*** |
| | (0.04) | (0.07) | (0.07) | (0.06) | (0.03) | (0.02) | (0.33) | (0.15) | (2.36) | (0.14) |
| Malaria | | | -0.72*** | -0.01 | -0.01 | 0.03* | -3.17*** | -0.35*** | 1.08 | 0.21* |
| | | | (0.05) | (0.04) | (0.02) | (0.01) | (0.22) | (0.10) | (1.60) | (0.10) |
| Constant | 0.93*** | 0.61** | 2.10*** | 0.47** | 0.03 | -0.04 | 10.91*** | 4.13*** | 38.39*** | 5.65*** |
| | (0.09) | (0.21) | (0.20) | (0.17) | (0.09) | (0.04) | (0.91) | (0.41) | (6.51) | (0.40) |
| Observations | 433 | 414 | 826 | 826 | 868 | 868 | 868 | 868 | 868 | 809 |
| $R^2$ | 0.024 | 0.036 | 0.218 | 0.024 | 0.014 | 0.032 | 0.199 | 0.035 | 0.022 | 0.323 |
| Mean Dependent Variable | 0.94 | 0.46 | 1.98 | 0.58 | 0.10 | 0.02 | 9.76 | 3.79 | 31.66 | 5.68 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on work environment including proxies for how busy the facility was at the time of the visit (morning visits from 7-11am, visits on a weekend, and the SP's wait time (normalized to mean 0 and standard deviation 1 for Babyl and CC visits separately), indicators for whether the provider was above median on ratings of feeling overwhelmed and rushed, as well as the provider's Maslach Burnout Inventory subscale averages for emotional exhaustion, depersonalization, and professional accomplishment. All regressions control for whether the case is malaria (vs. URI) and whether the SP pays out of pocket (vs. using CBHI). Sample limited to Babyl visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A19: SP Characteristics Malaria

| | (1) CCM | (2) Optional Medicines | (3) Unnecessary Medicines | (4) Optional Labs | (5) Unnecessary Labs | (6) Questions Asked | (7) Time with Provider | (8) Wait Time | (9) Log Pay |
|---|---|---|---|---|---|---|---|---|---|
| Babyl | -0.02 | 0.17*** | 0.02 | -0.09*** | -0.16*** | 2.99*** | -1.18*** | -69.27*** | -0.18** |
| | (0.02) | (0.04) | (0.04) | (0.02) | (0.02) | (0.18) | (0.28) | (3.51) | (0.06) |
| No Insurance | -0.12*** | -0.04 | 0.21** | -0.00 | 0.00 | -0.08 | 0.80 | -18.56** | 2.06*** |
| | (0.03) | (0.06) | (0.06) | (0.04) | (0.04) | (0.29) | (0.46) | (5.72) | (0.10) |
| Babyl × No Insurance | 0.08* | 0.03 | -0.02 | 0.12* | 0.07 | 1.02* | -0.89 | 18.12* | 0.79*** |
| | (0.04) | (0.10) | (0.10) | (0.06) | (0.06) | (0.46) | (0.73) | (9.13) | (0.16) |
| Age 30-34 | -0.02 | 0.03 | -0.02 | -0.04 | -0.01 | -0.27 | -0.38 | 2.81 | -0.03 |
| | (0.02) | (0.04) | (0.04) | (0.02) | (0.02) | (0.17) | (0.27) | (3.38) | (0.06) |
| Age 35-42 | -0.02 | -0.10 | 0.06 | -0.05 | 0.01 | 0.12 | -0.31 | 11.25* | 0.04 |
| | (0.03) | (0.06) | (0.06) | (0.04) | (0.04) | (0.28) | (0.44) | (5.53) | (0.10) |
| Female | 0.02 | 0.02 | -0.04 | 0.02 | 0.02 | 0.69*** | 0.23 | 2.11 | 0.23*** |
| | (0.02) | (0.04) | (0.04) | (0.02) | (0.02) | (0.16) | (0.26) | (3.29) | (0.06) |
| Constant | 0.95*** | 1.43*** | 0.51*** | 0.19*** | 0.18*** | 4.83*** | 4.87*** | 98.00*** | 5.52*** |
| | (0.02) | (0.04) | (0.04) | (0.02) | (0.02) | (0.16) | (0.26) | (3.29) | (0.06) |
| No Insurance + Babyl X No Insurance | -0.04 | -0.01 | 0.19* | 0.12** | 0.08 | 0.94** | -0.09 | -0.44 | 2.85*** |
| | (0.03) | (0.08) | (0.08) | (0.05) | (0.05) | (0.36) | (0.57) | (7.15) | (0.13) |
| Observations | 1263 | 1225 | 1225 | 1263 | 1263 | 1263 | 1263 | 1263 | 1223 |
| $R^2$ | 0.019 | 0.024 | 0.015 | 0.018 | 0.041 | 0.241 | 0.026 | 0.261 | 0.446 |
| Mean Dependent Variable in CC | 0.93 | 1.44 | 0.53 | 0.17 | 0.18 | 5.01 | 4.90 | 98.43 | 5.96 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on SP characteristics including whether the whether the SP pays out of pocket (vs. using CBHI), SP age, and SP gender. All regressions control for whether the visit is at Babyl (vs. CC). Sample limited to malaria visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A20: SP Characteristics URI

