NBER WORKING PAPER SERIES

DO PATIENTS VALUE HIGH-QUALITY MEDICAL CARE? EXPERIMENTAL EVIDENCE FROM MALARIA DIAGNOSIS AND TREATMENT

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Working Paper 32075
http://www.nber.org/papers/w32075

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 2024

We thank the staff of IPA Mali and especially Alassane Koulibaly for expert field coordination. This project would not have been possible without the advice and support of Dr. Seydou Doumbia and Dr. Issaka Sagara (Malaria Research and Training Center, University of Bamako) as well as Dr. Seydou Fomba (Programme National de Lutte contre le Paludisme (PNLP)). We thank the Ministry of Health and the participating community clinics for allowing us to conduct this research. The study was funded by ESRC/DFID Development Frontiers Award ES/ N00583X/1. The research protocol was approved by the IRB of La Faculté de Médecine de Pharmacie et d'Odontostomatologie de Bamako (FMPOS)(protocol No. 2016/47/CE/FMPOS) and registered in the AEA RCT registry at https://www.socialscienceregistry.org/trials/1707. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent. All errors are our own. None of the authors on this paper have any material or financial relationships to disclose. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Do Patients Value High-Quality Medical Care? Experimental Evidence from Malaria Diagnosis and Treatment

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NBER Working Paper No. 32075
January 2024
JEL No. I11,I12,O15

ABSTRACT

Can information about the value of diagnostic tests improve provider practice and help patients recognize higher quality of care? In a randomized experiment at public clinics in Mali, health providers and patients received tailored information about the importance of rapid diagnostic tests (RDTs) for malaria. The provider training increased provider reliance on RDTs, improving the match between a patient's malaria status and treatment with antimalarials by 15-30 percent. Nonetheless, patients were significantly less satisfied with the care they received, driven by those whose prior beliefs did not match their true malaria status. The patient information intervention did not affect treatment outcomes or patient satisfaction and reduced malaria testing. These findings are consistent with highly persistent patient beliefs that translate into low demand for diagnostic testing and limit patients' ability to recognize improved quality of care.

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1 Introduction

Health systems in many low-income countries struggle to provide quality care to citizens, resulting in lost life years, human suffering, and reduced economic productivity (Das and Hammer, 2014; Bariş et al., 2022). A fundamental challenge is the high rate of misdiagnosis and misallocation of medical treatment. Drugs like antimalarials and antibiotics are lifesaving for patients in need, and too many cases remain untreated (e.g. Macarayan et al., 2020); but at the same time, health workers distribute an alarming share of medications to patients who do not need them (see for example Busfield, 2015; Brownlee et al., 2017). This wastes resources, negatively affects patient health due to adverse drug interactions and side effects, and can promote emergence of drug-resistant pathogens, which put future patients' lives at risk (World Health Organization, 2022).

In this paper, we evaluate the effects of patient- and provider-side information treatments promoting diagnostic testing on treatment outcomes and patient satisfaction. Diagnostic testing has the potential to reduce misallocation by providing credible information on a patient's cause of illness and reducing frictions that arise because patients cannot assess the quality of the care they receive (Dulleck and Kerschbamer, 2006). By creating common knowledge between provider and patient about whether treatment is needed, diagnostic testing may leave less room for information asymmetries, lack of trust, and mis-aligned incentives that can lead providers to overtreat. Reducing misallocation of medical treatment may also improve quality of care by accelerating learning and adoption of effective treatments (Adhvaryu, 2014).

However, the slow adoption of accurate diagnostic tools remains a pervasive challenge in healthcare (Baker, 2001; Fleming et al., 2021). Many efforts in low- and middle-income countries have focused on education and training interventions for healthcare providers. While systematic reviews indicate that provider-targeted training can improve patient outcomes, the overall quality of evidence remains low, and there are still relatively few studies that directly address adherence to test results (Rowe et al., 2018, 2021). Moreover, most such studies do not consider patient responses. However, health workers do not operate in a vacuum: care outcomes are a product of interactions between providers and patients. To the extent that patients do not value diagnostic testing, providers may have limited incentives to routinely verify their diagnoses with medical tests.[1] The empirical evidence on this channel is limited, in part because identification requires downstream data on provider behavior, care outcomes, and patient satisfaction.

[1]For a review documenting the inconsistent linkages between patient satisfaction and quality of care, see Farley et al. (2014).

Our paper tackles this gap in the context of malaria, where misallocation is a major problem. In our study setting in urban Mali, around 60 percent of malaria-negative patients at public health clinics received an antimalarial prescription.[2] Market forces do not appear to reward better malaria care – neither price nor patient satisfaction are positively correlated with better malaria treatment outcomes. Moreover, even though rapid diagnostic tests (RDTs) for malaria are extremely accurate, easy to administer, and available for free in the public sector, adoption is poor: in our sample, over one-third of patients prescribed an antimalarial were not tested, and around two-thirds of RDT-tested malaria negative patients were prescribed an antimalarial.

Our analysis uses data from a randomized controlled trial we conducted with 58 public health clinics in the greater Bamako region. We collaborated with Mali's National Malaria Control Program to design two cross-randomized interventions that provided information about RDTs to health workers and patients, respectively. Half of the clinics were randomly selected for a training on RDT accuracy for healthworkers. The patient-side intervention was randomized at the clinic×day level and entailed a short video on the importance of malaria testing and how to read an RDT result, recorded in the local language.

We collected detailed data from health workers and patients to connect quality of care to patient satisfaction, eliciting provider beliefs about the quality of malaria tests before and after the training intervention. Our patient surveys captured malaria testing and treatment outcomes at the clinic, and we also administered a post-consultation malaria test in patients' homes to observe their true malaria status. Finally, we measured patients' pre- and post-consultation beliefs about whether they had malaria, and their satisfaction with the provider's testing and treatment decisions.

We find that under the status quo, providers incorrectly believed that RDTs had limited ability to detect mild malaria cases and relied too strongly on more time- and skill-intensive (and therefore less accurate in practice) microscopy-based tests, sometimes conducting more than one test.[3] In the control group, we estimate that only 41-44 percent of patients received treatment recommendations for malaria that matched their underlying illness status (i.e. an antimalarial prescription if malaria positive, no prescription if negative). The provider information intervention was successful in shifting beliefs about the accuracy of RDTs and essentially closed the perceived effectiveness gap between RDTs and microscopy-based tests. As a result, use of RDTs as the sole tool for malaria diagnosis increased by 12 percentage points (55 percent), while use of microscopy alone declined by 9 percentage points (37

[2]Other studies in Sub-Saharan Africa find similarly high rates of overprescription (see for example Reyburn et al., 2004; Hamer et al., 2007; Bisoffi et al., 2009; Ansah et al., 2010).

[3]From qualitative observation, we understand that this often reflects cases where a provider conducts an RDT, questions the result, and seeks confirmation via microscopy.

percent, not significant), and double-testing declined by 5 percentage points (68 percent). These changes improved the allocation of malaria treatment by 7-13 percentage points (15-30 percent).[4]

Despite significant improvements in the quality of care in the form of better allocation of antimalarials, the provider information treatment *decreased* patient satisfaction by 0.09 standard deviation units, with point estimates indicating displeasure with both testing and medications dispensed at the clinic. What is driving this effect? We find no evidence that the training affected other aspects of care, including use of antibiotics and other medications. Several pieces of evidence indicate that patients have rigid prior beliefs and do not value diagnostic testing. First, the patient information treatment – with the main message to "take a test and only treat if positive," in line with national malaria policies – *reduced* use of malaria tests by 6 percentage points, with no change in the allocation of antimalarials. This suggests that, even though 49 percent of patients came to the clinic with incorrect beliefs about their malaria status, there is no unfulfilled demand for more information or for basing treatment on test results. Second, the negative effect of the *provider* information treatment on patient satisfaction is entirely driven by patients who were ex-ante misinformed about their malaria status. This suggests that unwelcome prescription outcomes after RDT testing may have driven decreased patient satisfaction.

