How the Adoption of Telemedicine Changes the Quality and Cost of Medical Care*

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Abstract

The adoption of telemedicine by medical care organizations has been on the rise. While telemedicine may increase access to healthcare, little is known about how the medium changes provider medical decision making and efficiency. To understand the extent telemedicine differs from conventional in-person health care, we compare the quality and cost of care between traditional in-person clinic care and care provided remotely via phone for common health conditions in Rwanda. To control for patient selection, we collected data from 1,461 mystery standardized patient (SP) visits, where locally recruited individuals presented standardized cases for malaria and upper-respiratory infection (URI) either virtually or in-person. We control for provider selection using a rich set of training, experience and preference covariates. Based on condition-specific correct case management definitions bench marked to government clinical practice care guidelines, we find that quality of virtual care is better than the quality of conventional care in the case of URI and at least as good for malaria. In addition, telemedicine providers asked more medical history questions and prescribed more medicines for symptom management than conventional care providers. We further find that telemedicine is more efficient than in-person care: in contrast to conventional care, telemedicine consultations were shorter, had reduced patient wait times, and cost less for patients. Finally, we find a significant shift in the patient-provider dynamic. Notably, providers were less likely to yield to patient requests for unnecessary antibiotics over the phone than in-person.

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1 Introduction

Healthcare organizations traditionally provider patients care through in-person visits to physical locations allowing providers to physically assess and communicate directly with the patient. For vulnerable populations, several factors make in-person consultations challenging, including geographic accessibility of health facilities, cost of seeking care, and limited provider availability across locations. With the accessibility of mobile phones and improving mobile networks across the world, telemedicine platforms hold increasing potential to provide appropriate solutions for some of these issues. Remote delivery of health care via telemedicine holds the promise of revolutionizing certain types of healthcare by improving access to care (Hollander and Carr, 2020; Dahlstrand, 2021; Goetz, 2023; Uscher-Pines and Mehrotra, 2014).

However, what is much less studied is how telemedicine may also change the nature of the provider-patient interaction in ways that may have implications for quality of care (Henry et al., 2017; Miller, 2003). Providers must diagnose illness without physical examination of patients which could cause mistakes or increased use of specialist services or other costly substitutes to primary care, rendering telemedicine more suitable for certain conditions and less suitable, and even harmful for other conditions through delayed in-person care that may be necessary (Ashwood et al., 2017; Li et al., 2021). In this sense, providers may be less able to use heuristics that have proven helpful to augment clinical practice guidelines for diagnosis (Singh, 2021; Boone, 2024). Patients may be less able to communicate illness concerns and treatment preferences. On the other hand, telemedicine may reduce distractions and focus the patient-provider interaction on the presenting symptoms. Understanding how telemedicine changes medical decision making and hence quality of care is critical to guide the future use of remote medicine.

We investigate how seeking primary care services from a provider via telemedicine versus in-person in a clinic setting influences medical care decision making. Specifically, we address the following questions assuming the minimal standard of correct care should be provided in both settings. How does medical decision making differ across telemedicine and in-person care? How much of these differences are explained by variations in provider characteristics across mediums?

We study these issues in Rwanda where Babylon UK, a digital healthcare provider, established a Rwanda-based operation in 2016 (Babyl). In partnership with the Rwanda Ministry of Health and the Rwanda Social Security Board, Babyl runs a nationwide, telemedicine platform that allows individuals to access medical triage and clinical consultations remotely using mobile phone audio features, as well as an SMS-based system for issuing digital prescriptions that can be filled at pharmacies in Rwanda.[1] This telemedicine platform provides an alternative to conventional care (CC; defined as an in-person visit to a physical health facility), allowing us to measure the differences between them. As of 2024, Babyl is no longer active in Rwanda; however, the results

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

of this study can be generalized to the broader field of telemedicine with service delivery through audio only.

We primarily investigate these issues in the context of two important and highly prevalent diseases among adults in Rwanda: acute malaria and upper respiratory illness (URI). These two cases allow us to compare how the medium affects care in low and high discretion cases that are common across the country. Acute malaria in adults has a clear diagnostic and effective treatment protocol that can be implemented in a single visit. In Rwanda, the malaria disease burden has been on the decline, but it remains a significant threat with the entire population still at risk of being infected (Rudasingwa and Cho, 2020). Clinically, nearly all deaths and serious illness related to malaria 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).

URI, which is a common health issue and can affect large proportions of populations, is much harder to diagnose and treat. 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 challenging at point-of-care and introduces room for provider discretion in diagnosis and treatment, particularly in a first visit. URI is also self-limiting, meaning that medical treatment is not required for a patient to recover. However, palliative medical care might be useful in helping to alleviate symptoms.

We conducted an audit study that employs standardized patients (SPs) to capture the quality of care delivered across virtual and in-person care, using the same clinical case presentation in both settings.[2] We recruited and trained seemingly healthy individuals to present identical, standardized acute malaria and URI case scenarios as real patients with a sample of telemedicine or health facility providers.

Our main outcome of interest is whether SPs presenting with malaria or URI were correctly managed, with definitions benchmarked against international and national guidelines and agreed upon by our technical advisory group of two health care providers in Rwanda. For malaria, international and Rwandan national clinical practice guidelines offer little discretion - for a patient with acute malaria symptoms, providers are to test for malaria (with a malaria rapid diagnostic test or microscopy). Providers have much more discretion in the diagnosis and treatment of URI. There is no clear diagnostic test or treatment, and so we define URI correct case management as

[2]The SP method has been used to measure quality of care extensively and is considered the gold standard for measuring quality of health care provision. The method 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, and medical record abstraction (Peabody et al., 2000; Kwan et al., 2019). 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); Xue et al. (2021)

not ordering any medically unnecessary labs or prescribing unnecessary medicines (most notably, antibiotics).

To compare telemedicine versus CC, we further control for both SP and provider selection to identify the pure effect of the medium. We include SP fixed effects 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 adjust for any potential provider heterogeneity that may be correlated with both choosing to work in telemedicine and medical decisions.

We analyze data at the level of SP visits - phoned-in SP visits with Babyl telemedicine platform and in-person SP visits to a sample of 81 public, for-profit primary health care facilities in Rwanda. Facilities were randomly sampled from the 506 health facilities approved for use with 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 number of outpatient visits in the 3 months prior to random sampling. In total, our SPs made 1,461 in-person visits to CC facilities and 1,225 telemedicine visits via mobile phone. Approximately 5 months following the end of SP data collection, we administered a provider survey where we surveyed 327 providers in CC facilities and 130 telemedicine providers, using a provider list derived from those identified as providing care during SP visits.

We find that quality of care in telemedicine is at least as good as CC, if not better. SPs presenting the malaria in telemedicine 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 through telemedicine. During these telemedicine consultations for both conditions, providers asked SPs more medical history questions. They also prescribe more optional medicines to help alleviate symptoms presented by SPs. Providers who treated SPs both in CC and over the phone reported that it was easier to get information from patients, easier to treat patients, and easier to relate to patients over the phone than in person.

In addition to being of higher quality, telemedicine visits appear more efficient than CC - telemedicine providers gathered more information and provided the same or better care during shorter consultations. Providers' perceptions of these visits match the objective evidence. They report that consultations over the phone are shorter and less tiring than face-to-face interactions. SPs also received care faster, waiting an hour less for a telemedicine consultation. Telemedicine providers prescribe fewer unnecessary medicines for URI and, in both cases, order fewer labs. SPs pay less out of pocket for these telemedicine visits than they do in CC.

The provider survey reveals significant differences between telemedicine and CC providers in their levels of experience and other characteristics. However, the differences do not appear to drive any of our results. We do find support for several other reasons why telemedicine might have a higher quality of care than CC. First, telemedicine providers are well-trained on a set of

limited conditions for which they can treat.[3] They demonstrate higher levels of knowledge of correct case management for URI in the provider survey. These providers may also over-focus on conditions treatable via telemedicine; in a third case of diarrhea, we find that telemedicine providers do not recognize this presentation as needing referral for in-person care. Second, our provider survey reveals that the work environment in telemedicine and CC differ substantially. Specifically, providers who consult on the telemedicine platform do so only part-time and report being significantly less overwhelmed, feeling less rushed, and less emotionally exhausted than their CC peers. Providers who see patients in both settings report telemedicine consultations to be less tiring than in-person visits. Third, telemedicine may change the nature of the patient-provider interaction, which is critical for medical decision making. Some research has raised concerns that telemedicine depersonalizes the provider-patient relationship and may hinder the provider's ability to diagnose and treat patients Miller (2003). In this setting, and consistent with our SP analysis, providers report that it is easier to get information from, treat, and relate to patients over the phone.

To explore how telemedicine may change the patient-provider interaction, we introduce several variants to our SP case presentations to test how the nature of interaction changes when providers treat activated patients. When SPs request an unnecessary antibiotic, providers in face-to-face interactions are 2-9 times more likely to give it to the SP. Our results suggest that it may be easier for providers to say no over than phone than in person. Indeed, providers report that they feel more pressure to agree with a patient's self-diagnosis or comply with requests for medicines or tests when face-to-face than they do over the phone. Thus, telemedicine may help to alleviate provider pressure and improve quality when treating demanding patients.

We find that telemedicine changes medical decision making and the nature of the patient-provider interaction. In our setting, telemedicine improves quality of care, improves efficiency, and reduces provider bias in response to SP requests for unnecessary antibiotics. These findings have implications for policymakers looking to efficiently increase access to high-quality health care.

Our paper contributes to the existing literature on the impacts telemedicine, which has largely focused on evaluating the impact of access on healthcare utilization with mixed results across settings. For example, in studies of acute respiratory illness, Ashwood et al. (2017) estimates that 88% of telemedicine visits represent new utilization, and Li et al. (2021) finds that initial consultations via telemedicine led to follow-up visits 75% more often than those in-person. Among young adults in Sweden, Ellegård et al. (2021) estimates that 45% of telemedicine visits replace an in-person visit. Shah et al. (2018) found that availability of virtual visits in one accountable care organization increased total visits by 80% but reduced in-person visits by 33%. In the treatment of mental health, Rabideau (2021) find that an increase in telemedicine visits is almost perfectly offset by the reduction of in-person visits. Focusing specifically on the demand for telemedicine, Lagarde et al. (2024) elicit patients' willingness-to-pay for telemedicine and conventional in-person

[3] In Rwanda, Babyl had a fixed set of conditions providers were approved to treat.

care in South Africa. They find that patients are willing to pay a 10% premium for in-person care and only 36% of patients are willing to pay the market rate for a telemedicine visit. This finding points to a key empirical challenge when comparing telemedicine and conventional care: which patients choose to seek telemedicine and for what conditions may be highly selected.

Because the choice of medium (in-person vs. telemedicine) is endogenous, there have been fewer studies of how telemedicine affects medical decision making and quality of care. To address the endogeneity issue, one approach is to match telemedicine visits to in-person visits with similar characteristics (e.g., Ray et al., 2019; Shi et al., 2018). Leveraging changes in cost-sharing for telemedicine, Rabideau (2021) estimates that a higher use of telemedicine for the treatment of mental illness leads to an increased likelihood of an emergency department visit (for certain subsets of patients) but no increase in the likelihood of an inpatient stay. Zeltzer et al. (2024) overcomes the challenge of endogeneity by leveraging variation across providers in the adoption of telemedicine during the COVID-19 pandemic. They find that increased access to telemedicine increases visits to primary care but lowers total costs and, for several conditions, does not affect the likelihood of missed diagnosis or adverse outcomes. In these studies, patient outcomes are assumed to be indicative of quality but ultimately unknown without assessing the actual underlying patient condition, including severity. The SP methodology we employ allows us to circumvent this problem of patient endogeneity by keeping the case presentation identical. Additionally, the provider survey allows us to measure and control for provider heterogeneity across telemedicine and CC.

Our study is focused on comparing quality of care provided via telemedicine to conventional in-person care. Several other studies have evaluated quality of care within telemedicine to highlight the importance of the specific features of a telemedicine platform but do not compare telemedine to cnoventional in-person care. In the two studies most closely related to ours, Xue et al. (2021) and Si et al. (2024) use the SP methodology to study how quality of care differs across 36 telemedicine platforms in China with different features. For example, both studies find that quality of care is higher in video consultations (vs. SMS). Zeltzer et al. (2023) compares outcomes of patients of a virtual care clinic that have (vs. have not) adopted an at-home exam device to be used during their telemedicine consultation. Adoption of the device results in 12% more primary care visits, partially offset by a reduction in phone and video visits without the device. Device adoption reduces use of urgent care, emergency room, and hospital visits but increases antibiotic prescribing. We build on the findings in these papers by comparing quality of care in telemedicine to conventional in-person care. We study a single telemedicine platform that leverages audio and SMS compared to in-person convebtional care in Rwanda, but believe the findings on how telemedicine changes the nature of the patient-provider interaction likely generalize to other virtual care settings.

Beyond the health setting, our findings contribute to a broader literature on how the channel of communication can affect behavior. Most existing studies have focused on the propensity to lie or cheat (e.g., Cohn et al., 2022; Cartwright and Xue, 2020). One exception is Laudenbach et al.

(2018) who observe more debt repayment following a call from the lender compared to a letter. We contribute to this literature by showing that providers feel more pressure from patients and are more likely to comply with their requests when face-to-face. This is consistent with other evidence of social pressure in face-to-face interactions, for example in door-to-door fundraising (DellaVigna et al., 2012).

The rest of the paper proceeds as follows. Section 2 provides institutional context for our setting in Rwanda and the telemedicine platform and health system that we study. Section 3 describes the SP methodology and data collected as well as our empirical approach. Section 5 summarizes our main empirical results. Section 6 concludes.