| | (1) CCM | (2) Optional Medicines | (3) Unnecessary Medicines | (4) Optional Labs | (5) Unnecessary Labs | (6) Questions Asked | (7) Time with Provider | (8) Wait Time | (9) Log Pay |
|---|---|---|---|---|---|---|---|---|---|
| Babyl | 0.29*** | 0.30*** | -0.31*** | -0.24*** | -0.02** | 5.92*** | -1.59*** | -71.52*** | -0.29*** |
| | (0.03) | (0.05) | (0.03) | (0.03) | (0.01) | (0.22) | (0.32) | (3.51) | (0.07) |
| No Insurance | -0.04 | 0.02 | 0.04 | -0.15*** | -0.02* | 0.68* | 0.80 | -30.70*** | 2.13*** |
| | (0.04) | (0.07) | (0.05) | (0.04) | (0.01) | (0.32) | (0.45) | (5.07) | (0.09) |
| Babyl × No Insurance | -0.06 | 0.07 | 0.07 | 0.05 | 0.03 | -1.17* | -1.33 | 25.88** | 0.29 |
| | (0.07) | (0.11) | (0.08) | (0.08) | (0.02) | (0.54) | (0.77) | (8.59) | (0.16) |
| Age 30-34 | -0.04 | 0.04 | 0.04 | -0.05 | 0.00 | 0.26 | -0.54 | -1.29 | -0.24*** |
| | (0.03) | (0.05) | (0.03) | (0.03) | (0.01) | (0.21) | (0.30) | (3.40) | (0.06) |
| Age 35-42 | -0.05 | -0.04 | 0.08 | -0.04 | 0.00 | 1.12** | -0.08 | -2.31 | 0.01 |
| | (0.04) | (0.08) | (0.05) | (0.05) | (0.01) | (0.36) | (0.51) | (5.73) | (0.11) |
| Female | -0.08** | 0.02 | 0.08* | -0.06* | -0.00 | -0.11 | -0.32 | -1.52 | 0.12 |
| | (0.03) | (0.04) | (0.03) | (0.03) | (0.01) | (0.21) | (0.30) | (3.33) | (0.06) |
| Constant | 0.24*** | 1.99*** | 0.82*** | 0.41*** | 0.03*** | 5.11*** | 5.96*** | 104.32*** | 5.63*** |
| | (0.03) | (0.05) | (0.03) | (0.03) | (0.01) | (0.22) | (0.31) | (3.47) | (0.06) |
| No Insurance + Babyl X No Insurance | -0.10 | 0.09 | 0.11 | -0.10 | 0.01 | -0.49 | -0.53 | -4.82 | 2.42*** |
| | (0.05) | (0.09) | (0.07) | (0.06) | (0.02) | (0.43) | (0.62) | (6.90) | (0.13) |
| Observations | 1241 | 1241 | 1241 | 1273 | 1273 | 1273 | 1273 | 1273 | 1219 |
| $R^2$ | 0.106 | 0.043 | 0.081 | 0.060 | 0.009 | 0.397 | 0.038 | 0.268 | 0.442 |
| Mean Dependent Variable in CC | 0.17 | 2.02 | 0.88 | 0.33 | 0.02 | 5.43 | 5.77 | 96.22 | 6.05 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on SP characteristics including whether the whether the SP pays out of pocket (vs. using CBHI), SP age, and SP gender. All regressions control for whether the visit is at Babyl (vs. CC). Sample limited to URI visits. Standard errors in parentheses. $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