Our findings build on the large literature on the drivers of healthcare quality, which distinguishes shortfalls in provider knowledge and provider effort.[5] This literature highlights that knowledge deficits coexist with substantial gaps between what providers know to do, and what they actually do during patient consultations (see de Walque et al., 2022, for a summary of the framework and evidence).[6] Our paper contributes to this literature by showing, first, that despite the know-do gap, a relatively low-cost information intervention *can* precipitate both behavior change and better care. Second, we show that patients do not reward this improvement in quality, and we identify persistent misaligned beliefs about underlying cause of illness as a mechanism.

We also contribute to the ongoing debate regarding the role of regulation and the private sector in healthcare markets, which dates back to Arrow (1963) and Friedman and Friedman

[4]These effects are not driven by simply reminding providers of best-practice treatment guidelines. Before the study, providers at *all* clinics received a short training emphasizing that they should only dispense antimalarials to patients with a positive test.

[5]Together with the lack in capacity, these deficits are sometimes termed the "three gaps" (Ibnat et al., 2019).

[6]Research studying mechanisms driving this gap have focused on financial incentives (Iizuka, 2012; Currie et al., 2014; Das et al., 2016; Lagarde and Blaauw, 2022), demand-side pressure from patients Kravitz et al. (2005); Currie et al. (2014); Lopez et al. (2022), and issues related to low motivation and effort among providers (Banerjee et al., 2008; Das et al., 2008; Das and Hammer, 2014).

(1962):[7] in settings where patients do not reward or even punish marginal improvements in quality of care, competitive pressure may have perverse effects on market outcomes. Our results suggest that, absent improvements in patient perception, closing provider knowledge gaps may in the longer run only contribute to a larger effort gap, without actually improving care. Indeed, Banerjee et al. (2020) argue that providers may rationally and intentionally misallocate treatment in settings where patients have low confidence in providers' ability to deliver quality care, and instead make inferences regarding provider quality based on prior beliefs and the outcome of the consultation.

The rest of the paper is structured as follows: in section 2 we provide background on health care and malaria treatment in Mali and present evidence of status quo health provider beliefs and knowledge as well as current treatment practices. Then, section 3 describes the experimental design, section 4 presents our empirical results, and section 5 concludes.

2 Background

Health Care and Status Quo Malaria Treatment in Mali. Mali's public health care sector is organized after the model of community-funded public health care laid out in the Bamako Initiative, launched in 1987.[8] For most patients in the public sector, the first points of contact are community health clinics or *centres de santé communautaires* (CSComs), which are run by local health associations and charge moderate user fees to cover costs. Almost all of these community clinics also have a pharmacy that supplies basic medications. CSComs are an essential pillar of primary care. In our study area around Bamako city, a typical CSCom has 1-2 physicians and around 10 other staff who can administer malaria treatment.

Mali is among the 10 countries with the most malaria cases in Africa (World Health Organization et al., 2021), but in urban areas such as Bamako, the incidence is comparatively low: in 2018, only 2.9 percent of children 6-59 months old tested positive for malaria, compared to 18.9 percent countrywide (Koenker et al., 2020). Most malaria infections present as "simple" or "uncomplicated" malaria, characterized by flu-like symptoms such as fever, chills, body aches, and fatigue. However, if left untreated, simple malaria cases can progress to a more severe stage characterized by life-threatening complications, with symptoms ranging from convulsions to coma and organ failure (Trampuz et al., 2003). Prompt treatment of simple malaria is therefore a cornerstone of good care.

[7] For more recent work, see, e.g. Chandra et al. (2016) and Skinner (2011) for higher-income country settings and Das et al. (2016) and Banerjee et al. (2020) for lower-income country settings.

[8] In early 2019, the Malian ministry of health announced plans to expand health care access and move towards universal health care by removing user fees and expanding the network of community health workers by 2022, but these reforms have been stalled by political instability and the COVID-19 crisis (Adepoju, 2019).

Mali's national malaria policy states that all suspected malaria cases must first be tested via microscopy or RDT, with antimalarials only given to those who test positive (Ministère de la Santé, 2013).[9] This conforms with World Health Organization (WHO) recommendations formulated to counteract the rise of drug-resistant malaria parasites, which have rendered several classes of antimalarials ineffective across much of Sub-Saharan Africa and Asia (World Health Organization, 2014a; Arrow et al., 2004). Over and above the risk of fostering drug-resistant malaria strains, overtreatment with antimalarials wastes resources and may cause medical harm by delaying the patient from receiving the correct treatment and potentially triggering side effects.

Public health facilities are expected to offer free RDTs to all patients. The RDT brand adopted by the Malian government, SD Bioline, shows zero false positives in WHO tests, a detection rate of over 90% for low parasite loads, and an almost 100 percent detection rate for high parasite loads, which accompany severe malaria cases (World Health Organization, 2014b). Despite the wide availability of RDTs, many clinics have blood test laboratories and use microscopes to perform blood smear tests on site. In our study area, RDTs were free of charge 70 percent of the time, while microscopy tests were free less than 3 percent of the time.

The relative performance of RDTs and microscopy differ depending on the setting. While microscopy tests are typically considered a "gold standard" malaria test (Lee et al., 2002; Trampuz et al., 2003), they require good quality equipment and skilled technicians who visually identify malaria parasites on blood slides. The advantages of microscopy include the ability to assess parasite load and differentiate between types of malaria parasites. A primary disadvantage is variable performance in resource-constrained settings, which can result in over or underdiagnosis of malaria (Wongsrichanalai et al., 2007; Berzosa et al., 2018). By comparison, RDTs are much simpler to administer (apart from a finger prick, procedures are similar to those required for a COVID-19 rapid test) and can be performed by trained laypeople. Disadvantages of RDTs include higher false positive rates because RDTs detect antigens, which remain in the bloodstream for some time after parasites are cleared (Abba et al., 2011). Another limitation is that some brands cannot detect parasites other than *p. falciparum*.[10]

Health Provider Beliefs in the Study Sample. To describe status quo provider attitudes, Appendix Table A1 reports average beliefs about malaria prevalence, confidence in

[9]Mali's testing requirement for malaria was first introduced in its five-year strategic plan for 2007-2011. Previously, the primary approach to malaria control included presumptive treatment of any fever cases (Koné et al., 2015).

[10]P. falciparum is the most dangerous malaria parasite and accounts for more than 85 percent of infections in Mali (Cissoko et al., 2022).

RDTs, and confidence in microscopy tests among health providers in the group of clinics that did not receive training on RDT accuracy.[11] Panel A shows that providers think malaria prevalence is very high, afflicting 28 percent of the general population and 44 percent of patients at their clinic. Alongside, 51 percent of the workers report feeling pressure from patients to prescribe unnecessary medications, with 68 percent of those workers saying that most of the pressure they receive is to prescribe antimalarials.

Panel B summarizes confidence in RDTs among providers. Ninety-eight percent of providers use RDTs to diagnose malaria, but they believe that only 56 percent of patients with simple malaria will test positive. In line with this concern, 47 percent of providers report they would give an antimalarial to a sick relative despite a negative RDT. Providers put significantly more faith in RDTs to diagnose severe malaria, reporting that 89 out of 100 such patients will test positive. These results coincide with our qualitative observation that doctors believe RDTs become more effective as the parasite load in the blood increases. While this belief is founded in fact, RDTs perform very well when presented with parasite loads typical of simple malaria (World Health Organization, 2014b).