2 Institutional Context

Rwanda is an East African country with over 14 million residents and a GDP of US$966 in 2023. It is internationally recognized for its success in offering universal access to healthcare. With over 84% of Rwandans insured by the Mutuelle de Santé (community-based health insurance, CBHI), 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 a large majority of in-person CC at over 1700 health posts, 500 health centers, 42 district hospitals, and five national referral hospitals. [4]

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 UK established its Rwanda-based operation Babyl in 2016, with the aim of increasing access to healthcare in Rwanda using a digital healthcare model. As of October 2018, Babyl had over 2 million registered users in Rwanda.

Babyl offers Unstructured Supplementary Service Data (USSD) and voice-based services 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 telemedicine consultation with Babyl can lead to several care outcomes, some of which may include linkage to CC services 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

[4] Rwanda has a private health sector, comprised of two general hospitals, two eye hospitals, 50 clinics and polyclinics, eight dental clinics, four eye clinics, and 134 dispensaries.

for confirmation. Outcomes may include a medication/treatment prescription, medical advice, and/or referral to CC. 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 provider may require diagnostic lab tests, medication or an in-person conventional consultation at a clinic. Babyl processes for these are:

- Prescription for a lab test: Babyl sends a code for a lab test prescription to the patient's phone. The patient is to then visit 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 health facility: Babyl providers can refer a patient for in-person care for conditions outside the Babyl license or for those that may require physical examination to confirm diagnosis.
- Prescription for medication: Babyl sends a code to the patient's phone for his/her medication that can be filled at a pharmacy within Babyl's network partner pharmacies. Codes are decoded by Babyl agents working at these pharmacies.

3 Data & Methodology

To evaluate quality of care provided via telemedicine versus conventional care, we analyze data from SP surveys combined with provider surveys. A total of 1,461 SP visits to 81 conventional care facilities took place from June 16, 2022 to February 1, 2023, and 1,225 SP telemedicine calls took place from June 20, 2022 to February 2, 2023. Data from the SP encounters were collected via a debriefing SP exit questionnaire that took place shortly after the interaction and included a form that captured medicines either prescribed or dispensed by the provider. The medicine form was completed either at the same time as the debrief (for CC visits) or after the SP visited the Babyl network facility to pick up prescribed medications (for telemedicine calls). After the conclusion of SP fieldwork, we re-visited the facilities where the SP visits took place and additionally visited the telemedicine call center to survey providers who received SPs. The provider survey collected provider-level perspectives on the workplace, clinical knowledge, training, experience, as well as attitudes, personality traits and behavioral measures. We surveyed a total of 327 providers in CC (corresponding to 85% of CC SP visits) and 130 at the telemedicine platform (corresponding to 86% of telemedicine SP visits) 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 telemedicine and CC, 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 the following while portraying themselves as real patients: (i) visits as real walk-in clients to providers in CC settings, and (ii) calls to Babyl telemedicine services. After either the in-person 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 medicines prescribed. For each SP visit, SPs and their field supervisors attempted to identify all providers seen by the SPs.

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). Ahead of data collection, we conducted a pilot to confirm and validate that the implementation of SPs did not pose any more than minimal risk to individuals involved. Based on the pilot and following other studies utilizing the SP method within certain provider networks (Kwan et al., 2018, 2019; Rhodes and Miller, 2012; Boone et al., 2023; Daniels et al., 2023), we sought and received ethical clearance for a waiver of provider consent. [5] Below, we describe SP cases, recruitment, training and pilot, fieldwork, and the analytic sample in this study.

3.1.1 SP Case Presentations

Three standardized, pre-scripted case scenarios for adults were developed for this study: acute malaria, viral URI, and non-specific 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 telemedicine visit, and a set of correct and not correct case management outcomes. Below we describe each case scenario:

- Case 1. Acute Malaria - 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.*
  - 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). We define **correct case management** as

[5] 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).

correctly completing the first step in this process: ordering either a malaria microscopy test or rapid diagnostic test (RDT).

- Case 2. Viral URI - 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. Non-specific Diarrhea (telemedicine only) - 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 telemedicine providers can accurately recognize and refer emergent cases that should not be treated via telemedicine.

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 C.

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, telemedicine SPs 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 telemedicine visits, 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 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.

Activated Patients For the malaria and URI cases, we introduce two additional sources of variation in the case presentation to test how providers interact with activated patients across mediums. We use the term "activated patients" defined as, "the skills and confidence that equip patients to become actively engaged in their health care," following Hibbard and Greene (2013).

First, we designed SP case variations to assess what happens when patients suggest their diagnoses. We randomly assigned half of visits where SPs were to suggest a diagnosis for themselves, keeping all elements of the case presentation the same. If assigned to a suggestion visit, SPs suggested a potential diagnosis at the beginning of the interaction by asking whether the provider thought it was a particular condition. This suggested diagnosis is intended to make a provider think of a particular condition without providing any clinically relevant information. For malaria, SP visits assigned to suggest were randomly assigned to suggest either (i) the correct diagnosis by asking *"Do you think this is malaria?"* or (ii) an incorrect diagnosis *"Do you think this is COVID-19?"*. For URI, SP visits assigned to suggest were randomly assigned to suggest either (i) the correct diagnosis by asking *"Do you think this is a cold?"* or (ii) an incorrect diagnosis *"Do you think this is pneumonia?"*. To assess whether providers were influenced by SP suggestions, we evaluate whether providers were more likely to treat the SO 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 SPs suggesting they have a common cold in the URI case, we evaluate whether SPs were more likely receive CCM. For SPs suggesting pneumonia, we evaluate whether the SP was prescribed a medicine to treat pneumonia.

Second, we designed SP case variations to assess what happens when patients request unnecessary medicines. We randomly assigned 25% of malaria and URI SP visits where SPs were to request a specific medicine. If assigned, SPs were instructed to request an unnecessary antibiotic (Bactrim for malaria; Ciprofloxacin for URI). SPs were trained to make the request at one of 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. 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).

Insurance Status The final variation in case presentation is insurance status declared at point of care. At the beginning of visits, SPs are asked how they will be paying for services that day either by the facility's receptionist or during Babyl registration (e.g., What type of insurance do you have?). To roughly match the population demographics, in 83% of visits, SPs were assigned to pay for the visit with community-based health insurance (CBHI). In the remaining 17% of visits, SPs were assigned 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 in Section A.3.

3.1.2 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, such as the following: (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 fieldwork, 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 facilities in-person, and (ii) teams conducted telemedicine 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, case variants, 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.

To minimize SP detection due to Babyl record keeping, SPs could only complete at most one telemedicine 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 (49 females and 82 males) were hired as SPs for the fieldwork to complete in-person and telemedicine consultations.

SP Fieldwork. Before and after the fieldwork 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.

3.1.3 SP Analytic Sample

SP visits were conducted in two waves. The first wave completed conventional care visits; the second wave completed primarily telemedicine visits and secondarily more conventional care visits. For CC visits, SPs visited a total of 81 health facilities in Rwanda. For telemedicine visits, SPs visited 134 facilities for follow-up as directed by the Babyl provider after an initial telemedicine call. 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 in the CC sample are distributed across all 4 of Rwanda's provinces as well as Kigali city, and 16 of the country's 30 districts.

Table 1 summarizes the samples sizes for each variant of the case presentation in both CC and telemedicine.[6] We analyzed 2,686 total SP visits, 1,461 to CC and 1,225 to telemedicine. SPs conducted a total of 1,266 visits with the malaria case presentation, 1,275 with URI, and 145 with diarrhea.

[6] In all analyses, we code SP visits as assigned. For the 6 visits missing a suggestion or request assignment, we assume there was no suggestion or request made. In 3 visits, SPs requested the incorrect drug or made no request when assigned. In 3 visits, SPs suggested the wrong diagnosis or made no suggestion when assigned. In our main analyses, we categorize all visits as assigned. Our results are robust to excluding observations with missing assignments and those that did not present as assigned.

Table 2 summarizes the demographics of our 131 SP individuals and the types of cases that they performed. At the time of fieldwork, SPs ranged in age from 25-42 with 47% under 30 years of age, 45% aged 30-34, and the remaining 8% were 35+. 37% of our SPs are female. Among malaria and URI SP visits, the majority of SPs (80%) conducted both cases; 12% presented only URI; 8% presented only malaria. 19% of SPs completed at least one diarrhea visit. All of our SPs conducted telemedicine visits. Of all SPs, 85% conducted visits in-person at a CC facility. Focusing on the case variants presented, 81% of SPs had at least one visit when they requested an antibiotic and 99% had a visit where they suggested a diagnosis. 45% of our SPs presented both insurance types (CBHI and no insurance), 52% presented only with CBHI insurance, and 3% only presented without insurance.

3.1.4 SP Visit Data

After SPs concluded their visits, they completed a debrief survey to document details of their experience as well as a separate medicine survey to capture details on all medicines they were prescribed and/or were dispensed during the visit. Data from the SP debrief and medicines surveys were matched (see Appendix B.3 for detail) and this combined SP visit data was used to construct our key outcome variables, defined in Table 3.

Many of the definitions are dependent on the classifications of medicines and lab tests into categories of "Correct," "Optional," and "Unnecessary." Correct medicines are those necessary for the presenting condition; an example is prescribing an anti-malarial drug after a positive malaria test. Optional medicines are those that may be used to alleviate symptoms, such as paracetamol and vitamins. These may be helpful, but are not clinically necessary for correctly managing the case. Unnecessary medicines are those that are clinically unnecessary to treat the condition and also do not provide any useful palliative care. At best, these medicines are unrelated to the condition or symptoms and, at worst, may even be harmful to the patient. An example of an unnecessary medicine is an antibiotic for treatment of our viral URI case. We use a similar categorization for labs. For example, for the malaria SP case, a correct lab test is considered either malaria rapid diagnostic test (RDT) or malaria microscopy; a stool test is unnecessary; and a COVID-19 test is optional. All medicines prescribed and labs ordered during our malaria and URI SP visits were classified into one of these three categories by our technical advisory group (TAG) in Rwanda, described in Appendix Tables A1, A2 and A3.

Table 4 summarizes the SP outcome variables separately for malaria and URI, including correct case management (CCM). For malaria, CCM 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 as 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.[7] SPs are prescribed or dispensed an average of 1.51 optional medicines for malaria and 2.15 optional medicines for URI. These medicines are not clinically necessary, but are largely used for symptom management. While optional medicines may be helpful for the presenting conditions, SPs also receive clinically unnecessary medicines. The average SP receives 0.5 unnecessary medicines for malaria and 0.8 medicines for URI. 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.

In terms of other quality of care outcomes, 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 C). 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 consultations lasted for approximately 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 patient out of pocket costs to minimize the impact of outliers.

The second panel of the table summarizes our case presentations by type, which are similar across conditions. 43% of SP visits were through telemedicine and the remainder to CC. In 25% of visits, the SP requests an antibiotic. In about 25% of visits, SPs suggested the correct diagnosis at the start of the consultation. In about 25% of visits, SPs suggested an incorrect diagnosis and in the remaining 50% did not make any suggestion. In 17% 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.

3.2 Provider Survey

Several months after the conclusion of SP fieldwork, we attempted to survey all providers who treated our SPs. We surveyed 457 providers (130 in telemedicine and 327 in CC), roughly 90% of all providers identified as having treated our SPs.[8] See Appendix Section B.2 for more detail. The survey was conducted independently of the SP visits and there was no mention of the SP encounters. Providers were told that the survey was meant to study health workforce environment and the survey included questions about training, experience, demographics, attitudes, and beliefs as well as measures of personality traits, burnout, and a dictator game. We also assess providers' familiarity and knowledge of correct case management for our SP cases (malaria and URI, described more below) with vignettes that describe a similar case presentation. In Table 5, we define the

[7] For all outcomes that involve medicines (number of optional and unnecessary medicines, CCM for URI), we exclude 41 malaria visits and 34 URI visits that were not matched to a medicines file. Results are robust to including these observations and treating as if they received no medicines.

[8] Two telemedicine providers also saw SPs in CC and were surveyed at their CC facility. In Table 6, they are included with CC.

variables constructed from the provider survey data. Table 6 summarizes these variables for providers in CC and telemedicine.

3.3 Identification and Estimation

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

$$Y_{ijk} = \beta_0 + \beta_1 * Telemedicine_i + \beta_2 * Visit_i + \beta_3 * Provider_k + SP_j + \epsilon_{ijk}$$

Where:

Y_{ijk} = Care outcome of encounter i by SP j with provider k
$Telemedicine_i$ = Encounter i was a visit to telemedicine
$Visit_i$ = Visit i characteristics
$Provider_k$ = Provider k characteristics
SP_j = SP j fixed effects
ϵ_{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. The first threat occurs when 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 the exact standardized case in-person or virtually avoids the selection issue based on illness type, and the inclusion of SP fixed effects controls for selection based on SP individual personality and any other unobservable characteristics. We also control for SP visit characteristics including details of the case presentation (activated patient variants, insurance status) and timing (morning, weekend).

The second threat introduces bias when providers with certain characteristics select into practicing one form of care over another - for example, if providers more skilled in the management of malaria or URI choose to practice in telemedicine. Indeed, the URI vignette in our provider survey reveals that telemedicine providers were significantly more knowledgeable about CCM. To control for provider heterogeneity correlated with care across the settings, we include a set of provider characteristics. To maximize the sample, we impute missing values for these characteristics using the average across providers from the same setting (telemedicine or CC). The potential set of controls are described in Section 3.2 above. Rather than control for all provider characteristics, we utilized double-selection lasso linear regression to identify the most appropriate controls (Belloni et al., 2014).

4 Hypotheses and Research Questions

Why might SPs have different outcomes in telemedicine compared to in-person, conventional care? The SP methodology allows us to fix the patient and conditions, ruling this out as a source of variation in care across mediums. Any remaining variation could come from one of two sources: (1) the providers who choose to treat patients in each medium and (2) features of the medium itself.