Table A21: SP Characteristics CC

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| No Insurance | -0.11*** | -0.03 | -0.01 | 0.10** | -0.08* | -0.01 | 0.41 | 0.82* | -24.35*** | 2.11*** |
| | (0.03) | (0.04) | (0.04) | (0.04) | (0.03) | (0.02) | (0.21) | (0.41) | (4.78) | (0.05) |
| Age 30-34 | 0.01 | -0.02 | 0.01 | 0.01 | -0.05 | -0.01 | -0.02 | -0.74* | 1.46 | -0.09* |
| | (0.02) | (0.03) | (0.04) | (0.03) | (0.03) | (0.02) | (0.18) | (0.35) | (4.01) | (0.04) |
| Age 35-42 | -0.04 | -0.07 | -0.11 | 0.10 | -0.03 | 0.01 | 0.54 | -0.27 | 12.66* | 0.08 |
| | (0.03) | (0.05) | (0.06) | (0.05) | (0.05) | (0.03) | (0.29) | (0.55) | (6.42) | (0.07) |
| Female | 0.01 | -0.02 | -0.01 | 0.01 | -0.01 | 0.01 | 0.01 | -0.15 | 1.61 | 0.21*** |
| | (0.02) | (0.03) | (0.03) | (0.03) | (0.03) | (0.02) | (0.17) | (0.33) | (3.84) | (0.04) |
| Malaria | | | -0.58*** | -0.35*** | -0.16*** | 0.16*** | -0.41* | -0.80* | 0.55 | 0.01 |
| | | | (0.03) | (0.03) | (0.03) | (0.02) | (0.17) | (0.32) | (3.75) | (0.04) |
| Constant | 0.94*** | 0.20*** | 2.03*** | 0.85*** | 0.37*** | 0.02 | 5.29*** | 5.99*** | 99.07*** | 5.53*** |
| | (0.02) | (0.03) | (0.04) | (0.03) | (0.03) | (0.02) | (0.18) | (0.34) | (3.97) | (0.04) |
| Observations | 727 | 728 | 1447 | 1447 | 1461 | 1461 | 1461 | 1461 | 1461 | 1443 |
| $R^2$ | 0.031 | 0.003 | 0.171 | 0.092 | 0.030 | 0.049 | 0.010 | 0.011 | 0.021 | 0.558 |
| Mean Dependent Variable | 0.93 | 0.17 | 1.73 | 0.71 | 0.25 | 0.10 | 5.22 | 5.34 | 97.32 | 6.00 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on SP characteristics including whether the whether the SP pays out of pocket (vs. using CBHI), SP age, and SP gender. All regressions control for whether the case is malaria (vs. URI). Sample limited to conventional care visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A22: SP Characteristics Babyl