Finally, Panel C shows that 70 percent of providers use microscopy tests to detect malaria. They trust this method more; on average, they think 84 and 95 out of 100 patients with simple and severe malaria respectively will have a positive microscopy result. Consequently, only 33 percent of providers would treat a relative with a negative microscopy test for malaria.

Malaria Testing and Treatment in the Study Sample. Health workers' beliefs indicate widespread skepticism of tests – especially RDTs – coupled with inflated beliefs regarding malaria prevalence. To understand how these beliefs translate into patient care, we use data from surveys conducted with patients visiting our study clinics. We focus on two sets of outcomes: patients' reports of whether they received a malaria test at the clinic and whether they were prescribed an antimalarial, and patients' "true" malaria status, which we measure via follow-up RDTs conducted by our research team at patients' homes, 1-2 days after they visited the clinic (see subsection 3.3 for more detail). To capture status quo outcomes, we limit attention to patients visiting clinics that were not trained on RDT accuracy.

Figure 1 studies how the match between the underlying cause of illness (malaria positivity per our home follow-up tests) and treatment (antimalarial prescriptions) varies with in-clinic testing. Panel A shows that compared to those who received RDTs at the clinic, patients tested via microscopy are less likely to be malaria positive yet more likely to receive antimalarials. As a result, the darkest bar in Panel B shows that the match between malaria status and malaria treatment is worst in the microscopy group and best in the group of

[11] These data come from a post-intervention survey that we conducted with health providers at the end of the study (see a detailed description in subsection 3.3).

patients who received an RDT only. Yet even in this group, the match remains under 50 percent. The lighter bars in Figure 1, Panel B report the match rate for malaria negative patients (middle gray bar) and malaria positive patients (light gray bar). Here we see that the poorer performance of microscopy patients is largely driven by overtreatment – roughly a third of malaria negative patients in the RDT-only group do not receive an antimalarial prescription, while just 17 percent of malaria negative patients in the microscopy group receive the same. These patterns suggest two issues are at play: first, providers may ignore test results when writing prescriptions, either due to patient pressure (Lopez et al., 2022) or due to their own misgivings regarding the test results – especially in the case of RDTs. Second, lab technician errors (unintended or due to poor infrastructure/supplies) may lead to false positives (poor specificity) and, therefore, overtreatment among malaria negative patients tested via microscopy.

3 Experimental Design

3.1 Sample

Our experiment was carried out in a set of public community clinics (CSComs) in the greater Bamako area. We obtained an administrative list of all clinics in the area, dropping those that had closed or were more than 15 kilometers away from Bamako city. We also excluded 21 clinics that were working with a local NGO to offer subsidized care to mothers and children. This left us with a sample of 60 clinics, which we divided into three geographical clusters. Within each cluster, we formed matched pairs based on the average number of patients per day. The matched pairs serve as strata for the provider-centered RDT training, described in more detail below.[12]

Pre-Study Training. Before the study started, four health workers at each participating clinic were invited to attend a refresher training that covered Mali's official malaria diagnosis and treatment guidelines. Malian doctors conducted all training via our partnership with the University of Bamako, the Malaria Research and Training Centre, and Mali's National Malaria Control Program. Key points covered included: (i) all suspected malaria cases should receive a diagnostic test; (ii) microscopy is the "gold standard" test and should be used when available; (iii) RDTs should be used when microscopy is not available or cannot deliver a result within two hours; (iv) symptoms and recommended treatment for simple and severe malaria; (v) procedures for microscopy and rapid diagnostic tests for malaria; (vi) a hands-on training on how to administer an RDT.

[12]We could not collect census data for one clinic; we assigned the median caseload to this clinic before the randomization. This and all other random assignment was conducted in-office using Stata's random number generator.

At the end of the training, participants were informed of upcoming study activities – namely that research staff would be visiting the clinic during a future two-week period, and that on some days, a separate set of study staff would offer vouchers for free malaria treatment and/or information for patients on RDTs (see next sub-section on the study interventions). Health workers were not told what days these interventions would be offered.

Our analysis sample drops two clinics in one stratum where one of the clinics had to be replaced after the training period ended, leaving a final sample of 58 clinics in 29 strata.[13]

3.2 Interventions

Our experimental design includes four cross-randomized treatments, three randomized within clinics and one across clinics. Two of the within-clinic treatments randomized access to antimalarial subsidies and are studied in detail in a companion paper (Lopez et al., 2022). In this paper, we focus on the effects of the two information treatments on the quality of malaria care and patient satisfaction.

Extended Training Treatment. We randomly assigned one clinic in each matched pair to receive more intensive pre-study RDT training. This "extended training" was designed to increase providers' trust in the diagnostic accuracy of RDTs and adherence to test results. Another aim was to empower providers with evidence in case patients pushed to get unnecessary medication. The treatment was administered as part of the pre-study training described above, following the core "basic training" which every clinic received. The content covered the high sensitivity (and specificity) of rapid diagnostic tests available at clinics, both in WHO quality assurance testing and in field studies conducted in Mali.[14] The training also reviewed the dangers of unnecessary treatment with antimalarials, from drug interactions to missed diagnoses to parasite resistance. The objective was to improve provider reliance on RDT results and to heighten awareness of the problem of overtreatment.

Patient Information Treatment. The "patient information" intervention was randomized within clinic and consisted of a short video shown to patients while they were waiting to consult a health provider. The video depicted dialogue between a doctor and a mother visiting a clinic with her child to explain the symptoms of malaria, the use of an RDT, the importance of testing for malaria before treating, and the risks (and unnecessary costs) associated with treatment for severe malaria in cases where the patient is not at high risk. The main message was that antimalarials should only be prescribed to individuals with positive tests. The video also demonstrated how to interpret RDT results. The video's objective

[13]The clinic in question was replaced because we learned it was hosting other interventions unrelated to our study.

[14]The training specifically addressed the performance of SD Bioline tests, the brand purchased and distributed by the government for free distribution in the public health system (Djimde et al., 2016).

was to teach patients about Mali's malaria diagnosis and treatment policies while empowering them to ask questions about treatments they did not understand. The empowerment component was designed to help patients in case a health provider prescribes unnecessary medication. 1,002 eligible patients visited the study clinics when this intervention was conducted. Appendix Table A2 shows no difference in self-reported waiting time prior to seeing the healthcare provider among patients in the patient information arm versus the control. Our administrative records show that almost 90 percent of patients in this arm watched the complete video, and those who did not finish it watched on average 4 minutes out of 7.

Voucher Treatments. The patient information treatment was cross-cut with two other within-clinic treatments, described and analyzed in detail in Lopez et al. (2022). In both, patients were eligible to receive a free course of antimalarials as part of simple malaria treatment. This was operationalized via vouchers which could – with provider prescription and certification – be redeemed for free antimalarials at the clinic pharmacy. The voucher reduced the cost of treatment for simple malaria, leaving both the revenue to the clinic and the cost of other types of treatment to the patient fixed.

Trained "intervention officers" oversaw the voucher distribution and showed the patient information videos to patients. Intervention officers did not perform any survey activities and were stationed in a separate part of the clinic from the data collection staff. Patients did not need to participate in any survey or other study activities to be eligible to receive the voucher or information interventions.

3.3 Data Collection

Study field activities were conducted in November and December 2016, covering the end of the rainy season and, therefore, the period of highest malaria risk. Our primary analysis uses data from the following sources.