Data from the provider survey, summarized in Table 6, reveals there is selection in which providers work in telemedicine versus CC. Relative to CC, telemedicine has more doctors and more men. Providers tend to be younger and have less experience in the health sector and at the facility where surveyed. On the Big Five personality traits, telemedicine providers rate lower on conscientiousness and higher on neuroticism, but similarly on extraversion, agreeableness, and openness. Providers marginally differ in their altruism towards patients. When playing a real-stakes modified dictator game with an unidentified patient, providers in CC gave 27% of their endowments to the patient while providers in telemedicine gave 31%.

We also find differences in clinical knowledge and experience across mediums. For malaria, 99% of providers in both settings knew the correct case management (CCM) and reported that they would (correctly) order a malaria test. For URI, knowledge differed substantially, with only 32% of providers responding to the vignette with CCM in CC compared to 77% in telemedicine. 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.

These differences in provider characteristics and experience suggest that quality of care might differ between telemedicine and CC. For example, if doctors provide higher quality care, we should expect to see higher quality of care for our SPs treated via telemedicine. If more experience leads to better quality, we should instead expect to see higher quality in CC.

Beyond differences in the types of providers who treat patients via telemedicine or in conventional care, features of the medium itself may drive differences in care.

For example, telemedicine providers are well-trained on a set of limited cases to treat. The focus on fewer conditions may cause telemedicine providers to become specialized in treating these cases. This is consistent with the fact that telemedicine providers have higher levels of URI case knowledge than CC providers.

The provider survey also reveals significant differences in the work environment between telemedicine and CC. CC providers tend to work full time at the facility (6 days/week), while telemedicine providers work only part-time on the platform (3 days/week). On days they do work, telemedicine shifts tend to be shorter (5 hours versus 9 in CC). Perhaps in part due to the different work environment, telemedicine providers report feeling less overwhelmed, less rushed,

and less emotionally exhausted than CC providers. If this affects quality, we might expect to see lower quality of care in CC.

These considerations motivate our first research question:

Research Question 1: Does patient care differ between telemedicine and in-person?

The provider survey allows us to not only measure selection in providers who choose to provide care in telemedicine and CC, but also to control for these differences in our analysis of the SP data. Controlling for this rich set of provider characteristics allows us to separate out the role of the medium from selection of providers on the characteristics measured in our survey. Thus, the second research question is:

Research Question 2: If there are differences in care between telemedicine and CC, how much is explained by variation in provider characteristics across mediums?

Beyond differences across providers and the work environment, telemedicine may change the nature of the patient-provider interaction. For 108 telemedicine providers who also see patients in CC, we asked them to compare their interactions with patients over the phone and in-person. We summarize these findings in Figure 1. Roughly 60% of providers find it easier to get information, easier to treat, and easier to relate to patients on the phone compared to in person. Around 20% find these easier in person and 20% find them to be the same across mediums. The majority of providers also found in-person consultations to be longer and more tiring than those over the phone.

Narrowing in on one particular aspect of patient-provider interaction, we asked providers about their experiences with activated patients, specifically those who suggest a self-diagnosis or request a particular treatment (along the lines of our activated patient SP case presentations). When interacting with patients who suggest a diagnosis for themselves, providers report that they don't feel a lot of pressure to agree (average of about 1.6 out of 5). To prevent under reporting of potentially undesirable behaviors (in this case, being persuaded by a patient's self-diagnosis), we also ask providers how much pressure they think their colleagues feel in these scenarios.[9] Providers report thinking that their colleagues feel slightly more pressure than they do, and significantly more in CC than telemedicine (1.9 in CC versus 1.7 in telemedicine). We also ask providers about what they do when interacting with a patient who requests a clinically unnecessary medicine or test. Providers in both CC and telemedicine report that they sometimes give into these requests (6.5% of the time in CC and 9.7% in telemedicine, difference n.s.) and that their colleagues give in slightly more often (7.1% CC, 10.2% telemedicine). Though, on average, telemedicine and CC providers reported similar beliefs about being persuaded by patients, when we asked providers who treat patients via both telemedicine and CC about the pressure they feel in each setting, 60% felt less pressure on the phone to agree with a patient's suggested self-diagnosis (compared to 9%

[9]See Krumpal (2013) for a review of social-desirability bias in surveys.

in person and 31% who felt the same) and 55% felt less pressure to comply with a patient request for a specific medicine or test over the phone (compared to 13% in person and 32% who felt it was the same). These results are shown graphically in Figure 2.

If providers indeed feel more pressure from patients in face-to-face interactions than they do over the phone, we may expect to see lower quality of care in CC relative to telemedicine when providers interact with these activated patients. We use the SP case variants with activated patients to answer our third research question:

Research Question 3: Does telemedicine change the nature of providers' interactions with activated patients?

5 Results

5.1 Telemedicine vs. Conventional Care

To evaluate quality of care in telemedicine compared to conventional care, we ask our first two research questions: Does patient care differ between telemedicine and in-person? How much of these differences are explained by variation in provider characteristics across mediums?

Tables 7 and 8 summarize the key findings for malaria and URI, respectively. The tables show the coefficients on an indicator for telemedicine (relative to CC) in a regression of the outcome from the SP visit, listed in the rows, on an indicator for telemedicine 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.

For malaria, there is no difference in correct case management (CCM), defined as ordering a malaria test, between telemedicine and CC visits. CCM is very high (93% in CC), and providers in both settings recognize the need for a malaria test and correctly order one. SPs receive 0.18 (13%) more optional medicines from telemedicine than from CC. There is no difference between telemedicine and CC in the prescribing of unnecessary medicines. Telemedicine SPs receive 0.07 (41%) fewer optional labs and 0.16 (89%) fewer unnecessary labs.

Telemedicine providers are also able to get more information out of patients in a shorter period of time. Telemedicine 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% shorter) for telemedicine consultations. Telemedicine 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).

SPs presenting URI symptoms are much less likely to be correctly managed in CC than those presenting with malaria symptoms, with only 17% of URI SPs receiving CCM in CC. For this clinically more difficult case, we find that SPs receive significantly better care in telemedicine. CCM

is 28pp (65%) higher in telemedicine than CC, largely coming from a reduction in the prescriptions of unnecessary medicines. Telemedicine SPs receive 0.30 (34%) fewer unnecessary medicines. This reduction in unnecessary prescribing is offset by the prescribing of optional medicines: SPs receive 0.31 (15%) more optional medicines in telemedicine which can help alleviate secondary symptoms for the case presentation. As with malaria, URI SPs seeking telemedicine are ordered significantly fewer labs than CC. SPs receive 0.22 (67%) fewer optional labs and 0.02 (100%) fewer unnecessary labs in telemedicine.

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

In Column (2), we add controls for potential sources of variation introduced in the SP framework, namely SP fixed effects and visit characteristics including our activated patient variants, insurance status, and the timing of the visit. 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 telemedicine from differences in outcomes *within* SP. We also control for variation in the presentation of the case including whether the SP suggests a diagnosis at the start of the interaction, whether the SP requests an antibiotic, whether the SP pays out of pocket (instead of using CBHI), as well as whether the visit occurred in the morning and on the weekend.

Including these visit controls and SP fixed effects has little impact on the results. While the coefficients in most models are almost identical, the one exception is SP out of pocket costs for malaria cases. Similar to URI, Malaria SPs pay less out of pocket for telemedicine than CC when we control for SP fixed effects and visit characteristics. The estimated effect of telemedicine on the number of unnecessary labs for URI is similar in magnitude to that in Column (1), but statistically insignificant.

To summarize across malaria and URI visits, we find that the quality of telemedicine care is at least as good as quality of CC. SPs receive the same level of (high-quality) care for malaria across mediums and better telemedicine care for URI, a condition when providers have more discretion relative to malaria. We find that providers in telemedicine are able to extract more information during the consultation as measured by the number of history questions asked. We consider telemedicine visits to be more efficient than CC, as SPs spend less time waiting, spend less time with the provider, and pay less out of pocket.

What could be driving these differences in SP outcomes? The SP method allows us to control the details of case presentation and rule out any differences that would exist in quality of care data from real patients across mediums such as case severity and comorbidities. With the SP

method, the pre-scripted symptoms and responses to medical history questions ensure that all presenting characteristics of SPs are the same. Including SP fixed effects further rules out any unobserved differences across SPs, such as demeanor. Ruling out differences in patients, there are two remaining sources of variation: the medium (telemedicine vs. face-to-face) and the types of providers that choose to practice in each setting.

As shown in Table 6, providers in CC and telemedicine differ quite significantly in their characteristics, experience, and the workplace environment. In Column (3), we attempt to isolate the impact of the medium (telemedicine vs. CC) from these differences in the providers across these settings. Ideally, to isolate the impact of the medium, we would compare patient (or SP) outcomes for the same patient (or SP) visiting the same provider in both telemedicine and 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 the workplace has on providers. To avoid over-fitting the data with the many potential controls, we use double/debiased machine learning with lasso to select from the following provider and visit characteristics:

- 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 feels overwhelmed (indicators for ratings 1 to 5)
- Provider feels rushed (indicators for ratings 1 to 5)
- Provider averages for each of the three MBI subscales: emotional exhaustion, depersonalization and professional accomplishment
- Big five personality traits: Extraversion, Agreeableness, Conscientiousness, Neuroticism, Openness (normalized to mean 0 sd 1 across all providers)
- Average percent of endowment the provider gives to the patient in the dictator game
- Provider perception of pressure to agree with patient-suggested diagnosis (indicators for ratings 1 to 5)
- Provider perception of others' pressure to agree with patient-suggested diagnosis (indicators for ratings 1 to 5)
- Percent of time provider complies with medically unnecessary patient requests (indicator for above median across providers)
- Percent of time provider thinks others comply with medically unnecessary patient requests (indicator for above median across providers)
- Provider knowledge of CCM as measured by the case vignette

- Percent of provider's patients with symptoms similar to the case vignette (bins of 0-20, 20-39, 40-59, 60-79, 80-100)
- SP suggested a diagnosis (correct, incorrect)
- SP requested an antibiotic
- SP presented with no insurance
- SP visit in the morning
- SP visit on a weekend

Column (3) reports the telemedicine coefficient from each of these models. The results change very little when we allow the model to control for differences across providers. The results are very similar to estimates in previous models. SPs pay about 19% less out of pocket for malaria treatment via telemedicine than they do in CC. As in Column (1), SPs receive 0.02 fewer unnecessary labs for URI in telemedicine compared to CC. The final column in the Tables reports the p-value from Column (3). Using the Benjamini and Hochberg (1995) algorithm to control the false discovery rate at 10% across all of our 18 outcomes, all significant estimates in Column (3) remain. All significant effects also survive a Bonferroni correction to control the family-wise error rate at 0.05 with a p-value threshold of 0.0028.

Appendix Table A4 reports the controls selected by lasso for each of the models. Despite the large number of potential controls to be selected from, the lasso model selects very few. While providers in telemedicine and CC differ on many dimensions measured in the provider survey, these differences don't have a significant impact on SP outcomes and do not explain the difference in outcomes between telemedicine and CC.[10] Though the provider survey was quite comprehensive, it is possible that there are unmeasured provider characteristics that drive both the likelihood of working in telemedicine and SP outcomes. Alternatively, our results suggest that differences in SP outcomes are not driven by provider heterogeneity.

Ruling out differences in SPs and differences in providers as driving the observed differences in our estimates for quality of care, we revisit the mechanisms discussed in Section 4. First, telemedicine providers are well-trained on a set of limited cases to treat. This specialization of telemedicine providers is consistent with the findings in the provider survey that URI case knowledge is higher in telemedicine than CC. However, even controlling for knowledge of CCM, SPs are more likely to receive CCM in telemedicine.[11] The protocol for telemedicine is that more complex cases are triaged out before talking to a provider. Our malaria and URI cases are designed to be cases that could be treated in both telemedicine and CC, but when providers in telemedicine consult with a real patient, they may infer something from the fact that the patient (i) sought care through telemedicine instead of going in-person and (ii) that the patient was triaged to a phone consultation. We do find some evidence for this, as providers on telemedicine have

[10] In Appendix Section A.1, we explore the roles of these provider characteristics more directly.

[11] Knowledge of CCM is not selected as a control in the lasso (see Appendix Table A4) and when included as a control does not significantly predict CCM (see Appendix Table A5).

shorter consultations and order fewer labs, suggesting they may be doing less exploration of potential diagnoses. On the other hand, we find that telemedicine providers ask SPs more medical history questions. Providers in telemedicine may also only be considering the more narrow set of conditions that they are allowed to treat. In the next section, we describe another a third SP case (non-specific diarrhea among adults) where we find that telemedicine providers often don't recognize when SPs should be referred to CC instead of being treated over the phone.

A second potential mechanism is the work environment in telemedicine versus CC facilities. In the provider survey, telemedicine providers reported feeling less overwhelmed, less rushed, and less emotionally exhausted. They reported phone consultations to be shorter and less tiring than in-person visits. This may be due to the part-time nature of the telemedicine platform or by differences in the number and complexity of cases being treated.[12] The self-reported measures of feeling overwhelmed, rushed, and emotionally exhausted are not selected in the lasso models (see Appendix Table A4) and, when included in the regressions, are generally not significantly predictive of quality of care (see Appendix Table A7).[13] This tells us that variation in these self-reported measures is not driving differences in outcomes between telemedicine and CC. However, because the work environment is inextricably linked to the telemedicine platform, we cannot rule out that differences in the work environment are driving SP outcomes in ways not captured by these self-reported measures.