| | (1) Malaria CCM | (2) URI CCM | (3) Optional Medicines | (4) Unnecessary Medicines | (5) Optional Labs | (6) Unnecessary Labs | (7) Questions Asked | (8) Time with Provider | (9) Wait Time | (10) Log Pay |
|---|---|---|---|---|---|---|---|---|---|---|
| No Insurance | -0.04 | -0.09 | 0.03 | 0.15** | 0.01 | 0.04*** | 0.18 | -0.36** | -2.49 | 2.64*** |
| | (0.03) | (0.06) | (0.07) | (0.05) | (0.03) | (0.01) | (0.29) | (0.13) | (2.04) | (0.12) |
| Age 30-34 | -0.07** | -0.04 | 0.08 | 0.00 | -0.03 | 0.01 | 0.10 | -0.02 | 0.41 | -0.20* |
| | (0.02) | (0.05) | (0.05) | (0.04) | (0.02) | (0.01) | (0.21) | (0.09) | (1.49) | (0.09) |
| Age 35-42 | 0.03 | 0.00 | -0.03 | 0.02 | -0.06 | 0.01 | 0.65 | -0.14 | -7.02** | -0.06 |
| | (0.04) | (0.08) | (0.08) | (0.07) | (0.04) | (0.02) | (0.37) | (0.17) | (2.63) | (0.15) |
| Female | 0.02 | -0.17*** | 0.06 | 0.06 | -0.02 | 0.00 | 0.56** | 0.13 | 0.43 | 0.14 |
| | (0.02) | (0.05) | (0.05) | (0.04) | (0.02) | (0.01) | (0.21) | (0.09) | (1.46) | (0.09) |
| Malaria | | | -0.71*** | -0.04 | -0.01 | 0.02** | -3.01*** | -0.35*** | 0.91 | 0.20* |
| | | | (0.05) | (0.04) | (0.02) | (0.01) | (0.20) | (0.09) | (1.41) | (0.08) |
| Constant | 0.95*** | 0.56*** | 2.27*** | 0.54*** | 0.13*** | -0.01 | 10.77*** | 3.95*** | 31.37*** | 5.28*** |
| | (0.02) | (0.04) | (0.05) | (0.04) | (0.02) | (0.01) | (0.20) | (0.09) | (1.42) | (0.08) |
| Observations | 536 | 513 | 1019 | 1019 | 1075 | 1075 | 1075 | 1075 | 1075 | 999 |
| $R^2$ | 0.026 | 0.034 | 0.199 | 0.011 | 0.004 | 0.018 | 0.185 | 0.023 | 0.010 | 0.347 |
| Mean Dependent Variable | 0.92 | 0.46 | 1.97 | 0.56 | 0.10 | 0.02 | 9.62 | 3.75 | 31.23 | 5.73 |

*Notes:* This table reports estimates from OLS regressions of SP visit outcomes on SP characteristics including whether the whether the SP pays out of pocket (vs. using CBHI), SP age, and SP gender. All regressions control for whether the case is malaria (vs. URI). Sample limited to Babyl visits. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

# C Description of Analysis Files

## C.1 Constructing the Data Crosswalk: Match Link File

To match across the three surveys, debrief surveys were matched to planned visits (field notes) to first see how many were executed as originally planned. The field notes document used for this is titled "EIDPHC_SP_Field_Notes.xlsx". Field notes observation matches were done in waves, first matching on combinations of facility visited, date of visit, and SP name, and then by using SP name with alternate ordering. After this, only date and both versions of the name were used. After being matched, these matches were transferred into a file titled "Master Link File," in order to keep track of all matches and their key information. Key information includes unique survey identifiers from ODK, names, dates, and similar identifiers. Debrief observations matched to their field plan counterpart were placed in the same row to represent the match. Incomplete rows represent failed matches. All unmatched observations were placed below the section of matched observations. Following this, the debrief survey was similarly matched to the medicine survey, using combinations of facility visited, date of visit, and SP name. In the Master Link File, matched medicine observations were again set to the right of the debrief section, with observations in the same row as their debrief match. Unmatched medicine observations were placed below the unmatched debrief observations, as to prevent confusion. For observations not matched via Stata, field coordinators manually matched surveys appropriately. To do this, field coordinators used a combination of monitoring sheets (used by supervisors to report daily achievements), the aforementioned field plans, and a list of providers from SP data collection. If a match was found, the appropriate row was taken from the reserve of unmatched observations and placed next its manual match and highlighted. Reasons for observations not being matched through Stata include variations in name spellings, as well as medicine facilities being visited on a date separate from the original visit. For robustness checks, any debrief survey without a medicine file, any medicines prescribed, or noticeably incomplete were flagged.

To match provider surveys with debrief surveys, all provider spellings from both the debrief and provider survey were exported. These names were then matched manually with a created unique identifier (provider FORMID) based on field plans (document titled "List of Providers during CC data collection - Matched Names.xlsx"), which were confirmed through a survey generated unique identifier, "PID". Once these provider FORMIDs were matched with debrief and provider survey spellings, the two surveys merged on this provider FORMID. This section is contained in the Master Link File in a tab titled "PS_ID for prov_survey". Again, matched providers were placed in the same row and to the right of the medicines section. Unmatched observations were examined by field coordinators and manual matching was attempted through the earlier mentioned "Matched Names" file.