Clinic Census. When building the sampling frame, we conducted a short survey of candidate clinics, which captured information on total reported caseloads, malaria caseloads, clinic testing, and pharmacy capabilities. This information was used to conduct the randomization.[15]

Health Workers: Pre- and Post-Training Tests. As part of the training for health workers, we administered a pre-training and post-training test to all healthcare providers in attendance. The test included questions on providers' knowledge of topics covered in the basic training (e.g., recommended malaria treatments, symptoms of severe malaria). The post-training test additionally included topics covered only in the "extended training" treatment (e.g., sensitivity and specificity of RDTs).

[15]One clinic in the sample was not surveyed during the census and is missing information.

Patients: In-Clinic Survey. The geography-based clinic cohorts rotated through two weeks of data collection and experimental intervention during the study period. Within each cohort, we randomly assigned each clinic to one of the 20 intervention schedules depicted in Figure 2. Intervention delivery and in-clinic survey of patients occurred on 6 days during a two-week study period. Each clinic received one control day (no within-clinic interventions), one day with patient information only, two days with voucher interventions only, and two days with both patient information and vouchers. The clinic staff was not informed of the intervention schedule in advance; instead, intervention officers communicated the day's interventions at the beginning of each day.

Enumerators attempted to interview all acutely ill patients with malaria-like symptoms at clinic intake on these observation days. We classified a patient as "acutely ill" if they were feeling sick (neither preventive care nor follow-up visit for earlier treatment) and exhibited any of the following symptoms: fever, chills, excessive sweating, nausea, vomiting, diarrhea, poor appetite, headache, cough, weakness, fatigue, or reduced consciousness. We interviewed the patient (or a caretaker, in the case of children or the very sick) both before and after meeting with a provider. The survey covered demographic characteristics, ex-ante perceptions about their condition, symptoms, any prior treatment and/or diagnosis, medications prescribed and purchased, and blood tests taken at the clinic. Finally, the survey collected data on the price of consultation and treatment.

Patients: Home Follow-Up Survey. In order to collect independent data on patients' underlying malaria status and satisfaction, we conducted a follow-up survey of patients at their homes. This survey targeted a random subset of 1,669 patients who participated in the in-clinic survey. In addition to conducting an RDT to learn the true malaria status of the patient and asking a series of questions designed to measure satisfaction with care received at the clinic, the survey also collected data on any additional medications or tests taken after the clinic visit. Appendix Table A3 shows that the probability of taking the home survey and home-based RDT are uncorrelated with the extended training and patient information treatments. It also shows that 87 percent of patients selected for the home survey were successfully interviewed, and 64 percent took a home-based RDT.

Health Workers: Endline Survey. We selected up to three care providers per clinic for a post-intervention endline survey. We interviewed the clinic director and randomly selected one other doctor and one other care provider for an interview, including nurses, health technicians, and midwives (subject to staffing). The survey included questions on providers beliefs about the performance of RDTs and microscopy tests, perceived patient knowledge, patient requests for medications, and personal preferences regarding malaria diagnosis and treatment.

Timeline. The health worker trainings were conducted on November 2-4, 2016. In-clinic data collection ran from November 14 to December 30, 2016, with the provider endline following shortly thereafter, from December 10, 2016 to January 6, 2017. Thus, our experiment can only capture the short-run (0-2 month) effect of the extended provider training.

3.4 Predicting Malaria Risk

One of our primary research aims is to understand how improving information about RDTs impacts the quality of care at clinics. While home-based RDTs give a very precise signal of a patient's underlying malaria status, test results are not available for those who did not participate in the home survey or did not consent to take the RDT. To address this, we follow Cohen et al. (2015) and Lopez et al. (2022) and use the home-tested sample to predict malaria positivity using patient symptoms and demographics. Specifically, we use probit regression to estimate the following:

$$E\left[pos_{ict} \mid \mathbf{x_{ict}}\right] = \Phi\left(\mathbf{x_{ict}}'\lambda\right) \tag{1}$$

where pos_{ict} is a dummy variable identifying those who test RDT positive and $\mathbf{x_{ict}}$ includes dummy variables for symptoms listed in Appendix Table A4: days since onset of illness, patient age, a dummy equal to one if the patient is under age 5, the interaction between age and the under 5 dummy, patient gender, and patient pregnancy status.[16] Appendix Table A5 reports results.[17] When analyzing the allocation of malaria treatment for the full sample of patients, we use the predicted value $\hat{pos}_{ict}$ as a measure of each patient's malaria risk, including those who were not tested at home.

3.5 Randomization Verification

Table 1 verifies that clinic characteristics and provider knowledge are balanced across the extended and basic training groups. Column 1 of the table reports the average value in the control group, and column 2 reports the difference between the two groups, conditional on randomization strata (clinic pair) fixed effects. Throughout the paper we cluster standard errors at the clinic-pair level (de Chaisemartin and Ramirez-Cuellar, forthcoming).

Overall, the extended training randomization was balanced, with no treatment-control differences significant at conventional levels. Point estimates do, however, suggest that

[16] We also control for demographic characteristics that may correlate with malaria risk, including the survey respondent's ethnicity, ability to speak French, literacy in French, education, and a dummy variable indicating cases where the patient and respondent are different people. Our results are similar if we omit these demographic characteristics from the specification.

[17] This regression specification matches that in Lopez et al. (2022), but for this paper, we only include observations from the 58 clinics included in our analysis sample.

providers in the extended training arm had greater faith in RDTs at pre-test than their peers in the basic training arm. Extended training clinics were also 11 percentage points less likely to have a lab capable of performing microscopy tests. These differences could bias us toward finding more use of RDTs in the extended training arm – to address this risk while tying our hands in terms of covariate selection, we use the post-double-lasso procedure by Belloni et al. (2014) to select covariates throughout our main analysis.[18]

Appendix Table A4 uses data from the in-clinic survey to assess whether patient volumes and patient characteristics are balanced across the patient information and extended training treatment groups. Each row represents a single regression, where we regress the outcome of interest on an indicator for clinic-days where the patient information intervention was in place, and an indicator for clinics selected for extended training. All regressions include strata and survey date fixed effects.

On average, enumerators interviewed 6 eligible acutely ill patients per observation day, with no significant differences across treatment arms. The average patient suspects malaria 59 percent of the time, presents with 3.4 symptoms, is 17 years old, and is malaria positive (per RDTs administered during the home survey) 22 percent of the time. Panel B shows that most patient characteristics are balanced across treatment, though patients in the patient information arm are less likely to report fever, slightly older, and less likely to be pregnant; those in the extended training arm are more likely to present with nausea/vomiting/diarrhea and had been sick for slightly longer. Importantly, malaria positivity – both measured via RDTs and predicted based on symptoms – is balanced across treatment arms.

Panel C studies balance in terms of survey respondent and household characteristics. Those randomly selected for patient information are less likely to report Bambara as their ethnic group and more likely to be literate (and consequently less likely to have a primary school education or less); those visiting clinics selected for the extended training are worse off – they are less likely to be literate, have less education, and belong to slightly bigger households. Given our design, we cannot rule out the possibility that some of these differences are due to patient selection – especially in the case of the extended training intervention, which could have had a lasting effect on quality of care at the clinic. To address concerns regarding balance, our main results use double lasso to select covariates as described in footnote 18. As a robustness check, Appendix B reports results without additional controls.

[18]We include clinic averages of all covariates listed in Table 1 and, for patient-level regressions, characteristics considered for double lasso selection in Lopez et al. (2022): all individual-level characteristics in Table A4 (excluding predicted malaria risk and characteristics only measured in the home survey) as well as the square of patient age and illness duration. We also include pairwise interactions of the aforementioned characteristics. Missing values for all characteristics are dummied out and recoded to the mean prior to forming interactions. Missing dummies are also included in the potential covariate set and set of pairwise interactions.