As a third mechanism, the medium (phone versus in-person) may change the nature of the provider-patient interaction. Providers report that it is easier to get information and to treat patients over the phone versus in-person. Phone interactions may allow providers to focus on the presenting symptoms and not get distracted by misleading characteristics. In Section 5.2, we explore how providers deal with specific distractions: patient-suggested diagnoses and requests for unnecessary medicines.

5.1.1 Telemedicine-only Outcomes

Diarrhea Cases Quality of malaria and URI care management across mediums are the focus of this paper, as this is where we are able to compare the SP visit outcomes across telemedicine and CC. These conditions were selected to capture both potential under- and over-treatment. As telemedicine providers have the authorization to treat both of these conditions on the platform, we can compare SP outcomes from visits in both settings.

Another aspect of quality in telemedicine 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 developed a case of viral, non-specific adult diarrhea to test whether

[12] See Currie et al. (2024) for a review of the impact of time pressure and fatigue on provider decision making.

[13] Providers who feel more overwhelmed are less likely to provide CCM for SPs presenting with malaria. Given the very high rates of CCM for malaria, the lack of significant differences in other aspects of care, and the fact that this was not selected by the lasso model, we believe this is likely sampling variation.

telemedicine providers would refer the presenting SP to CC. Out of 145 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 SPs received via telemedicine 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, SPs seeking telemedicine were given a code and directed to the closest health facility for any ordered labs and to pick up any prescribed medicines. At the facility, a Babyl Agent was responsible for decoding the SMS code to let the lab tech or pharmacist know what the SP was ordered.

In 24% of telemedicine visits conducted by SPs, 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 (s.d. 23) waiting for their help.

The ability of a real patient to follow-through with taking any ordered labs and picking up prescribed medicines is critical to the success of a telemedicine 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 telemedicine.

5.2 Activated Patients

In this section, we describe the results from the activated patient case variants when SPs were assigned to suggest a diagnosis or request an antibiotic. These SP case variants are designed to answer our third research question: Does telemedicine change the nature of providers' interactions with activated patients?

With the suggested diagnosis, we explore whether providers treat SPs differently when a diagnosis is suggested at the start of the SP-provider interaction. In Table 9 we report the results of OLS regressions of SP care outcomes on indicators for telemedicine (vs. CC), the suggestion variant assigned, and the statistical interaction of the two indicators. All regressions control for SP fixed effects. As visit and provider controls did not have a large impact, we omit them from these regressions.[14]

[14]Results are similar if we include any controls selected by the ML model as reported in Appendix Table A4.

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, as there is not much room for improvement when the SP suggests a (correct) malaria diagnosis. In Column (2), we find that suggesting COVID at the start of the malaria case significantly increases the likelihood of receiving a COVID test by 25pp, a 108% increase over baseline rates in CC. There is no difference in the effect whether the SP suggests COVID in telemedicine or CC; however, we do find that the baseline rate of COVID tests administered in telemedicine (without a suggestion) is 5pp lower. The normative interpretation of this difference is unclear. In Column (3), we find that suggesting a common cold alongside URI presentation has no impact on CCM in either CC or telemedicine. In Column (4), we estimate noisy null effects of suggesting a pneumonia diagnosis on being prescribed a medicine to treat pneumonia in both mediums.

Table 10 summarized the results of our request variants to SP cases. We regress indicators for prescriptions of Bactrim (for the malaria case) and Ciprofloxacin (for the URI case) on indicators for telemedicine (vs. CC), whether the SP was assigned to request the antibiotic, and the statistical interaction of the two variables. Both regressions include SP fixed effects. Relative to CC, telemedicine providers are 5pp less likely to prescribe Bactrim without a request. When an SP requests Bactrim, they are 18pp more likely to get it in CC and 2pp (n.s.) more likely to get it in telemedicine. We see a similar pattern for prescribing of Ciprofloxacin in URI in Column (2). When an SP requests Ciprofloxacin, they are 7pp more likely to get it in CC but only 3pp (n.s.) more likely to get it in telemedicine.

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. Consistent with providers' self-reports (Figure 2), saying no to patient may be easier over the phone. If so, telemedicine may be welfare improving in interactions with demanding patients: reducing the prescriptions of unnecessary antibiotics without requiring doctors to say no in costly face-to-face interactions.

6 Conclusion

Our findings suggest three key insights on the nature of telemedicine compared to conventional, in-person care. First, quality of care based on clinical guidelines is no worse, and likely better, in telemedicine compared to CC. The likelihood of CCM is higher for individuals presenting with URI symptoms and no worse for individuals presenting with malaria symptoms. Providers conducting telemedicine (versus conventional care) consultations ask more medical history questions. They also prescribe more optional medicines, such as analgesics, which may help to alleviate patient symptoms. Second, telemedicine appears to be more efficient. We find that wait times were significantly less for telemedicine consultations, compared to in-person care. Telemedicine 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 over the telemedicine platform. For individuals presenting malaria or URI, providers order fewer labs in telemedicine visits. In total, telemedicine providers charged less out of pocket for visits than providers at health facilities. Third, telemedicine changes the nature of the patient-provider interaction. We find that telemedicine providers are less likely to be persuaded by 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 or all telemedicine platforms. Future work could explore cases that are either more serious or require more ongoing care than those considered in our study. We study one telemedicine platform and CC setting; to better understand the generalizability of these results, more evidence is needed from additional telemedicine platforms and CC settings.

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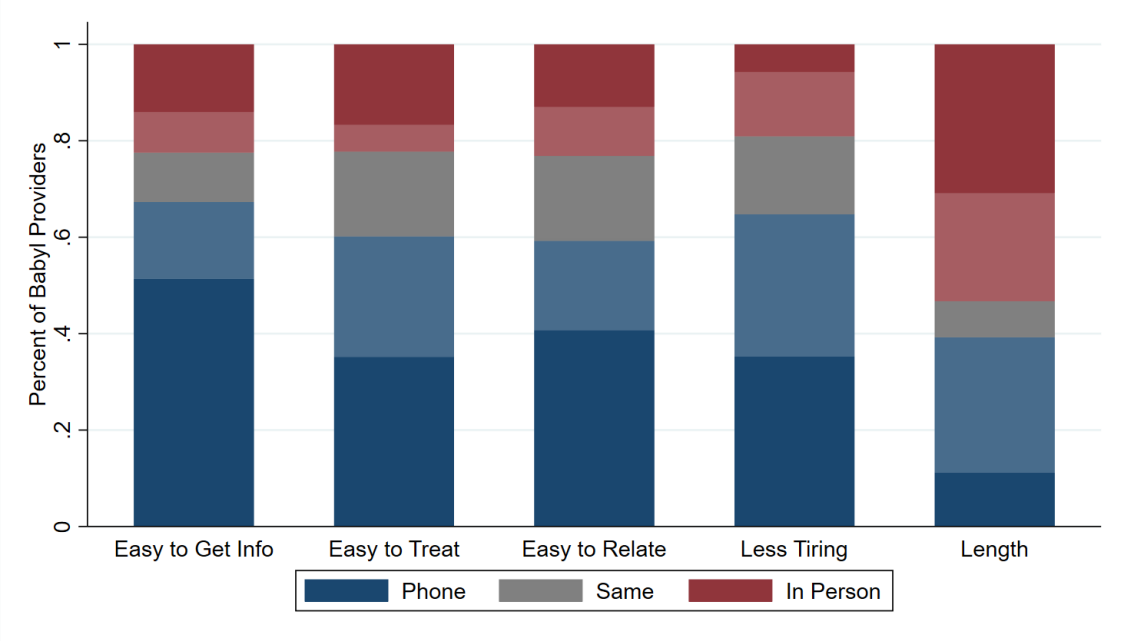
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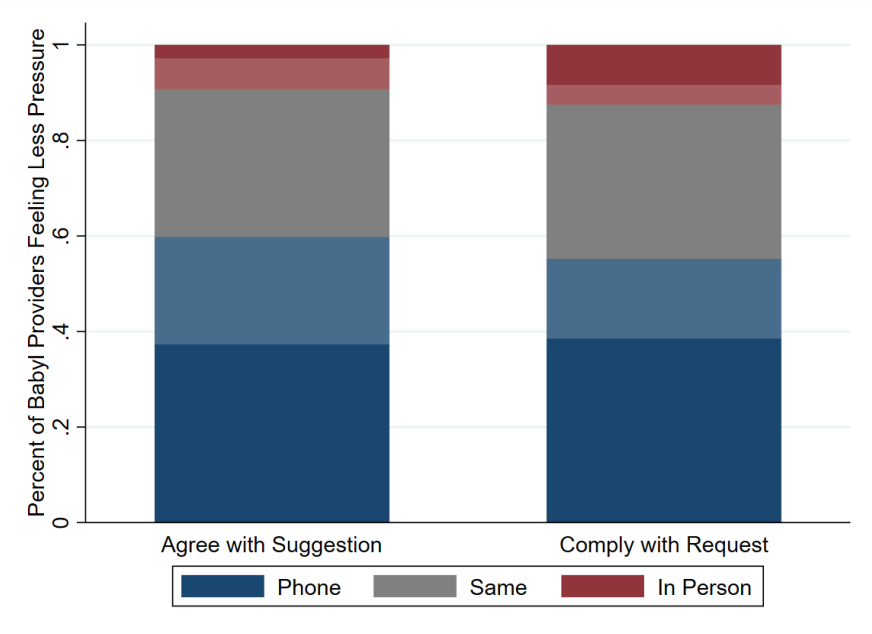
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Figure 1: Provider Ratings of Phone vs. In-Person Care



Notes: Figure summarizes provider perceptions of patient care in person vs. over the phone as measured in the provider survey. Sample is 108 telemedicine providers who also provide care in a conventional care facility. Providers asked to rate how easy it is to get information from, treat, and relate to patients from the options: a lot easier on the phone, a little easier on the phone, the same on the phone and in person, a little easier in person, a lot easier in person. Similarly, providers were asked about how tiring their interactions were (options ranging from a lot more tiring on the phone to a lot more tiring in person) and about the length of the their interactions (options ranging from a lot longer on the phone to a lot longer in person).

Figure 2: Provider Perceptions of Pressure on the Phone vs. In Person



Notes: Figure summarizes provider perceptions of pressure to agree with a patient's suggested self-diagnosis or comply with a patient request for a specific treatment (medicine or test) in person vs. over the phone as measured in the provider survey. Sample is 107 telemedicine providers who also provide care in a conventional care facility. Providers asked to rate how much pressure their feel from the following options: a lot less pressure on the phone, a little less pressure on the phone, the same on the phone and in person, a little less pressure in person, a lot less pressure in person. For complying with a particular test, 11 providers who selected "no pressure at all" are excluded from the Figure.

Table 1: Sample Size: SP Visits by Case Presentation Type

Case	Activated Patient Variant		Insurance	CC	Telemedicine	Total
Malaria	Suggestion: COVID	Request Bactrim	CBHI	83	57	140
			No Insurance	11	10	21
		No Request	CBHI	78	63	141
			No Insurance	17	8	25
	Suggestion: Malaria	Request Bactrim	CBHI	78	58	136
			No Insurance	15	10	25
		No Request	CBHI	82	52	134
			No Insurance	11	10	21
	No Suggestion	Request Bactrim	CBHI	0	0	0
			No Insurance	0	0	0
		No Request	CBHI	286	236	522
			No Insurance	66	35	101
	Total			**727**	**539**	**1266**
URI	Suggestion: Pneumonia	Request Cipro	CBHI	80	54	134
			No Insurance	17	15	32
		No Request	CBHI	81	56	137
			No Insurance	15	8	23
	Suggestion: URI	Request Cipro	CBHI	73	60	133
			No Insurance	16	4	20
		No Request	CBHI	72	55	127
			No Insurance	21	10	31
	No Suggestion	Request Cipro	CBHI	0	0	0
			No Insurance	0	0	0
		No Request	CBHI	267	239	506
			No Insurance	92	40	132
	Total			**734**	**541**	**1275**
Total Malaria and URI				**1461**	**1080**	**2541**
Diarrhea			CBHI	0	125	125
			No Insurance	0	20	20
Total				**1461**	**1225**	**2686**

Notes: Number of SP visits by Type (CC or telemedicine), case (malaria, URI, or diarrhea), assigned activated patient variant (whether the SP suggested a diagnosis, whether the SP requested an antibiotic), and insurance status (whether the SP paid with state-sponsored health insurance (CBHI) or paid out of pocket (No Insurance)). Visits with missing assignments assumed to be no suggestion and no request.

Table 2: SP Demographics and Case Presentation Types

	Mean
Age	
SP Age 25-29	0.47
SP Age 30-34	0.45
SP Age 35-42	0.08
Female	0.37
Cases Performed	
Only Malaria	0.08
Only URI	0.12
Both Malaria and URI	0.80
At least one diarrhea visit	0.19
Type of Visit Performed	
Only CC Visits	0.00
Only telemedicine Visits	0.15
Both CC and telemedicine Visits	0.85
Activated Patient Variants Performed	
At least one visit requesting an antibiotic	0.81
At least one visit suggesting a diagnosis	0.99
Insurance Type Performed	
Only CBHI	0.52
Only No Insurance	0.03
Both CBHI and No Insurance	0.45
N	131

Notes: Table summarized SP demographics (age and gender) and the types of cases performed including condition (malaria, URI, and dirrhea), type (telemedicine vs. CC), activated patient variants (requesting an antibiotic, suggesting a diagnosis), and insurance (CBHI vs. no insurance).