Each row in the Master Link File represents an observation, and is given a unique identification number called a "visit_id." Additionally, both the Debrief and Medicine survey observations had unique identifiers, named "debrief_KEY" and "med_KEY." Having the matches listed in the Master Link File with these identifying "KEY" variables, we first merged the Master Link File with the debrief, followed by the medicine survey. Subsequently, the provider FORMIDs (manually matched to both Debrief and Provider Survey spellings) are used to merge in the provider survey. The do files, input files, and output files for the construction of the crosswalk file are as follows and contained in the zip file "crosswalk replication files.zip":

- **"LinkFile_FieldNotes.do"**
  - **Input Files**
    - **"EIDPHC_SP_Field_Notes"**: Field notes containing SP information split into two cohorts. This file contains schedules for planned visits.
  - **Output Files**
    - **"FieldNotes.dta"** and **"Field Notes For Linkfile"**
      Complete version of all planned visits in one dataset.
- **"Compiling Link Datasets, Debrief.do"**
  - **Input Files**
    - **"SPdebrief.dta"**: SP Debrief Surveys output from the file **"01. Sp_debrief_odk_to_stata.do"**.
    - **"FieldNotes.dta"**: Field Notes output from the file **"LinkFile_FieldNotes.do"**.
  - **Output Files**
    - **"SPdebrief_link.dta"**, **"SPdebrief_link.xlsx"**, and **"SPdebrief_clean.dta"**
      Matches of planned visits to their corresponding debrief visits. **"SPdebrief_clean.dta"** is a cleaner version of **"SPdebrief.dta"**.
- **"Compiling Link Datasets, Medicines.do"**
  - **Input Files**
    - **"medicines.dta"**: SP Medicine Surveys output from the file **"02. medicines_odk_to stata.do"**.
    - **"SPdebrief_clean.dta"**: Slightly cleaned SP Debrief data to try and merge with the medicines data.
  - **Output Files**
    - **"Medicine_link_total.dta"** and **"Medicines_link.xlsx"**
      Matches of debrief surveys to their corresponding medicine surveys.
- **"Compiling Link Datasets, Provider Survey.do"**

- **Input Files**
  - **"Provider survey_V17_Final_2October2023.xlsx"**: All provider survey data.
  - **"SPdebrief_clean.dta"**: Slightly cleaned SP Debrief data to try and merge with the medicines data.
  - **"MergedSP&PS.xlsx"**:Provider names as written by the provider matched with a unique identifier
  - **"data_andrew_V2.xlsx"**: Provider names as written by the SPs matched to the same unique identifier as above.
- **Output Files**
  - **"Provider_survey_link.xlsx"**
    Matches of debrief surveys to their corresponding provider surveys.

## C.2 Stata Do Files

In this section, we describe all input data files as well as Stata do files for data cleaning and analysis that were used to generate the findings in this report. All data files described below are stored on the servers at the University of Rwanda. All do files are in the attached zip file "replication files.zip".

**"00. run.do"**

- This do file runs all programs necessary to merge and clean the data and generate all analysis results.
- This file creates the structure and will put all output where it should be for later do files. To run correctly, the structure of the master file folder should be as follows:
  - **"data/input"** should contain all input data files below:
    - All ODK files. These files are direct output from the fieldwork without any processing.
    - Debrief Survey
      - **"SP Debriefing tool for Conventional Care and Babyl Final_1"**
        SP Debrief Data from wave one: June and July 2022, as well as a few observations in September 2022, December 2022, and January 2023.
      - **"Debriefing tool for Babyl Final"**
        SP Debrief Data from wave two: September through December 2022.
      - **"SP Debriefing tool for Babyl Final_January"**
        SP Debrief Data from wave three: January and February 2023.
    - Medicine Survey

- **"SP Medicines Tool for Conventional Care and Babyl Final_1.xlsx"**
  Medicine data from wave one: June and July 2022, with some observations from October and November 2022.
- **"SP Medicines Tool for Babyl Final"**
  Medicine data from wave two: September through November 2022.
- **"SP Medicines Tool for Babyl Final_2a"**
  Medicine data from wave three: November 2022 through January 2023.