Overall, our findings are very similar – we therefore believe it is unlikely that balance issues affect our main conclusions.

4 Results

4.1 Empirical Approach

We begin our analysis by documenting the impact of the extended training treatment on health providers' beliefs about the accuracy of RDT and microscopy tests. Next, we study how this treatment – and the patient information intervention – impacted malaria testing at the clinic, the allocation of malaria treatment, and patient satisfaction.

We use the following regression to study the impacts of our treatments on patient outcomes:

$$y_{ict} = \beta_0 + \beta_E ET_c + \beta_P PI_{ct} + \mathbf{x'_{itc}}\alpha + \gamma_\mathbf{c} + \delta_\mathbf{t} + \varepsilon_{ic} \tag{2}$$

where y_{ict} is the outcome of interest for patient i visiting clinic c on date t, ET_c is a dummy variable indicating clinic c was selected for the extended training intervention, PI_{ct} identifies clinic-days with the patient information intervention, $\mathbf{x'_{itc}}$ is a vector of individual and clinic-level covariates selected by double lasso, $\gamma_\mathbf{c}$ are strata (clinic-pair) fixed effects and $\delta_\mathbf{t}$ are date fixed effects. When studying effects of the extended training intervention on provider outcomes, for which we have only one post-treatment observation, we omit the patient information dummy and the date fixed effects. In all cases, we cluster standard errors at the clinic-pair (strata) level (following de Chaisemartin and Ramirez-Cuellar, forthcoming).

4.2 Effects of Extended Training on Provider Trust in RDTs

Table 2 evaluates the impact of the extended training intervention on provider beliefs about the diagnostic capability of RDTs and microscopy tests.

Panel A uses the knowledge test carried out with participants right after the training to assess short-term effects. As discussed in section 2, the averages from the basic-training group indicate that trust in the sensitivity of RDTs is low at the outset: participants think that an RDT will detect simple malaria only in 60 percent of cases, compared to 85 percent of cases for a microscopy test. The extended training leads to large, significant growth in confidence in RDTs: providers who received extended training estimate that 80 percent of patients with simple malaria will test positive with an RDT, a 20 percentage point increase (column 2). We also see a 7.1 percentage point increase in providers' estimate of the sensitivity of an RDT for severe malaria patients. Column 4 shows no significant change in the estimated share of malaria negative patients who would test RDT negative. Column 1 reports treatment effects on an index that averages standardized versions of the outcomes in columns 2-4,

following Kling et al. (2007). We estimate a 0.31 standard deviation unit increase in this index, significant at the 1 percent level.

Panel B uses data from the provider endline survey, carried out after in-clinic data collection, to assess whether shifts in beliefs persisted over a longer term. To make consistent comparisons vis-a-vis Panel A, we limit the sample to providers who attended the training. Control group means and treatment effects for RDT-related beliefs are similar to those in Panel A, suggesting that increased trust in RDTs was durable over the course of the experiment.

The extended training did not provide information on microscopy tests. In line with this, we find no systematic positive effects on beliefs about microscopy. Inspection of point estimates shows that the extended training roughly equalized beliefs about the performance of the two diagnostic testing technologies.

4.3 Impacts on Testing and Treatment Allocation

We now ask whether our treatments induced changes in how malaria tests are used and who received malaria treatment. We begin by examining the impacts of the extended training for providers.

Effects of the Extended Training. Table 3 shows treatment effects on providers' use of malaria diagnostics. Over half of all patients received a malaria test in the basic training arm. While the extended training had no significant effect on overall rates of malaria testing, we do find evidence of significant reallocation – patients are 11.6 percentage points more likely to report receiving just an RDT test and 4.8 percentage points less likely to report receiving more than one kind of malaria test. While not significant, point estimates also indicate a 9 percentage point decline in use of microscopy alone.

Figure 3 explores this further. Panel A shows the composition of different test types used in clinics with basic vs. extended training, using the full sample. The shift from multiple testing and microscopy to RDT only use that is documented in Table 3 can be clearly seen. Panel B of the figure focuses on patients who tested RDT negative at home – we see an even more marked shift away from multiple testing and a corresponding increase in use of RDTs only. This is consistent with providers' increased trust in RDTs for patients with suspected simple malaria and therefore an increased willingness to rely on an RDT alone for diagnosing a malaria infection. By comparison, Panel C, which focuses on those with a positive RDT at home, shows less of a shift towards RDTs (but note the relatively small sample of N=253). For this group, extended training is associated with a reduction in microscopy and "unspecified" malaria tests, which refer to tests that patients could not identify as either an RDT or microscopy test.

Next, we consider the impact of extended training on the allocation of malaria treatment. Quality of care is higher if (i) a higher proportion of patients with malaria receive antimalarials and (ii) a lower proportion of patients without malaria do not receive antimalarials; that is, if the "match" between treatment and illness improves. To measure this, we need to link receipt of a malaria prescription to patients' underlying malaria status. As discussed in section 3.4, measuring malaria status is straightforward for the home-tested subsample because we have access to actual RDT results. For the full sample, we use predicted malaria risk $\hat{pos}_{ict}$ based on symptoms and demographics.

We explore treatment effects on misallocation graphically in Figure 4. Panel A reports results of local linear regressions where the outcome is antimalarial prescription and the running variable is predicted malaria risk. Confidence intervals are based on bootstrapped standard errors clustered at the clinic-pair level.[19] The graph shows that prescription rates were lower in the extended training group up to the 75th percentile of predicted risk; at the highest levels of predicted risk, prescription rates in the extended training group exceeded those in the basic training group. Panels B and C compare patterns among patients with and without an RDT test at the clinic. While we interpret these results with caution, since use of RDTs is endogenous to treatment, we see that allocative differences are more pronounced among RDT-tested patients.

Appendix Table A6 formally tests whether the slope of the malaria risk-malaria prescription line differs for those in the basic versus extended training groups.[20] We find that the slopes do indeed differ significantly, consistent with improved allocation in the extended training group. Moreover, differences persist when we limit the sample to patients who took a home-based RDT and use actual malaria status as a measure of malaria risk.

To better assess the welfare consequences of the changes in prescription behavior documented in Figure 4 and Table A6, we directly examine the effect of the extended training on the match between underlying malaria status and prescribed treatment. We construct a measure of this match as

$$m_i = \pi_i^M \times AM_i + (1 - \pi_i^M) \times (1 - AM_i).$$

The variable π_i^M denotes patient i's malaria status, either measured by their actual status

[19] To address the fact that predicted malaria risk is a generated regressor, we re-calculate predicted risk on each bootstrap replication.

[20] To do this, we study treatment effects on antimalarial prescriptions, modifying the regression specification given by equation 2 to include a measure of malaria risk (either home RDT result, predicted risk, or a dummy variable identifying patients with above median predicted risk) and the interaction between risk and extended training. If extended training improved the allocation of antimalarials, the interaction term should be positive and statistically significant.

in the home-testing subsample ($pos_{ict} \in \{0, 1\}$), or by their predicted risk ($\hat{pos}_{ict} \in [0, 1]$). AM_i is a dummy variable indicating that the patient was prescribed an antimalarial. Table 4 presents results – first for all patients using predicted risk (column 1), then for home-tested patients using predicted risk (column 2) and actual malaria status (column 3). We find significant improvements in quality of care that are meaningful in magnitude: whereas just 41-44 percent of patients in the basic training arm received the appropriate malaria treatment per our measure, the extended training increased this by 7-13 percentage points, an up to 30 percent improvement in antimalarial allocation. Notably, this improvement was realized without significantly changing the number of other medications prescribed, use of antibiotics, or time spent at the clinic (Appendix Table A7).