Table 3: Definitions of SP Outcomes and Case Presentations

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 or dispense during the visit any unnecessary medicines or order any unnecessary labs. Missing if SP visit was not matched to a medicine file.
Medicine	Number optional medicine	Count of optional medicines prescribed or dispensed. 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 of optional labs ordered.
	Number unnecessary labs	Count of unnecessary labs ordered.
Consultation	Questions asked patient	Count of pre-specified medical history questions that the provider asked the SP during the consultation.
	Time with provider	Minutes spent with the provider in the initial consultation. For telemedicine, this is duration of the phone call when the provider calls for initial consultation. For CC, this is time spent with the provider during the in-person consultation.
	Time waiting for provider	Minutes spent waiting for the provider to begin the initial consultation. For telemedicine, this is the time from first calling 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	Total amount of Rwandan Francs (RWF) paid out of pocket by the SP for the interaction, including the cost of all medicines and labs. Missing if SP visit was not matched to a medicine file.
	Log of total patient payment	Log transformation of the total patient out-of-pocket payment plus 1.
Visit Type	Telemedicine	Indicator equal to 1 if the SP executed the visit over the phone via telemedicine, 0 if n-person at a CC facility.
Activated Patient Variant	Request	Indicator equal to 1 if the SP was assigned to request a specific drug (Bactrim for malaria cases and Ciprofloxacin for URI), 0 if no request was made.
	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?" 0 if the SP was assigned to suggest an incorrect diagnosis or make no suggestion.
	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?" 0 if the SP was assigned to suggest the correct diagnosis or make no suggestion.
Insurance	No Insurance	Indicator equal to 1 if the SP pays without insurance for the consultation, 0 if pays with the state-sponsored CBHI insurance.
Visit Time	Morning visit	Indicator equal to 1 if the SP started the consultation with the provider (face-to-face or when the telemedicine provider calls) between 7 and 11am.
	Weekend visit	Indicator equal to 1 if the consultation occurred on the weekend.

Notes: This table defines the standardized patient outcomes and case presentation variables as constructed from SP visit debrief and medicine surveys. Categorization of medicines and labs into correct, unnecessary, and optional are shown in Appendix Tables A1, A2 and A3. List of pre-specified medical history questions for each case are reported in Appendix Section C.

Table 4: Summary of Malaria & URI SP Case Presentations and Outcomes

	Malaria			URI		
	Mean	SD	N	Mean	SD	N
Panel A: SP Outcomes						
CCM	0.92		1266	0.29		1241
Number Optional Medicines	1.51	0.62	1225	2.15	0.75	1241
Number Unnecessary Medicines	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
Questions Asked Patient	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
Panel B: SP Case Presentations						
Telemedicine	0.43		1266	0.42		1275
Request an Antibiotic	0.25		1266	0.25		1275
Suggest Correct Diagnosis	0.25		1263	0.24		1272
Suggest Incorrect Diagnosis	0.26		1263	0.26		1272
No Insurance	0.15		1266	0.19		1275
Morning Visit	0.70		1266	0.67		1275
Weekend Visit	0.12		1266	0.13		1275

Notes: Data collected during standardized patient visits. Panel A summarizes the SP 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 of 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. We report total patient out of pocket payment in Rwandan Francs (i) winsorized at the 99th percentile and (ii) adding 1 and taking the log transformation. Optional and unnecessary medicine and lab categorization shown in Appendix Tables A2 and A3. Panel B summarizes the case presentations including the share of SP visits to telemedicine (vs. CC), when the SP requests an antibiotic, suggests a correct/incorrect diagnosis, pays out of pocket without insurance (vs. not using CBHI), as well as the timing of the visit.

Table 5: Provider Survey Variable Definitions, Part 1

Category	Variable	Definition
Provider Qualifications	Doctor	Indicator equal to 1 if provider is a doctor (general practitioner or specialist), 0 otherwise.
	Nurse	Indicator equal to 1 if provider is a nurse (nurse, triage nurse, AI nurse) or midwife, 0 otherwise.
	Other	Indicator equal to 1 if provider specified another qualification, 0 otherwise.
Provider Demographics	Female	Indicator equal to 1 if provider is female, 0 otherwise.
	Age	Age of provider in years.
Workplace Experience	Years in health sector	Years spent in health sector.
	Years at this facility	Years spent at this facility/Babyl.
Work Environment	Days per week at this facility	Typical days per week a provider works at this facility/Babyl.
	Hours per shift at this facility	Number of hours worked in a typical shift at this facility/Babyl.
	Full time at this facility	Indicator equal to 1 if the provider works 5 or more days per week.
	Works in another facility	Indicator equal to 1 if the provider provides health care services in another setting.
	Feels overwhelmed	Agreement with the following statement during a typical shift: "I feel overwhelmed by the number of patients I have to see." Scale of 1 (strongly disagree) to 5 (strongly agree).
	Feels rushed	Agreement with the following statement during a typical shift: "I feel rushed when I consult with patients." Scale of 1 (strongly disagree) to 5 (strongly agree).
Maslach Burnout Inventory (MBI)	Emotional exhaustion	Average of MBI questions on emotional exhaustion. Subscale ranges from 0 to 6, with higher numbers indicate feeling emotional exhaustion more often.
	Depersonalization	Average of MBI questions on depersonalization. Subscale ranges from 0 to 6, with higher numbers indicate feeling depersonalization more often.
	Personal accomplishment	Average of MBI questions on personal accomplishment. Subscale ranges from 0 to 6, with higher numbers indicate feeling personal accomplishment more often.

Notes: Part 1 of variable definitions constructed from the provider survey. All responses are self-reported by providers on the provider survey. "This facility" refers to the facility (conventional care health facility or the telemedicine platform) where the provider was surveyed. We use the Maslach Burnout Inventory Human Services Survey for Medical Personnel - MBI-HSS (MP): Copyright ©1981, 2016 by Christina Maslach & Susan E. Jackson.

Table 5: Provider Survey Variable Definitions, Part 2

Category	Variable	Definition
Big Five Personality Traits	Extraversion	Average of questions measuring extraversion. Scale ranges from 1 (least) to 5 (most).
	Agreeableness	Average of questions measuring agreeableness. Scale ranges from 1 (least) to 5 (most).
	Conscientiousness	Average of questions measuring conscientiousness. Scale ranges from 1 (least) to 5 (most).
	Neuroticism	Average of questions measuring neuroticism. Scale ranges from 1 (least) to 5 (most).
	Openness	Average of questions measuring openness. Scale ranges from 1 (least) to 5 (most).
Altruism in Dictator Game	Percent of endowment given to patient	Average percent of endowment given to a patient by provider across 20 rounds of a real-stakes modified dictator game.
Pressure to Agree with Patient Suggestion or Request	Pressure to agree with patient-suggested diagnosis	Agreement with the statement "When a patient thinks they know their diagnosis, I feel pressured to agree, even if they are incorrect." Scale of 1 (strongly disagree) to 5 (strongly agree).
	Others' pressure to agree with patient-suggested diagnosis	Agreement with the statement "When my colleagues have a patient who thinks he/she knows his/her diagnosis, they tend to agree, even if they are incorrect." Scale of 1 (strongly disagree) to 5 (strongly agree).
	Percent of time I comply with patient requests	Percentage of time they report giving a patient a medically unnecessary treatment when requested.
	Percent of time others comply with patient requests	Percentage of time they report their colleagues giving a patient a medically unnecessary treatment when requested.
Frequency and Knowledge of Correct Case Management (CCM)	Knowledge of CCM, malaria	Provider knowledge of malaria correct case management as measured in the malaria patient vignette. Indicator equal to 1 if ordered a malaria test, 0 otherwise.
	Knowledge of CCM, URI	Provider knowledge of URI correct case management as measured in the URI patient vignette. Indicator equal to 1 if they would not prescribe any unnecessary medicines or order any unnecessary labs, 0 otherwise.
	Percent of patients with similar symptoms, malaria	Percentage of the provider's patients with symptoms similar to those presented in the malaria vignette.
	Percent of patients with similar symptoms, URI	Percentage of the provider's patients with symptoms similar to those presented in the URI vignette.

Notes: Part 2 of variable definitions constructed from the provider survey. All responses are self-reported by providers on the provider survey. Big Five Inventory from Rammstedt and John (2007). Modified dictator games adapted from Andreoni and Miller (2002), following Gertler and Kwan (2024).

Table 6: Provider Characteristics in Conventional Care and Telemedicine

	CC			Telemedicine			P-value of
	Mean	SD	N	Mean	SD	N	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 this facility	7.58	6.60	327	3.12	1.42	130	<0.01
Work Environment							
Days per week at this facility	5.73	0.69	327	2.87	0.81	130	<0.01
Hours per shift at this facility	9.14	0.92	327	5.17	0.79	130	<0.01
Full time at this facility	0.99		327	0.05		130	<0.01
Works in another facility	0.05	0.21	327	0.88	0.32	130	<0.01
Feels overwhelmed	3.29	1.36	326	2.47	1.32	129	<0.01
Feels rushed	3.44	1.31	327	2.68	1.40	130	<0.01
Maslach Burnout Inventory (MBI)							
Emotional Exhaustion	2.33	1.04	324	1.73	1.16	126	<0.01
Depersonalization	0.41	0.64	317	0.51	0.78	125	
Personal Accomplishment	5.47	0.53	317	5.35	0.75	125	0.07
Big Five Personality Traits							
Extraversion	0.03	1.00	324	-0.09	1.00	130	
Agreeableness	-0.02	1.00	323	0.05	1.00	130	
Conscientiousness	0.08	0.91	327	-0.19	1.19	130	0.01
Neuroticism	-0.06	0.92	325	0.15	1.16	130	0.04
Openness	0.03	1.00	324	-0.07	1.00	130	
Altruism in Dictator Game							
Percent of endowment given to patient	27.40	21.21	327	31.35	21.97	130	0.08
Pressure to Agree with Patient Suggestion or Request							
Pressure to agree with patient-suggested diagnosis	1.59	0.85	327	1.68	1.02	129	
Others' pressure to agree with patient-suggested diagnosis	1.94	0.96	327	1.73	0.95	126	0.04
Percent of time I comply with patient requests	6.51	18.15	327	9.70	23.81	130	
Percent of time others comply with patient requests	7.07	16.99	317	10.22	22.62	121	
Frequency and Knowledge of Correct Case Management (CCM)							
Knowledge of CCM, malaria	0.99		327	0.99		130	
Knowledge of CCM, URI	0.32		327	0.77		130	<0.01
Percent of patients with similar symptoms, malaria	48.01	26.19	327	41.48	22.92	130	0.01
Percent of patients with similar symptoms, URI	60.50	24.27	327	56.07	21.42	130	0.07

Notes: This table reports the mean and standard deviation of provider characteristics, separately for conventional care (first three columns) and telemedicine (second three columns). The right most column shows the P-value of the difference in means between CC and telemedicine 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 Table 5.

Table 7: Malaria Outcomes in Telemedicine (vs. CC)

Dependent Variable	CC Avg	(1) Telemedicine	(2) Telemedicine	(3) Telemedicine	p-value
Correct Case Management	0.93	-0.01	-0.01	-0.00	0.775
		(0.01)	(0.02)	(0.01)	
Observations		1266	1257	1087	
Number Optional Medicines	1.44	0.18***	0.19***	0.18***	<0.001
		(0.04)	(0.04)	(0.04)	
Observations		1225	1222	1059	
Number Unnecessary Medicines	0.53	0.01	0.02	0.01	0.887
		(0.04)	(0.04)	(0.04)	
Observations		1225	1222	1059	
Number Optional Labs	0.17	-0.07***	-0.05*	-0.07***	<0.001
		(0.02)	(0.02)	(0.02)	
Observations		1266	1257	1087	
Number Unnecessary Labs	0.18	-0.16***	-0.14***	-0.15***	<0.001
		(0.02)	(0.03)	(0.02)	
Observations		1266	1257	1087	
Questions Asked Patient	5.01	3.09***	3.17***	3.17***	<0.001
		(0.16)	(0.18)	(0.16)	
Observations		1266	1257	1087	
Time with Provider (Min)	4.90	-1.31***	-1.28***	-1.19***	<0.001
		(0.26)	(0.31)	(0.18)	
Observations		1266	1257	1087	
Time Waiting for Provider (Min)	98.43	-66.83***	-72.91***	-68.46***	<0.001
		(3.23)	(3.79)	(2.76)	
Observations		1266	1257	1087	
Log Total Patient Out of Pocket Payment	5.96	-0.13	-0.23***	-0.19**	0.001
		(0.08)	(0.06)	(0.06)	
Observations		1225	1220	1057	
SP Fixed Effects			X	X	
Visit Characteristics			X	X	
Provider Characteristics				X	

Notes: This table reports the coefficient on an indicator for Telemedicine (vs. CC) from OLS regressions in Columns (1) and (2) and a Double/Debiased Machine Learning Model (DDML) with LASSO in Column (3). DDML selects controls from visit and provider characteristics. Visit characteristics include indicators for suggestion and request treatment conditions, an indicator for insurance, and variables for whether the visit occurred in the times of morning and weekend. Provider characteristics include qualification, age, experience in the health sector and facility, measures of how overwhelmed and rushed providers feel, MBI subscales, Big Five personality traits, generosity with a patient in the dictator game, perceptions of pressure to agree with patient-suggested diagnosis (themselves and others), compliance with medically unnecessary patient requests (themselves and others), knowledge of CCM, experience with patients presenting similar symptoms. Nominal p-values from column (3) displayed in the last column. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 8: URI Outcomes in Telemedicine (vs. CC)