- Provider Survey
  - **"Provider survey_V17_Final_2October2023.xlsx"**
    All Provider Survey data.
- Master Link File
  - **"Master Link File.xlsx"**: Crosswalk file to match observations between the field visit notes, SP debrief, SP medicine, and provider survey data. See Appendix Section C.1 for more detail.
- **"No medicine comments.xlsx"**
  Contains manually created flags for incomplete medicine files, SP debriefs without a medicine file, and similar classifications described in do file **"08. No Medicine Output.do"**

- **"do files"** folder should have all do files: 00 to 08
- Generated folders:
  - Output Folder: Contains all output from the replication files, organized by type of output. Types of output include figures, logs, and tables. Any output with personal identifying information is included in an output folder titled **"output_pii."**
  - Data Folder: Contains an input and processed data subfolders. Place all of the input data mentioned above into the input data folder. After running the replication files, any generated data will appear in the processed subfolder.

**"01. Sp_debrief_odk_to_stata.do"**

- This file reads in the Debrief data from ODK, merges the data from different waves of fieldwork, and outputs a cleaned debrief file for merging to the SP medicines data and provider survey data in subsequent do files.
- Input files
  - **"SP Debriefing tool for Conventional Care and Babyl Final_1"**
  - **"Debriefing tool for Babyl Final"**
  - **"SP Debriefing tool for Babyl Final_January"**

- Output file: **SPdebrief.dta**

**"02. Sp_medicines_okd_to_stata.do"**

- This file reads in the Medicines data from ODK, merges the data from different waves of fieldwork and outputs a cleaned medicines file for merging to the SP debrief data in subsequent do files.
- Input files
  - **"SP Medicines Tool for Conventional Care and Babyl Final_1.xlsx"**
  - **"SP Medicines Tool for Babyl Final"**
  - **"SP Medicines Tool for Babyl Final_2a"**
- Output file: **Medicines.dta**

Before running the code in **"03. Survey_merge.do"**, you must have the Data Crosswalk: Match Link File. A description of this file and the process used to create it is in Appendix section C.1, which is to be referenced for this process.

**"03. Survey_merge.do"**

- This do file merges the SP debrief data, SP medicines data, and provider survey data, along with additional information from the SP field notes including planned visit dates as well as characteristics of the SPs.
- To merge across datasets, we rely on the mapping between planned visit schedules from the fieldnotes, SP debrief data, SP medicines data, and provider survey data constructed in **"Master Link File.xlsx."** This crosswalk file was constructed through a combination of merges done in Stata and subsequent matching by hand for observations that were not perfect matches. This process is described in more detail in Appendix Section C.1.
- Input files used for Link File Construction
  - **"EIDPHC_SP_Field_Notes.xlsx"**
  - **"List of Providers during CC data collection - Matched Names.xlsx"**
  - **"SPdebrief.dta"**
  - **"Medicines.dta"**
  - **"Provider survey_V17_Final_2October2023.xlsx"**
- SP field notes, debrief data, and medicines data were manually matched using SP name, date, and facility.

- Providers were matched to SP visits by facility and name when clear enough, and by facility and provider characteristics if more information was needed.
- Where there are discrepancies, e.g., between dates, this file has the corrected data which was determined by field notes, comments, SP characteristics by supervisors of the fieldwork.
- Input data files for this do file:
  - **"Master Link File.xlsx"**
  - **"no medicine comments.xlsx"**
  - **"SPdebrief.dta"**
  - **"Medicines.dta"**
  - **"Provider survey_V17_Final_2October2023.xlsx"**
- Output files:
  - **"Merged_data,dta"**
    - The three merged surveys with personal identifying information included.
  - **"Merged_data_anon.dta"**
    - The three merged surveys without personal identifying information.
  - **"Match_summary_fn_debrief.xlsx"**
    - CSV File showing how frequently observations from the Debrief survey and Field Notes match on specific variables, such as name, date of visit, and type of visit
  - **"Match_summary_med_debrief.xlsx"**
    - CSV File showing how frequently observations from the Debrief and Medicines surveys match on specific variables, such as name, date of visit, and type of visit
  - **"Match_summary_prov_debrief.xlsx"**
    - CSV File showing how frequently observations from the Debrief and provider surveys match on specific variables, such as provider name as exactly spelled, part of the provider name as exactly spelled, and facility.