Taken together, the results are consistent with the hypothesis that the extended training increased providers' trust in RDTs, which in turn improved the quality of malaria care. Given that extended training largely shifted the *composition* of tests, rather than the overall testing rate, it stands to reason that this effect is driven by RDTs performing better in our setting than microscopy. As discussed in section 2, patients who received microscopy testing at baseline were less likely to be malaria positive, but more likely to receive antimalarials than patients tested with RDTs. Thus, RDT-tested patients have better treatment outcomes – largely due to a reduction in the use of antimalarials among those who are truly malaria negative (see Figure 1).

Effects of the Patient Information Intervention. Returning to Table 3, we see that the effects of patient information on testing and treatment outcomes are notably different. Counter to the aim of the intervention, we find a 6 percentage point decrease in the incidence of malaria testing. This result is mainly driven by the 4 percentage point reduction in the share of patients tested with an RDT only. Table 4 shows that the patient information treatment had no discernible effect on treatment allocation, despite the reduction in malaria testing.

One possible mechanism for this result is that (at least some) patients distrusted RDTs or arrived at the clinic with a strong ex-ante preference for a specific treatment. Reduced testing without a change in treatment allocation could have arisen because marginal patients who "opted out" of malaria testing were those who had very strong preferences regarding treatment and, therefore, took steps to ensure providers dispensed their preferred prescription regardless of the diagnostic outcome. This hypothesis is consistent with evidence from our companion paper, which shows that patients can successfully exert pressure on providers to prescribe antimalarials, worsening the match between treatment and underlying illness (Lopez et al., 2022). In the next section, we explore this idea further after studying the effect of our interventions on patient knowledge and satisfaction.

4.4 Impacts on Patient Knowledge and Satisfaction

Figure 5 uses data from the home survey to assess whether the extended training improved patients' knowledge of their own malaria status. Before carrying out the home RDT test, enumerators asked patients about the likely outcome of their test (on a scale from 1, definitely negative, to 5, definitely positive). The figure shows average patient scores conditional on the patient's actual home RDT result for both the basic and extended training groups. Patients treated at extended training clinics were better informed, with those who tested negative reporting lower scores (relative to their peers in the basic training group) and those who tested positive reporting higher scores. For a formal test, we run a difference-in-difference regression paralleling that in column 5 of Table A6. The coefficient on the interaction term is 0.516, with a p-value of 0.097.

Since patients at extended training clinics got higher-quality care *and* became better informed about their malaria status, it is natural to ask whether they recognize and reward this quality of care improvement. The home survey included a series of questions to measure patients' satisfaction with testing at the clinic, medicines prescribed at the clinic, and overall care. Specifically, patients were asked about the extent to which they agreed with a series of statements, such as "the doctor/nurse should have done additional medical testing before prescribing treatment", "the doctor/nurse based the treatment decision strongly on the result of my medical tests", and "the doctor should have given me a different or additional treatment or drug". We aggregate these into three standardized indices following Kling et al. (2007): an overall satisfaction index, which includes measures of satisfaction with tests, medications received, and overall care, as well as two sub-indices that focus on satisfaction with tests and medications separately.[21]

Table 5 reports treatment effects. Surprisingly, the extended training had significant negative effects on patient satisfaction: column 1 shows that patients in the extended training arm are 0.092 standard deviation units *less* satisfied (significant at the 5 percent level), with declines in satisfaction with both tests (column 2, significant at the 1 percent level) and medications (column 3, not significant, but similar in magnitude).[22] Figure 6 graphs CDFs of the satisfaction indices by provider training arm; the distribution of satisfaction in the basic training arm first-order stochastically dominates that in the extended training arm. Figure A1 uses local linear regression to explore how treatment effects on the three patient satisfaction indices vary with predicted malaria risk. The graphs show that patient

[21] See Appendix C for a complete list of questions included in the patient satisfaction indices and details on how we constructed index components.

[22] Appendix Table A8 reports treatment effects on individual index components. The extended training's treatment effects on individual components are generally modest and insignificant but consistently point to less satisfaction.

satisfaction is relatively constant across the risk distribution, with satisfaction for patients visiting extended training clinics consistently lower than satisfaction among patients visiting basic training clinics.

By contrast, Table 5 shows that the patient information treatment had no effect on patient satisfaction. This is not surprising, given that it had no impact on treatment allocation.

Mechanisms for the Decline in Patient Satisfaction. Why did patient satisfaction in the extended training group decline despite improved quality of care? One possibility is that patients themselves are skeptical of RDT tests, and judge providers relying on them more negatively. This hypothesis suggests that the patient information intervention should ameliorate the negative effects of the extended training on patient satisfaction – at least to the extent patient information can change beliefs. The patient information video explained that RDTs are accurate and that Mali's official malaria policy is to "only treat confirmed malaria positive cases" – this information may have helped cautious patients understand why providers relied on tests. Appendix Table A9 tests this hypothesis by formally studying the interaction between the two interventions on satisfaction indices. Overall, we find no evidence that patient information significantly moderated the negative effect of extended training – interaction terms are generally small in magnitude, vary in sign across the testing and medication sub-indices, and are never significantly different from zero.

A related possibility is that patients visiting the clinic have strong priors about their illness and resulting preferences regarding treatment, and react negatively when providers override their beliefs to follow test results. This is consistent with our finding that patient information reduced RDT testing, as well as evidence that patients exert pressure on providers to prescribe antimalarials (Lopez et al., 2022). To test this hypothesis, we examine whether negative satisfaction effects are concentrated among patients whose priors are incorrect. Here, we exploit the fact that we elicited patients' prior beliefs regarding the cause of their illness *before* they consulted with a provider. We construct a measure of "prior match" given by

$$\hat{m}_i = \pi_i^M \times p_0 + (1 - \pi_i^M) \times (1 - p_0),$$

where p_0 is a dummy variable equal to one if the patient suspected malaria pre-consultation. As above, π_i^M is either predicted malaria risk $\hat{pos}_{ict}$ or actual malaria status as measured by the home test pos_{ict}.

Table 6 studies how the effect of the extended training varies with patients' priors.[23] Column 1 uses the prior match measure constructed with predicted malaria positivity to examine patterns in the full sample, column 2 repeats the exercise for the subset of patients

[23]The regression equation is $y_{ict} = \beta_0 + \beta_E ET_c + \beta_{EM} ET_c \times \hat{m}_{ict} + \beta_m \hat{m}_{ict} + \beta_P PI_{ct} + \mathbf{x'_{ict}}\alpha + \gamma_\mathbf{c} + \delta_\mathbf{t} + \varepsilon_{ic}$.

with valid home RDT, and finally, column 3 uses the match between stated prior and actual malaria status per the home RDT. In all cases, we can interpret the coefficient on the extended training dummy (row 1) as the effect of the extended training on patient satisfaction *for patients whose priors were completely misaligned with their underlying malaria status*. The coefficient on the interaction term (row 2) tests whether the effect of extended training differed for better-informed patients, and the sum of the two rows provides the estimated effect of extended training for patients whose priors are exactly correct.

In all three columns, we see that the extended training had a negative effect on the ex-ante most misinformed patients (between -0.16 and -0.13 standard deviation units in magnitude, significant at the 5 percent level in columns 1 and 2 and at the 10 percent level in column 3). On the other hand, the interaction terms are positive, roughly equal in magnitude to the main effects, and significantly different from zero in columns 1 and 2. Thus, we find that patient priors moderate the effect of the extended training, with no ill-effects on satisfaction for patients whose priors were ex-ante correct. This suggests that the extended training reduced satisfaction by creating perceived mis-diagnosis among patients who were themselves poorly informed about the cause of their illness before consultation.