Dependent Variable	CC Avg	(1) Telemedicine	(2) Telemedicine	(3) Telemedicine	p-value
Correct Case Management	0.17	0.28***	0.27***	0.29***	<0.001
		(0.02)	(0.03)	(0.02)	
Observations		1241	1237	1046	
Number Optional Medicines	2.02	0.31***	0.25***	0.31***	<0.001
		(0.04)	(0.05)	(0.04)	
Observations		1241	1237	1046	
Number Unnecessary Medicines	0.88	-0.30***	-0.26***	-0.31***	<0.001
		(0.03)	(0.04)	(0.03)	
Observations		1241	1237	1046	
Number Optional Labs	0.33	-0.22***	-0.22***	-0.21***	<0.001
		(0.03)	(0.03)	(0.03)	
Observations		1275	1266	1069	
Number Unnecessary Labs	0.02	-0.02*	-0.01	-0.02**	0.002
		(0.01)	(0.01)	(0.01)	
Observations		1275	1266	1069	
Questions Asked Patient	5.43	5.68***	5.95***	6.16***	<0.001
		(0.20)	(0.22)	(0.18)	
Observations		1275	1266	1069	
Time with Provider (Min)	5.77	-1.84***	-1.70***	-1.81***	<0.001
		(0.28)	(0.34)	(0.30)	
Observations		1275	1266	1069	
Time Waiting for Provider (Min)	96.22	-65.49***	-75.55***	-69.72***	<0.001
		(3.21)	(3.72)	(2.84)	
Observations		1275	1266	1069	
Log Total Patient Out of Pocket Payment	6.05	-0.42***	-0.37***	-0.37***	<0.001
		(0.08)	(0.07)	(0.06)	
Observations		1221	1215	1025	
SP Fixed Effects			X	X	
Visit Characteristics			X	X	
Provider Characteristics				X	

Notes: This table reports the coefficient on an indicator for telemedicine (vs. CC) from OLS regressions in Columns (1) and (2) and a Double/Debiased Machine Learning Model (DDML) with LASSO in Column (3). DDML selects controls from visit and provider characteristics. Visit characteristics include indicators for suggestion and request treatment conditions, an indicator for insurance, and variables for whether the visit occurred in the times of morning and weekend. Provider characteristics include qualification, age, experience in the health sector and facility, measures of how overwhelmed and rushed providers feel, MBI subscales, Big Five personality traits, generosity with a patient in the dictator game, perceptions of pressure to agree with patient-suggested diagnosis (themselves and others), compliance with medically unnecessary patient requests (themselves and others), knowledge of CCM, experience with patients presenting similar symptoms. Nominal p-values from column (3) displayed in the last column. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 9: Suggestion Case Variants

	(1)	(2)	(3)	(4)
	Malaria Cases		URI Cases	
	CCM	Ordered COVID Test	CCM	Prescribed Pneumonia Medicine
Telemedicine	-0.03	-0.05*	0.30***	-0.13**
	(0.02)	(0.02)	(0.03)	(0.04)
Suggest Malaria	0.02	-0.01		
	(0.03)	(0.02)		
Telemedicine × Suggest Malaria	0.05			
	(0.04)			
Suggest COVID	-0.02	0.25***		
	(0.02)	(0.03)		
Telemedicine × Suggest COVID		0.02		
		(0.04)		
Suggest URI			0.06	-0.06
			(0.04)	(0.04)
Telemedicine × Suggest URI			-0.05	
			(0.07)	
Suggest Pneumonia			-0.07	0.04
			(0.04)	(0.05)
Telemedicine × Suggest Pneumonia				0.02
				(0.08)
Suggest + Telemedicine X Suggest	0.07	0.27***	0.01	0.06
	(0.04)	(0.04)	(0.06)	(0.07)
Observations	1260	1260	1238	1238
R^2	0.121	0.220	0.209	0.133
Mean Dependent Variable in CC	0.93	0.12	0.17	0.51

Notes: This table reports estimates from OLS regressions of SP outcomes on the suggestion case variants, an indicator for telemedicine (vs. CC), and their interactions. Dependent variable varies based on the type of suggestion being analyzed. For correct suggestions, the relevant outcome is CCM. For a COVID suggestion, the relevant outcome is ordering a COVID test. For a pneumonia suggestion, the relevant outcome is prescribing a medicine used for treating pneumonia. All regressions include SP fixed effects. 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 10: Request Case Variants

	(1) Malaria Cases	(2) URI Cases
	Prescribed Bactrim	Prescribed Ciprofloxacin
Telemedicine	-0.05*	0.00
	(0.02)	(0.01)
Request Bactrim	0.18***	
	(0.02)	
Telemedicine × Request Bactrim	-0.16***	
	(0.04)	
Request Cipro		0.07***
		(0.01)
Telemedicine × Request Cipro		-0.04*
		(0.02)
Request + Telemedicine X Request	0.02	0.03
	(0.03)	(0.02)
Observations	1223	1238
R^2	0.152	0.105
Mean Dependent Variable in CC	0.11	0.02

Notes: This table reports estimates from OLS regressions of prescribing behavior on the request case variants, an indicator for telemedicine (vs. CC), and their interactions. Request is an indicator for whether the SP was assigned to request an antibiotic during the interaction (Bactrim for malaria cases and Ciprofloxacin for URI). Dependent variable is whether the provider prescribed Bactrim from malaria and Ciprofloxacin (Cipro) for URI. All regressions include SP fixed effects. Column (1) is limited to malaria cases and Column (2) to URI. Standard errors are reported in parentheses. Standard errors for the combination of variables are computed via the delta method. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Online Appendix

A 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), Artesunate
Vitamins/home remedies	Iron (Fer, ferrousulfate), Folic Acid, Fefol, multivitamin, polyvitamin, probiotics, 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, Labocof
Anti-fungal	Griseofulvin (agofulvin), Nystatin
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, Cimetidine
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, Oral Rehydration Salt (ORS)
Topical Ointment	Onguentemulsifiant
Unknown	Zenfallogen, UX, PCIV, Uy, U, I, C+7, Chl, A, Chi, Cf, Abokoff

Notes: This table classifies prescribed medicines into drug classes for categorization into correct, optional, and unnecessary medicines. See Appendix Table A2. Unknown drugs could not be classified.

Table A2: Categorization of Medicines

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

Notes: This table shows the categorization of drug classes (see Appendix Table A1 into correct, optional, and unnecessary medicines for malaria and URI.

Table A3: Categorization of Labs

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

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

Table A4: Controls Variables Selected by ML

Outcomes From Tables 7 & 8	**Selected Controls**	
	Malaria	**URI**
Correct Case Management	No Insurance	AM Visit
Number Optional Medicines	None	None
Number Unnecessary Medicines	No Insurance	AM Visit
Number Optional Labs	Suggest Incorrect Pressure to Agree with Patient-Suggested Diagnosis (4)	None
Number Unnecessary Labs	None	None
Questions Asked Patient	None	None
Time with Provider (Min)	MBI Depersonalization	None
Time Waiting for Provider (Min)	AM Visit Big Five Extraversion	AM Visit No Insurance
Log Total Patient Out of Pocket Payment	Doctor No Insurance	Doctor No Insurance

Notes: This table shows the control variables selected by lasso in the double/debiased machine learning models in Column (3) of Tables 7 (malaria) and 8 (URI).

A.1 Provider Characteristics

In our main regression analyses, we use machine learning to select from a large set of potential controls. In this section, we include subsets of these controls in each regression to further explore how these provider characteristics affect our SP outcomes.

In each of the tables in this section, we present a condensed version of the OLS regressions in Tables 7 and 8 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, and 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. All regressions control for SP fixed effects and an indicator for telemedicine (versus CC). In all poooled outcomes, we also control for whether the case was malaria (vs. URI).

In Appendix Table A5, 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 at the facility, the percent of patients the provider sees with symptoms similar to the case, and case knowledge measured in the vignettes. Consistent with the results described in Section 5.1, 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 unnecessary labs, and have shorter wait times. Providers with more experience in the health sector order more unnecessary labs and ask more questions during the consultation, but providers with more experience at the health facility ask fewer questions. Providers who see more patients similar to the case presentation order more optional labs, 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. Interestingly, knowledge of CCM does not significantly predict CCM.

Though we report the statistically 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 5.1): that SPs who see doctors have significantly different out of pocket costs.

In Appendix Table A6, we conduct a similar exercise including as controls provider demographics including gender, Big Five personality traits, and generosity towards a patient in the dictator game. Female providers tend to prescribe fewer optional and unnecessary medicines and have a longer wait time. Providers who measure high in extraversion have lower CCM for URI, higher wait times, and lower patient out-of-pocket costs. Extraversion was selected by the ML approach in Section 5.1 to predict wait time. Providers high in agreeableness prescribe more optional medicines and

order more optional labs. Providers high in conscientiousness ask fewer medical history questions. Providers high in neuroticism have longer wait times. Providers high in openness prescribe fewer optional medicines, ask more questions, and have lower patient out of pocket costs. Providers who share more of their endowments with the patient in the dictator game have slightly shorter wait times.

In Appendix Table A7, we include controls for provider and visit characteristics that reflect the work environment. These include proxies for how busy the facility was at the time of the visit (indicators for morning visits, visits on a weekend, and the SP's wait time (normalized to mean 0 and standard deviation 1 for telemedicine 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 shorter wait time. In the ML approach, morning was selected as a control for CCM for URI, the number of unnecessary medicines for URI, and time waiting for the provider for both malaria and URI. Weekend visits have shorter wait time. SP visits with a longer wait time (thus presumably visiting the facility or calling the telemedicine platform at a busier time) have lower CCM for malaria, fewer optional labs, and lower patient out of pocket costs. Providers who feel more overwhelmed have lower CCM for malaria and longer wait times. Providers who feel more rushed order more unnecessary labs, ask more questions, and spend more time with SPs. Providers high in MBI depersonalization prescribe more optional medicines. In the ML approach, MBI depersonalization was selected in the model of time spent with provider for malaria.

Finally, in Appendix Table A8, we include measures of pressure to agree with patient-suggested diagnoses and compliance with patient requests for medically unnecessary medicines or tests, both for themselves and their colleagues. Though some individual coefficients are statistically significant (and one is selected in the ML models), the measures of pressure to agree with patient-suggested diagnoses don't show any clear trends across the ratings. Providers who report being more likely to comply with patient requests have higher wait times while those who think their colleagues have higher compliance rates have lower wait times and higher costs.

Controlling for these subsets of provider characteristics has minimal impact on the estimated telemedicine coefficients. Across all three tables, the telemedicine coefficients remain quite stable and consistent with the results from Section 5.1.

Table A5: SP Outcomes and Provider Characteristics: 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
Telemedicine	-0.01	0.31***	0.24***	-0.18***	-0.14***	-0.11***	4.81***	-1.28***	-66.79***	-0.53***
	(0.02)	(0.04)	(0.04)	(0.03)	(0.02)	(0.02)	(0.16)	(0.27)	(3.07)	(0.06)
Doctor	0.00	-0.06	-0.03	0.18**	0.01	0.06	0.21	0.41	3.35	1.00***
	(0.04)	(0.07)	(0.08)	(0.07)	(0.05)	(0.03)	(0.33)	(0.55)	(6.24)	(0.11)
Above Median Age	-0.02	0.04	-0.04	-0.11**	-0.05	-0.06**	-0.11	0.50	9.14*	0.01
	(0.02)	(0.04)	(0.04)	(0.04)	(0.03)	(0.02)	(0.20)	(0.33)	(3.75)	(0.07)
Above Median Years in Heath Sector	0.05	0.02	0.00	0.03	0.02	0.06**	0.56**	0.25	-2.50	0.02
	(0.02)	(0.04)	(0.04)	(0.04)	(0.03)	(0.02)	(0.20)	(0.33)	(3.75)	(0.07)
Above Median Years at this Facility	-0.01	0.08	-0.04	-0.04	0.02	0.01	-1.04***	-0.37	1.11	-0.02
	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.02)	(0.21)	(0.35)	(4.03)	(0.07)
Percent Similar Patients	0.02	0.03	-0.04	-0.04	0.04*	-0.01	0.27*	0.02	-5.50*	-0.03
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.01)	(0.14)	(0.22)	(2.57)	(0.05)
Case Knowledge	-0.05	0.06	0.01	-0.12**	-0.03	0.02	0.24	-0.45	6.47	-0.11
	(0.09)	(0.03)	(0.04)	(0.04)	(0.03)	(0.02)	(0.20)	(0.33)	(3.75)	(0.07)
Malaria			-0.65***	-0.16***	-0.07**	0.11***	-2.00***	-0.47	-1.37	0.12*
			(0.04)	(0.03)	(0.02)	(0.02)	(0.17)	(0.28)	(3.22)	(0.06)
Observations	1089	1047	2110	2110	2166	2166	2166	2166	2166	2088
R^2	0.146	0.235	0.267	0.134	0.140	0.119	0.471	0.126	0.307	0.497
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 age, has above median years working in the health sector, has above median years working at the facility, has above median percent of patients they typically see with symptoms similar to the case presentation (as measured in the vignette), and knowledge of correct case management for the case presentation. All regressions control for whether the visit is at telemedicine (vs. CC). Outcomes pooled across malaria and URI also control for case. All models include SP Fixed Effects. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A6: SP Outcomes and Provider Characteristics: Demographics