**"04. sp_var_construction.do"**

- The Purpose of this do file is to clean the SP debrief and medicines data and to construct all SP outcome variables and controls variables for analysis.
- Data files needed for this do file:
  - **"Merged_data_anon.dta,"** generated from do file 03.

- Generated Files:
  - **"SP_vars.dta"**

**"05. Provider_var_construction.do"**

- This do file cleans the provider survey data and constructs all provider control variables used in the analysis.
- Data files needed for this do file:
  - **"SP_vars.dta"**
- Generated Files:
  - **"Final_data.dta"**: this is the final cleaned dataset used for analyses.

**"06. Analysis.do"**

- This file generates all summary statistics and regression tables.
- Files needed for do file:
  - **"Final_data.dta"**
- Generated Files and Folders:
  - Output Folder: Contains all output from the replication files, organized by type of output. Types of output include figures, logs, and tables. Any output with personal identifying information is included in an output folder titled **"output_pii."**
  - Data Folder: Contains an input and processed data subfolders. Place all of the input data mentioned above into the input data folder. After running the replication files, any generated data will appear in the processed subfolder.

**"07. Summary Statistics and Histograms.do"**

- Generates summary statistics and histograms of Variables
- Files needed for do file:
  - **"Final_data.dta"**
- Output

- Summary statistics (**prov_vars.csv**, **sp_vars.csv**, **uri_vars.csv**, **malaria_vars.csv**) can be found in the tables subfolder.
- Histograms for each covariate and outcome variable can be found in the histograms subfolder.

**"08. No Medicine Output.do"**

- This program outputs a subset of variables that are used to investigate observations with no medicines. Using the output of this do file, we manually constructed flags to identify SP visits that we believe had no prescribed medicines, were unable to be completed because of a missing babyl agent at follow up, incomplete based on SP comments, had medicine stockouts, or were helped by anyone at the facility aside from a Babyl agent. Further description given below.
- No Agent: 1 if we don't think they ever saw an agent. 0 did see a babyl agent. Missing if we are unsure.
  - Comment in the **"comment"** variable suggests they never saw an Agent nor were they able to get help from an agent over the phone.
  - We believe **"Was there a Babyl agent at the health center?" (babyl_agent_at_fac)** indicates agent at the first facility visited. If no, check comment in **BF9_0** to see whether it seems like they saw an agent at a second facility.
- Incomplete: 1 if they were unable to get prescriptions or labs for any reason. 0 if we think it was complete, missing if unsure.
  - Incomplete if babyl agent is not there, not able to help over the phone, and no one else was able to decode the babyl code.
  - If Babyl (**Did you get the full prescription? BFL5/BFM5** = No (note: in the data these are **BFM5** but **BFL5** in the survey))
  - **M2 (did prov prescribe)** = Yes and (**med_M2a** and **med_M2b (did SP purchase meds)** = No)
  - Incomplete if the SP did not receive a prescribed med due to stockouts. **BFM4**
  - If there is a conflict between **M2** and any **BFM4** iterations, leave as missing.
- No_prescription: 1 if it seems like the SP was not prescribed any medicines (nor given any meds by the provider during the interaction). 0 if it seems like they were and may just be missing the medicines data. Missing otherwise.
  - 1 if:
    - If Babyl, no medicines in the BF medicine variables

        - **med_M1 (did prov dispense any drugs)** = No AND **med_M2 (did prov prescribe any drugs)** = No
    - 0 if not the above and/or:
        - **med_M2a or med_M2b (did SP purchase meds)** = Yes

- Non_agent_help: 1 = yes, Based on comments, was helped by someone other than a babyl agent (provider, other worker). Check **"comment"** and **"BF9_0-2d."** If someone said they did not see an agent but have medicine's information, this is an indication. 0 = no, Missing if unsure. Not relevant to CC visits. Used the variables below to determine steps taken by SP if an agent was not present, and if they received help from someone other than an agent:
    - **BF9_1 - What steps did you take?**
    - **BF9_1a - Specify other steps taken**
    - **BF9_2d - What did Babyl provider tell you when you called back?**
- Input Files:
    - **"Final_data.dta"**
      Final clean and merged version of the dataset, including all surveys.
- Output Files:
    - **"no medicine comments.xlsx"**
      Fed back into **"03. Survey_merge"** to incorporate the described flags into the merged data.