To further explore this channel, we create an outcome variable that indicates whether the patient got the medications they wanted (or expected) based on their prior beliefs about their malaria status. This match between patient prior and treatment is given by $p_0 \times AM_i + (1 - p_0) \times (1 - AM_i)$, where, as before, p_0 is a dummy equal to one if the patient suspects malaria pre-consultation and AM_i is a dummy variable indicating that the patient was prescribed an antimalarial. Following the structure of Table 6, we ask whether the extended training impacted the likelihood of receiving expected/desired treatment and whether this varies with patient priors, in Appendix Table A10. The first row in the table reports the effect of extended training for patients with incorrect beliefs about their true malaria status. We see that the extended training reduced the likelihood of these patients receiving their desired/expected treatment by 12-16 percentage points (significant at the 10 percent level in column 2 and at the 5 percent level in column 3). The sum of the first and second rows shows that the extended training had the opposite effect for patients with correct priors (significant at the 10 percent level in column 3). While underpowered, point estimates therefore suggest that the extended training reduced patient satisfaction among those individuals who were less likely to receive their desired/expected treatment. Overall, we interpret this as suggestive evidence that patient beliefs were affected very little by test results or provider recommendations, and consequently, the increased disagreement between their priors and the consultation outcome mediated the effect of extended training on patient satisfaction.

A final possibility is that the extended training negatively affected other aspects of care-giving – providers may, for example, use fewer soft skills and/or engage in less patient counseling when they are more motivated to use test results to inform treatment. Our measured outcomes that best capture this channel are patients' assessment of whether the provider clearly explained their diagnosis and/or test results (columns 1 and 2 in Appendix Table A8) and time spent in consultation (column 5 of Appendix Table A7). There are no significant impacts on these outcomes. It is also unclear why a change in soft skills alone would differentially impact the satisfaction of ex-ante well- versus poorly-informed patients.[24] Given these patterns, we conclude that a soft skills channel alone is unlikely to account for the impacts we observe.

5 Conclusion

Consistent with research in other low-income settings, we document significant gaps in the quality of malaria care at Malian medical clinics. These gaps are especially striking given that easy-to-administer, low-cost rapid diagnostic tests (RDTs) for malaria are readily available.

We present descriptive and experimental evidence that providers' beliefs about the quality of RDTs are part of the problem. Before the intervention, health workers were too pessimistic regarding the tests' accuracy. We evaluate the impact of an information intervention that provided information to health providers about RDTs' accuracy using data from quality assurance testing and field research in a Malian setting. In response, providers positively updated their beliefs about RDT accuracy.

Importantly, beliefs translated into diagnostic and treatment outcomes. First, we find changes in testing behavior that indicate providers were more comfortable relying on RDTs to establish a malaria diagnosis. Second, we find evidence that this led to improved quality of care – post-consultation, patients were more likely to hold correct beliefs about whether they had malaria and, critically, the match between underlying malaria status and prescribed treatment improved significantly. We estimate that the share of patients receiving the "right" malaria treatment (an antimalarial if malaria positive, no antimalarial if malaria negative) increased by 7-13 percentage points at treated clinics. This is a substantial improvement relative to the 41-44 percent rate of correct treatment in the comparison group.

Despite these benefits, our results also highlight important risks of health information interventions, associated with the incorrect (and persistent) beliefs of *patients*. First, despite improved quality of care, the extended RDT training reduced patient satisfaction by 0.09 standard deviation units, with evidence that this effect was concentrated among patients

[24] Poorer soft skills could, however, exacerbate the dissatisfaction patients felt when not prescribed what they wanted/expected.

who had incorrect pre-consultation beliefs about their underlying malaria status. Second, a patient-centered information intervention designed to increase demand for correct diagnosis of malaria (via malaria tests) had few effects and, if anything, backfired: patient information reduced use of malaria tests by 6 percentage points (11 percent) and had no impact on prescription outcomes. Both these findings suggest that patients may have hard-to-move priors about their cause of illness and/or persistently distrust diagnostic tests. While our study cannot speak to long-term effects, there is a risk that dissatisfied patients could reduce their demand for clinic services, or lead providers concerned about keeping patients satisfied to revert to their old behaviors.

In summary, our results demonstrate that simple provider-centered information interventions have the potential to effectively improve the quality of care at clinics. Still, patients may not recognize or reward these improvements, especially when they run counter to their preferences over treatment. While this points to the need to address patient preferences alongside provider practices, the unexpected result of our patient information intervention highlights that the success of such approaches is by no means assured. To the extent that patients have powerful priors, they may need more powerful interventions; a better understanding of how best to shift patient beliefs and create demand for high-quality care is an important area for future research.

References

Abba, K., J. J. Deeks, P. L. Olliaro, C.-M. Naing, S. M. Jackson, Y. Takwoingi, S. Donegan, and P. Garner (2011). Rapid diagnostic tests for diagnosing uncomplicated P. falciparum malaria in endemic countries. *Cochrane database of systematic reviews* (7).

Adepoju, P. (2019). Mali announces far-reaching health reform. *The Lancet 393*(10177), 1192.

Adhvaryu, A. R. (2014). Learning, misallocation, and technology adoption: Evidence from new malaria therapy in Tanzania. *Review of Economic Studies 81*(4), 1331–1365.

Ansah, E. K., S. Narh-Bana, M. Epokor, S. Akanpigbiam, A. A. Quartey, J. Gyapong, and C. J. Whitty (2010). Rapid testing for malaria in settings where microscopy is available and peripheral clinics where only presumptive treatment is available: A randomised controlled trial in Ghana. *BMJ 340*, c930.

Arrow, K., C. Panosian, and H. Gelband (Eds.) (2004). *Saving Lives, Buying Time: Economics of Malaria Drugs in an Age of Resistance*. Washington, DC: Institute of Medicine: National Academies Press.

Arrow, K. J. (1963). Uncertainty and the welfare economics of medical care. *The American Economic Review 53*(5), 941–973.

Baker, A. (2001). *Crossing the quality chasm: a new health system for the 21st century*, Volume 323. British Medical Journal Publishing Group.

Banerjee, A., J. Das, J. Hammer, R. Hussam, and A. Mohpal (2020). The market for healthcare in low income countries. Mimeo.

Banerjee, A. V., E. Duflo, and R. Glennerster (2008). Putting a band-aid on a corpse: Incentives for nurses in the Indian public health care system. *Journal of the European Economic Association 6*(2-3), 487–500.

Bariş, E., R. Silverman, H. Wang, and F. Zhao (2022). *Walking the talk: reimagining primary health care after COVID-19*. World Bank Publications.

Belloni, A., V. Chernozhukov, and C. Hansen (2014, May). High-dimensional methods and inference on structural and treatment effects. *Journal of Economic Perspectives 28*(2), 29–50.

Berzosa, P., A. de Lucio, M. Romay-Barja, Z. Herrador, V. González, L. García, A. Fernández-Martínez, M. Santana-Morales, P. Ncogo, B. Valladares, et al. (2018). Comparison of three diagnostic methods (microscopy, RDT, and PCR) for the detection of malaria parasites in representative samples from Equatorial Guinea. *Malaria Journal 17*(1), 1–12.

Bisoffi, Z., B. S. Sirima, A. Angheben, C. Lodesani, F. Gobbi, H. Tinto, and J. Van den

Ende (2009). Rapid malaria diagnostic tests vs. clinical management of malaria in rural Burkina Faso: safety and effect on clinical decisions. A randomized trial. *Tropical Medicine & International Health 14*(5), 491–498.

Brownlee, S., K. Chalkidou, J. Doust, A. G. Elshaug, P. Glasziou, I. Heath, S. Nagpal, V. Saini, D. Srivastava, K. Chalmers, et al. (2017). Evidence for overuse of medical services around the world. *The Lancet 390*(10090), 156–168.