	(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
Telemedicine	-0.03	0.31***	0.22***	-0.15***	-0.15***	-0.08***	4.68***	-1.58***	-64.96***	-0.46***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.01)	(0.14)	(0.24)	(2.68)	(0.05)
Female	-0.01	0.02	-0.09**	-0.06*	-0.03	0.00	0.16	0.01	5.25*	-0.05
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.01)	(0.14)	(0.23)	(2.58)	(0.05)
Big Five: Extraversion	-0.00	-0.04*	-0.03	0.02	-0.01	0.00	0.06	-0.05	6.86***	-0.06*
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.07)	(0.12)	(1.36)	(0.03)
Big Five: Agreeableness	-0.01	0.01	0.04*	-0.02	0.02*	0.01	-0.04	0.15	0.68	0.05
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.07)	(0.12)	(1.34)	(0.02)
Big Five: Conscientiousness	-0.02	0.02	-0.02	-0.02	-0.01	0.00	-0.19*	-0.11	-0.06	-0.05
	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.08)	(0.13)	(1.46)	(0.03)
Big Five: Neuroticism	-0.00	0.00	0.02	0.01	0.01	-0.00	-0.03	0.07	3.86**	0.02
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.07)	(0.12)	(1.31)	(0.02)
Big Five: Openness	-0.01	-0.01	-0.04*	0.01	0.01	0.00	0.15*	0.10	1.50	-0.06*
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.08)	(0.12)	(1.40)	(0.03)
Percent of Endowment Given to Patient	-0.00	0.00	0.00	0.00	-0.00	-0.00	-0.00	-0.01	-0.17**	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.06)	(0.00)
Malaria			-0.66***	-0.20***	-0.09***	0.12***	-1.95***	-0.64*	1.25	0.08
			(0.04)	(0.03)	(0.02)	(0.02)	(0.16)	(0.26)	(2.95)	(0.05)
Observations	1089	1047	2110	2110	2166	2166	2166	2166	2166	2088
R^2	0.153	0.229	0.276	0.125	0.142	0.115	0.465	0.124	0.316	0.481
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 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 a dictator game. All regressions control for whether the visit is at telemedicine (vs. CC). Outcomes pooled across malaria and URI also control for case. All models include SP Fixed Effects. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A7: SP Outcomes and Provider Characteristics: 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
Telemedicine	-0.03	0.27***	0.25***	-0.13***	-0.15***	-0.08***	4.50***	-1.60***	-72.85***	-0.44***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.01)	(0.15)	(0.25)	(2.73)	(0.05)
Morning	0.01	-0.09**	0.01	0.08**	0.03	0.02	0.01	-0.12	-34.71***	0.04
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.15)	(0.25)	(2.70)	(0.05)
Weekend	0.01	-0.01	-0.01	-0.03	0.01	-0.01	-0.32	0.31	-15.16***	0.01
	(0.02)	(0.04)	(0.04)	(0.04)	(0.03)	(0.02)	(0.20)	(0.32)	(3.54)	(0.07)
Normalized Wait Time	-0.03***	0.01	0.02	0.01	-0.02*	0.00	-0.03	-0.02		-0.05*
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.07)	(0.11)		(0.02)
Above Median Overwhelmed	-0.05*	-0.04	-0.00	0.07	0.01	-0.02	-0.12	-0.30	9.27*	-0.10
	(0.03)	(0.05)	(0.05)	(0.04)	(0.03)	(0.02)	(0.23)	(0.37)	(4.07)	(0.08)
Above Median Feels Rushed	0.00	-0.05	-0.02	-0.01	-0.01	0.05*	0.03	0.21	-7.01	0.08
	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.02)	(0.21)	(0.35)	(3.83)	(0.07)
MBI Emotional Exhaustion	-0.00	-0.01	-0.01	-0.02	-0.02	0.00	-0.14*	0.04	0.15	-0.02
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.07)	(0.11)	(1.21)	(0.02)
MBI Depersonalization	0.02	0.04	0.06**	-0.00	0.03	-0.01	0.26*	0.37*	-3.54	0.06
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.11)	(0.18)	(1.99)	(0.04)
MBI Professional Accomplishment	-0.00	-0.01	0.05	0.01	-0.02	0.01	-0.16	-0.00	-1.94	0.00
	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)	(0.12)	(0.19)	(2.09)	(0.04)
Malaria			-0.65***	-0.20***	-0.09***	0.12***	-1.99***	-0.65*	2.43	0.09
			(0.04)	(0.03)	(0.02)	(0.02)	(0.16)	(0.26)	(2.85)	(0.05)
Observations	1089	1047	2110	2110	2166	2166	2166	2166	2166	2088
R^2	0.160	0.233	0.270	0.127	0.143	0.115	0.466	0.125	0.364	0.479
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 provider and visit characteristics that describe the work environment. These include proxies for how busy the facility was at the time of the visit (morning visits, visits on a weekend, and the SP's wait time (normalized to mean 0 and standard deviation 1 for telemedicine 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 MBI subscale averages for emotional exhaustion, depersonalization, and professional accomplishment. All regressions control for whether the visit is in telemedicine (vs. CC). Outcomes pooled across malaria and URI also control for case. All models include SP Fixed Effects. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A8: SP Outcomes and Provider Characteristics: Patient Pressure

	(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
Telemedicine	-0.02	0.29***	0.25***	-0.15***	-0.14***	-0.09***	4.62***	-1.69***	-68.77***	-0.45***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.01)	(0.15)	(0.25)	(2.79)	(0.05)
Provider Pressured to Agree with Suggested Diagnosis, 2	0.02	-0.07	-0.02	-0.02	-0.05	-0.01	-0.34	-0.40	-1.39	-0.01
	(0.02)	(0.04)	(0.04)	(0.04)	(0.03)	(0.02)	(0.19)	(0.33)	(3.65)	(0.07)
Provider Pressured to Agree with Suggested Diagnosis, 3	0.02	0.05	0.03	-0.04	-0.05	-0.04	-0.51	0.23	0.96	-0.16
	(0.05)	(0.09)	(0.09)	(0.08)	(0.06)	(0.04)	(0.40)	(0.68)	(7.60)	(0.14)
Provider Pressured to Agree with Suggested Diagnosis, 4	0.08	-0.02	0.13	-0.10	0.15**	0.01	0.75*	-0.12	-19.55**	0.15
	(0.04)	(0.07)	(0.07)	(0.06)	(0.05)	(0.03)	(0.33)	(0.55)	(6.14)	(0.11)
Provider Pressured to Agree with Suggested Diagnosis, 5	0.05	-0.01	0.22	0.35*	0.03	0.05	-0.53	0.21	4.06	0.71**
	(0.09)	(0.15)	(0.16)	(0.14)	(0.10)	(0.07)	(0.73)	(1.24)	(13.75)	(0.25)
Colleague Pressured to Agree with Suggested Diagnosis, 2	-0.04	0.01	-0.04	-0.02	-0.01	-0.00	0.22	-0.05	6.46	-0.04
	(0.02)	(0.04)	(0.04)	(0.04)	(0.03)	(0.02)	(0.20)	(0.34)	(3.77)	(0.07)
Colleague Pressured to Agree with Suggested Diagnosis, 3	-0.04	0.06	-0.01	-0.13**	0.02	-0.03	0.91***	0.12	-2.18	0.10
	(0.03)	(0.05)	(0.05)	(0.05)	(0.03)	(0.02)	(0.23)	(0.40)	(4.40)	(0.08)
Colleague Pressured to Agree with Suggested Diagnosis, 4	-0.08	-0.01	-0.16*	0.01	0.07	-0.05	-0.72*	0.02	-4.42	-0.09
	(0.04)	(0.07)	(0.08)	(0.07)	(0.05)	(0.03)	(0.35)	(0.59)	(6.59)	(0.12)
Colleague Pressured to Agree with Suggested Diagnosis, 5	-0.20*	0.51***	0.06	-0.46**	-0.14	-0.10	1.86*	0.29	4.07	-0.25
	(0.10)	(0.15)	(0.17)	(0.15)	(0.11)	(0.08)	(0.77)	(1.30)	(14.51)	(0.26)
Above Median Provider Pressured to Comply with Patient Request	-0.01	0.04	0.02	0.01	0.03	0.02	-0.01	0.28	25.98***	-0.10
	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.02)	(0.21)	(0.35)	(3.95)	(0.07)
Above Median Colleagues Pressured to Comply with Patient Request	0.02	-0.06	0.02	0.02	-0.02	-0.02	-0.14	-0.38	-20.16***	0.14*
	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.02)	(0.21)	(0.35)	(3.91)	(0.07)
Malaria			-0.66***	-0.19***	-0.09***	0.11***	-2.00***	-0.64*	1.14	0.08
			(0.04)	(0.03)	(0.02)	(0.02)	(0.16)	(0.28)	(3.06)	(0.06)
Observations	1024	994	1998	1998	2047	2047	2047	2047	2047	1981
R^2	0.151	0.246	0.275	0.134	0.154	0.113	0.471	0.128	0.325	0.473
Mean Dependent Variable in CC	0.93	0.16	1.73	0.72	0.25	0.11	5.12	5.33	98.72	6.00

Notes: This table reports estimates from OLS regressions of SP visit outcomes on measures of pressure they/their colleagues feel to agree with patient suggested-diagnoses on a scale of 1 to 5 and indicators for above median percent of time they or colleague comply with patient requests for medically unnecessary medicines or tests. All regressions control for whether the visit is in telemedicine (vs. CC). Outcomes pooled across malaria and URI also control for case. All models include SP Fixed Effects. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A.2 SP Characteristics

In Section 5.1, 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 telemedicine and CC. In this section, we instead focus on these characteristics of SPs to ask whether SPs receive different care because of these characteristics.

Appendix Table A9 has a similar structure to the tables in Appendix Section A.1. We regress each of the key SP visit outcomes on an indicator for telemedicine (vs. CC) as well as indicators for SP age (in three bins) and gender. For regressions with a pooled sample of malaria and URI visits, we include an indicator for malaria.

We find little evidence on a systematic impact of SP age on outcomes, perhaps due to the rather narrow age range. All SPs are aged 25-42 years old. Relative 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.

Table A9: 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
Telemedicine	-0.01	0.28***	0.24***	-0.14***	-0.15***	-0.09***	4.42***	-1.59***	-65.92***	-0.27***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)	(0.13)	(0.19)	(2.28)	(0.05)
Age 30-34	-0.02	-0.04	0.04	-0.00	-0.04*	-0.00	0.05	-0.48*	2.01	-0.19***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.01)	(0.14)	(0.20)	(2.40)	(0.06)
Age 35-42	-0.02	-0.04	-0.07	0.06	-0.04	0.01	0.63**	-0.25	6.44	-0.05
	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.02)	(0.23)	(0.34)	(4.00)	(0.10)
Female	0.01	-0.08**	0.02	0.03	-0.02	0.01	0.27*	-0.05	1.13	0.23***
	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.01)	(0.13)	(0.20)	(2.32)	(0.06)
Malaria			-0.63***	-0.23***	-0.09***	0.10***	-1.53***	-0.64***	1.52	0.02
			(0.03)	(0.02)	(0.02)	(0.01)	(0.13)	(0.19)	(2.26)	(0.05)
Constant	0.94***	0.23***	2.03***	0.80***	0.32***	0.05***	5.78***	5.91***	94.53***	5.99***
	(0.01)	(0.02)	(0.03)	(0.03)	(0.02)	(0.01)	(0.14)	(0.21)	(2.48)	(0.06)
Observations	1263	1241	2466	2466	2536	2536	2536	2536	2536	2442
R^2	0.002	0.103	0.201	0.050	0.040	0.051	0.334	0.033	0.250	0.023
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 SP age (bins relative to SPs aged 25-29) and gender. All regressions control for whether the visit is in telemedicine (vs. CC). Outcomes pooled across malaria and URI also control for case. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A.3 Insurance Status

In Appendix Table A10, we explore the importance of SP insurance status. Specifically, we regress our main SP outcomes on indicators for telemedicine × insurance status, relative to SPs presenting with CBHI in CC. To consolidate the findings, we pool malaria and URI visits for all outcomes except CCM in columns (3) through (10). In CC, SPs paying out of pocket (no insurance) have slightly lower CCM for malaria, more time with the provider, less wait time for the consultation, and higher out-of-pocket costs than SPs paying with CBHI. In telemedicine, SPs paying out of pocket (no insurance) are ordered more unnecessary labs and pay higher out-of-pocket costs than SPs paying with CBHI.

Table A10: SP Outcomes with and without Insurance (CBHI)

	(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
CC, No Insurance	-0.10*	0.04	0.02	0.09	-0.06	0.00	0.11	0.93*	-22.08***	1.42***
	(0.04)	(0.06)	(0.07)	(0.06)	(0.04)	(0.03)	(0.30)	(0.46)	(5.48)	(0.09)
Telemedicine, CBHI	-0.02*	0.15***	0.12***	-0.08***	-0.07***	-0.05***	2.28***	-0.70***	-35.49***	-0.18***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.07)	(0.11)	(1.32)	(0.02)
Telemedicine, No Insurance	-0.01	0.16*	0.19*	0.05	-0.09	0.02	1.89***	-0.75	-36.95***	1.88***
	(0.05)	(0.07)	(0.08)	(0.07)	(0.05)	(0.03)	(0.35)	(0.53)	(6.34)	(0.10)
Malaria			-0.65***	-0.20***	-0.09***	0.11***	-1.85***	-0.57*	0.12	0.13**
			(0.03)	(0.03)	(0.02)	(0.01)	(0.15)	(0.23)	(2.73)	(0.04)
Telemedicine No Insurance - CC No Insurance	0.08	0.12	0.16*	-0.03	-0.02	0.02	1.78***	-1.69***	-14.87*	0.46***
	(0.05)	(0.08)	(0.08)	(0.07)	(0.05)	(0.03)	(0.36)	(0.55)	(6.55)	(0.11)
Telemedicine No Insurance - Telemedicine Insurance	0.01	0.01	0.07	0.13	-0.02	0.07*	-0.39	-0.05	-1.46	2.05***
	(0.05)	(0.07)	(0.08)	(0.07)	(0.05)	(0.03)	(0.35)	(0.54)	(6.43)	(0.11)
Observations	1260	1238	2465	2465	2536	2536	2536	2536	2536	2442
R^2	0.121	0.204	0.250	0.112	0.128	0.110	0.443	0.120	0.303	0.575
Mean Dependent Variable in CC, CBHI	0.95	0.18	1.72	0.68	0.26	0.11	5.14	5.15	102.11	5.59

Notes: This table reports the coefficients from OLS regressions of SP visit outcomes on whether the patient paid for the visit with CBHI or out of pocket (no insurance) for telemedicine and CC. The reference group are outcomes for SPs paying with CBHI in CC. Outcomes pooled across malaria and URI control for case. All models include SP Fixed Effects. Standard errors in parentheses. Standard errors for the combinations of variables are computed via the delta method. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

B Detailed Methodology

B.1 SP

B.2 Provider Survey

The provider surveys were conducted independently of SP encounters at least five 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 to March 11, 2023. During the pilot, enumerators surveyed 33 providers in CC who treated SPs during the SP pilot and 6 telemedicine 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 debrief surveys to rosters obtained from the telemedicine platform and CC facilities. To match telemedicine 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 the roster 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. In total, 148 telemedicine 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.

We attempted to survey all providers who provided care to our SPs, regardless of medium. 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. Of the 148 telemedicine providers identified, we were able to survey 132 (89%). Of the 357 CC providers identified, we were able to survey 328 (92%). In total, we surveyed 458 providers, and were able to match 457 of

these to SP visits.[15] Of these 457 providers, we classify 130 as telemedicine providers, and 327 as CC providers.[16]

B.3 Matching the SP Debrief Surveys, SP Medicine Surveys, and Provider Surveys

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: SP 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. Appendix Table A11 displays these sample sizes as well as summary statistics for the consistency of the identifier variables across these matched SP debrief and medicine surveys. 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 from the SP debrief in analyses unless otherwise noted by the field team in Rwanda (e.g., in the case of a typo in the visit date).

[15] One additional provider was surveyed who was not matched to any SP visit. We exclude them from all analyses.

[16] Two telemedicine providers also saw SPs in CC and were surveyed at their CC facility. In Table 6, they are included with CC.

Table A11: 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 using Stata with exact matches in combinations of facility, date, SP full name, and the number matched by hand. 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.

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 A11, across our matches, only 7% had exact matches in name and 50% had an exact match on one name (first or last). Minor misspellings were thus matched by hand. When the provider name was missing or otherwise unable to be matched to the provider roster, the field team used the rosters and provider survey data to attempt to match on provider characteristics such as gender and approximate age.

Table A12, shows the number of observations that were matched across each of the three datasets (SP debrief, SP medicine, and provider survey). 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 A12: Observations Matched Per Survey Combination

Surveys Matched Across	**Observations**	**Percent**
Debrief, Medicine, Provider	2,115	78%
Debrief, Medicine	349	13%
Debrief, Provider	180	7%
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.

C SP Case Scripts

This section includes the SP scripts for the malaria, URI, and diarrhea cases. SPs were extensively trained to memorize and present the information as scripted. Each case consists of:

- Case context and a background story, with slight adaptations to make sense for the individual SP and the location where presenting.
- The opening statement said to the provider.
- A list of scripted responses to potential medical history questions.

SP Script for 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).

KINYARWANDA:

(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:

(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.*

Suggestion 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 **Ikibazo**	**Response** **Igisubizo**
1	Which symptom started first? Nikihe kimenyetso wibonyeho bwa mbere?	*First I had headache followed by fever.* *Nabanje kumva mbabara umutwe nyuma ngira umuriro.*
2	Do you live with someone who have/had recently similar symptoms? Hari umuntu mubana waba ufite cyangwa yaragize ibimenyetso nk'ibi?	*No* *Oya*
3	How long have you had fever? Umaze igihe kingana iki ufite umuriro?	*Last three days* *Maze iminsi itatu*
4	When did you start vomiting? Watangiye kuruka ryari?	*Yesterday night/ early morning* *Ejo nijoro/mu gitondo kare*
5	Is the fever constant or does it come and go? 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.* *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? Ese umuriro uriyongera ukongera akagabanuka?	*Yes – It increases more in the evening but still moderate* *Yego –wiyongera cyane nimugoroba ariko nabwo udakabije*
7	When you have a fever is it very high? Ese iyo ufite umuriro, uba ari mwinshi cyane?	*Sometimes its high, sometimes its low* *Rimwe na rimwe, uba uri mwinshi, ikindi gihe uri muke*
8	Have you been able to eat and drink? 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? Ese wigeze uruka cyangwa ngo ucibwemo?	*Yes, just vomiting* *Yego, narutse gusa*
	How frequent is your vomiting since you started feeling unwell? Kuva wafatwa, umaze kuruka inshuro zingahe?	*Two times* *Maze kuruka inshuro ebyiri*
10	Have you taken any medicines? For how long? Ese hari imiti wigeze ufata? Umaze igihe kingana iki?	*I started to take Paracetamol yesterday but it did not help.* *Nari natangiye gufata Paracetamol ejo hashize ariko ntacyahindutse*
11	Have you taken a malaria test?	*No*

	Wigeze wipimisha malariya?	*Oya*
12	When was the last time you had malaria? Uheruka kurwara malariya ryari?	*Two years ago* *Hashije imyaka 2*
13	Have you travelled recently? Hari urugendo uheruka gukora vuba aha?	*Yes – give details only if asked* *Yego – utange amakuru arambuye ari uko gusa ubisabwe*
14	Have you had difficulty breathing? Wigeze ugorwa no guhumeka?	*No* *Oya*
15	Have you had any wheezing? Wigeze usemeka?	*No* *Oya*
16	Have you had any muscle or joint pain? Wigeze wumva ubabara mu mubiri cyangwa mu ngingo?	*Yes, joints ache.* *Yego, nagize ububabare mu ngingo*
17	Do you have chest pain? Waba uri kubabara mu gituza?	*No* *Oya*
18	Do you have a cough? Waba ufite inkorora?	*No* *Oya*
19	Have you had a cold, sneezing, sore throat or stuffiness in the last few days? Mu minsi ishize, waba warigeze ugira ibicurane, guhumeka nabi cyangwa kubabara mu muhogo cyangwa gufungana ?	*No* *Oya*
20	Have you had any fainting or convulsions? Wigeze ugira kugwa igihumure (ikirabira) cyangwa kugagara?	*No* *Oya*
	Have you had any shivering ? Waba wigeze ugire ikibazo cyo gutengurwa cyane (igitengo)?	*No* *Oya*
21	Do you feel dizzy? Urumva ufite isereri?	*Yes* *Yego*
22	Are you allergic to any medicines? Hari imiti ijya igutera aleriji (ikugwa nabi)?	*No* *Oya*
23	Do you have any other problems? Hari ibindi bibazo ufite?	*No* *Oya*
24	[For female case] When was your last period? Are you/could you be pregnant? [Ku bagore] ni ryari uheruka kujya mu mihango? Ese waba utwite?	*About a week ago. No* *Hashize icyumweru.* *Oya, ntabwo ntwite.*
25	Do you feel pain while swallowing? Ujya wumva ubabara igihe uri kumira?	*No* *Oya*
26	Where is the location of the headache? Ni ikihe gice wumva ubabara umutwe?	- *Front upper part of the head.* - *Back of the head* - *Ndibwa mu gahanga* - *Ndibwa Umutwe w'inyuma*
27	What is the severity/intensity of the headache?	- *Moderate*

	Ese urumva umutwe ukurya bingana iki?	- *but sometimes exacerbated/worsens in the evenings* - *Ubu ntibikabije,* - *Ariko rimwe na rimwe biba bikabije ni mugoroba*
28	Have you ever had typhoid? Wigeze urwara tifoyide?	*Never* *Nta na rimwe*
29	(Related to suggestion) Why do you ask if this is [malaria/COVID]? Kubera iki uri kubaza niba urwaye malariya cyangwa COVID?	*I don't know, I am just wondering* *Simbizi, ndi kwibaza gusa*

SP Script for 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:

(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 bihererye 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 as assigned version adds to the opening statement:
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 **Ikibazo**	**Response** **Igisubizo**
1	How can i help you today? Ni iki cyakuzanye uyu munsi?	[Opening Statement] [koresha interuro ifungura]
2	Which symptom started first? 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? Wigeze uhura n'umuntu ufite/wari ufite ibimenyetso bisa nkibyo?	*Yes, the nature of my work exposes me to meet people/clients.* *Yego, akazi nkora gatuma mpura n'abantu/abakiriya batandukanye*
4	How long have you had fever? Umaze igihe kingana iki ufite umuriro?	*Last two days* *Iminsi ibiri*
5	When did you start coughing? Ni ryari watangiye gukorora?	*Last four days* *Iminsi ine ishize*
6	How was the cough at the beginning? (Was it dry or productive) Ni gute inkorora yari imeze bigitangira? (Yari akayi cyangwa isohora igikororwa ?)	*It was dry with no mucus* *Yari akayi nta gikororwa izana*
7	How is your cough today? 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? Ni iki kindi cyahindutse kuva watangira gukorora?	I started having sore throat Natangiye kubabara mu muhogo
9	When did you start having sore throat? Ni ryari watangiye kubabara mu muhogo?	*Today morning.* *Uyu munsi mu gitondo.*

10	Have you been able to eat and drink? Wigeze ubasha kurya no kunywa?	*Not very well, as I have sore throat* *Si neza cyane, kuko ndi kubabara mu muhogo*
11	Have you had any vomiting or diarrhea? Wigeze uruka cyangwa ngo ucibwemo?	*No* *Oya*
12	Have you taken any home remedies? Which home remedies? 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). *yego, nagerageje kwivura nkoresheje* amazi ashyushye avanze n'ubuki n'indimu.
13	Have you had any difficulty swallowing? Wigeze ugorwa no kugira icyo umira?	*Yes,My throat is slightly painful,* *Yego,Ndababara mu muhogo buhoro*
14	Do you have nasal congestion? Hari ubwo uri gufungana mu mazuru?	*Yes, my nose has stayed stuffy* *Yego, amazuru yanjye aracyafunganye*
15	Is your nose running? Ese uripfuna buri kanya?	*Yes, very frequently* *Yego, kenshi cyane*
16	Do you have pain in your chest/lungs? Waba ubabara mu gatuza/mu bihaha?	*No* *Oya*
17	Do you have difficulty in breathing? Ese waba ugorwa no guhumeka?	*Yes,very light breathing difficulties, because of the congestion* *Yego, ndahumeka bingoyeho gake kubera gufungana*
18	Are you feeling tired? Urumva ufite umunaniro?	*Slightly tired.* *Ndananiweho gake.*
19	Have you taken any medication or treatment? Hari imiti wafashe cyangwa ubuvuzi wahawe?	*No* *Oya*
20	Does your family have any history of asthma? Ese mu muryango wawe hari umuntu warwaye asima?	*No* *Oya*
21	Do you have red eyes? Watery eyes? Ese amaso yawe aratukuye? Waba uzenga amarira mu maso?	*No* *Oya*
22	Have you had any discharge from your ears? Hari ibintu wigeze uzana mu matwi?	*No* *Oya*
23	Do you have pains in your joints? Hari uburibwe ufite mu ngingo ?	*No* *Oya*
24	Have you been in close contact with people with any respiratory infections like TB	*No- I don't know* *Oya- ntabwo mbizi*

	Wigeze uhura n'abantu bafite indwara z'ubuhemekero zandura, nk'igituntu?	
25	Have you been in close contact with people with any respiratory infections like COVID19 Wigeze uhura n'abantu bafite indwara z'ubuhemekero zandura, nka covid-19?	*No/ I don't know* *Oya- ntabwo mbizi*
26	Do you live with a person who is/was COVID 19+? Waba ubana n'umuntu urwaye cyangwa wigeze kurwara covid-19?	*No* *Oya*
27	When was the last time you had COVID-19 test Ni ryari uheruka kwipimisha covid-19?	*I did the test 3/4 days ago, it was negative* *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 Kuri Babyl: Ndagushishikariza kujya ku kigo nderabuzima kikwegereye ukipimisha covid-19	*Thank you.* *Urakoze.*
29	Have you ever had COVID-19? Wigeze urwara covid-19?	*No* *Oya*
30	Have you ever had pneumonia? Wigeze urwara umusonga?	*No* *Oya*
31	(Related to suggestion) Why do you ask if this is [pneumonia/a cold]? Kubera iki ubaza niba ari umusonga/cyangwa/ibicurane?	*I don't know, I am just wondering* *Simbizi, ndi kwibaza gusa*

SP Script for Case 3. Gastroenteritis (Diarrhea, Viral/Non-specific)

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.

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 **Ikibazo**	**Response** **Igisubizo**
1	What brings you today Ni iki cyakuzanye uyu munsi?	*I have diarrhea, and vomited since last 2 days and have a stomachache* *Maze iminsi ibiri mfite ikibazo cyo gucibwamo, kuruka ndetse no kuribwa munda.*
2	Have you eaten something unusual? Hari ikintu kidasanzwe wariye?	*Not that I can think of* *Ndumva ntacyo*
3	Which symptom started first? Ni ikihe kimenyetso wabanje kugaragaza?	*Stomach ache* *Kubabara mu nda*
4	Duration of the pain Uburibwe bumaze igihe kingana iki?	*Since last 2 days* *Bumaze iminsi ibiri*
5	How long have you had these symptoms for? Umaze igihe kingana iki ugaragaza ibi bimenyetso?	*For 2 days.* *Maze iminsi 2.*
6	Is the pain constant or does it come and go? 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* *Umunsi wa mbere, bwatangiye nijoro maze buragenda ariko ejo hashize bwaragarutse ariko ntibwongeye kugenda.*
7	Where is the pain located Uburibwe buherereye hehe?/ Urababara hehe?	*Around the belly button* *Mu gice cyo ku nda hafi y'umukondo*
8	Do you have any other symptoms? Ese hari ibindi bimenyetso ufite?	*(Paraphrase/repeat the symptoms that you have already given)* *(mu magambo yawe/subiramo ibimenyetso wari wamaze gutanga)*
9	What kind of symptoms 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 Ese urumva ufite isereri	*Yes* *Yego*
11	Do you have a headache Urumva ubabara umutwe?	*Yes* *Yego*

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

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