Busfield, J. (2015). Assessing the overuse of medicines. *Social science & medicine 131*, 199–206.

Chandra, A., A. Finkelstein, A. Sacarny, and C. Syverson (2016). Health care exceptionalism? Performance and allocation in the US health care sector. *American Economic Review 106*(8), 2110–44.

Cissoko, M., M. Magassa, V. Sanogo, A. Ouologuem, L. Sangaré, M. Diarra, C. S. Bationo, M. Dolo, M. D. Bah, S. Doumbia, et al. (2022). Stratification at the health district level for targeting malaria control interventions in Mali. *Scientific reports 12*(1), 1–17.

Cohen, J., P. Dupas, and S. Schaner (2015). Price subsidies, diagnostic tests, and targeting of malaria treatment: Evidence from a randomized controlled trial. *American Economic Review 105*(2), 609–45.

Currie, J., W. Lin, and J. Meng (2014). Addressing Antibiotic Abuse in China: An Experimental Audit Study. *Journal of Development Economics 110*, 39–51.

Das, J. and J. Hammer (2014). Quality of primary care in low-income countries: Facts and economics. *6*, 525–553.

Das, J., J. Hammer, and K. Leonard (2008). The Quality of Medical Advice in Low-Income Countries. *The Journal of Economic Perspectives 22*(2), pp. 93–114.

Das, J., A. Holla, A. Mohpal, and K. Muralidharan (2016). Quality and Accountability in Health Care Delivery: Audit-Study Evidence from Primary Care in India. *American Economic Review 106*(12), 3765–99.

de Chaisemartin, C. and J. Ramirez-Cuellar (forthcoming). At What Level Should one Cluster Standard Errors in Paired Experiments, and in Stratified Experiments with Small Strata? *American Econonmic Journal: Applied Economics*.

de Walque, D., E. Kandpal, A. Wagstaff, J. Friedman, M. Piatti-Fünfkirchen, A. Sautmann, G. Shapira, and E. Van de Poel (2022). *Improving Effective Coverage in Health: Do Financial Incentives Work?* World Bank Publications.

Djimde, A. A., H. Maiga, I. Sagara, K. Traore, H. Niangaly, A. Bamadio, A. Grivoyannis, M. Tekete, O. B. Traore, A. Kodio, et al. (2016). Field Assessment of SD Bioline Malaria Species Antigen Detection by Rapid Diagnostic Tests in Mali. *Journal of Parasitology and Vector Biology 8*(1), 1–9.

Dulleck, U. and R. Kerschbamer (2006). On doctors, mechanics, and computer specialists: The economics of credence goods. *Journal of Economic literature 44*(1), 5–42.

Farley, H., E. R. Enguidanos, C. M. Coletti, L. Honigman, A. Mazzeo, T. B. Pinson, K. Reed, and J. L. Wiler (2014). Patient satisfaction surveys and quality of care: An information paper. *Annals of Emergency Medicine 64*(4), 351–357.

Fleming, K. A., S. Horton, M. L. Wilson, R. Atun, K. DeStigter, J. Flanigan, S. Sayed, P. Adam, B. Aguilar, S. Andronikou, et al. (2021). The lancet commission on diagnostics: transforming access to diagnostics. *The Lancet 398*(10315), 1997–2050.

Friedman, M. and R. D. Friedman (1962). *Capitalism and Freedom*. Phoenix Book: Business/Economics. University of Chicago Press.

Hamer, D. H., M. Ndhlovu, D. Zurovac, M. Fox, K. Yeboah-Antwi, P. Chanda, N. Sipilinyambe, J. L. Simon, and R. W. Snow (2007). Improved diagnostic testing and malaria treatment practices in Zambia. *JAMA 297*(20), 2227–2231.

Ibnat, F., K. L. Leonard, L. Bawo, and R. L. Mohammed-Roberts (2019). The three-gap model of health worker performance. *World Bank Policy Research Working Paper* (8782).

Iizuka, T. (2012, May). Physician Agency and Adoption of Generic Pharmaceuticals. *American Economic Review 102*(6), 2826–58.

Kling, J. R., J. B. Liebman, and L. F. Katz (2007). Experimental analysis of neighborhood effects. *Econometrica 75*(1), 83–119.

Koenker, H., M. K. Coulibaly, and I. Bouare (2020). *Trends in and factors associated with malaria prevention in Mali: Further analysis of the Mali Demographic and Health Surveys and Malaria Indicator Surveys 2006-2018*. Demographic and Health Surveys.

Koné, D., D. Coulibaly, O. Doumbo, I.-S. Fall, E. Kibuchi, B. Mitto, G. Sang, D. Kyalo, R. W. Snow, and A. M. Noor (2015). *An epidemiological profile of malaria in Mali*. Programme National de Lutte contre le Paludisme (PNLP).

Kravitz, R. L., R. M. Epstein, M. D. Feldman, C. E. Franz, R. Azari, M. S. Wilkes, L. Hinton, and P. Franks (2005). Influence of patients' requests for direct-to-consumer advertised antidepressants: A randomized controlled trial. *JAMA 293*(16), 1995–2002.

Lagarde, M. and D. Blaauw (2022). Overtreatment and benevolent provider moral hazard: evidence from South African doctors. *Journal of Development Economics*.

Lee, S., U. Kara, E. Koay, M. Lee, S. Lam, and D. Teo (2002). New strategies for the diagnosis and screening of malaria. *76*(S1), 291–293.

Lopez, C., A. Sautmann, and S. Schaner (2022). Does patient demand contribute to the overuse of prescription drugs? *American Economic Journal: Applied Economics 14*(1), 225–60.

Macarayan, E., I. Papanicolas, and A. Jha (2020). The quality of malaria care in 25 low-

income and middle-income countries. *BMJ global health 5*(2), e002023.

Ministère de la Santé (2013, August). *Politique Nationale De Lutte Contre Le Paludisme*. Republique du Mali.

Reyburn, H., R. Mbatia, C. Drakeley, I. Carneiro, E. Mwakasungula, O. Mwerinde, K. Saganda, J. Shao, A. Kitua, R. Olomi, B. Greenwood, and C. Whitty (2004). Overdiagnosis of malaria in patients with severe febrile illness in Tanzania: A prospective study. *British Medical Journal 329*(7476), 1212.

Rowe, A. K., S. Y. Rowe, D. H. Peters, K. A. Holloway, J. Chalker, and D. Ross-Degnan (2018). Effectiveness of strategies to improve health-care provider practices in low-income and middle-income countries: a systematic review. *The Lancet Global Health 6*(11), e1163–e1175.

Rowe, A. K., S. Y. Rowe, D. H. Peters, K. A. Holloway, and D. Ross-Degnan (2021). The effectiveness of training strategies to improve healthcare provider practices in low-income and middle-income countries. *BMJ Global Health 6*(1), e003229.

Sautmann, A. and S. Schaner (2016). Incentives for Accurate Diagnosis: Improving Health Care Quality in Mali. Technical report, AEA RCT Registry. October 24. https://doi.org/10.1257/rct.1707-1.0.

Skinner, J. (2011). Causes and consequences of regional variations in health care. In *Handbook of Health Economics*, Volume 2, pp. 45–93. Elsevier.

Trampuz, A., M. Jereb, I. Muzlovic, and R. M. Prabhu (2003). Clinical Review: Severe Malaria. *Critical Care 7*(4), 315.

Wongsrichanalai, C., M. J. Barcus, S. Muth, A. Sutamihardja, and W. H. Wernsdorfer (2007). A review of malaria diagnostic tools: microscopy and rapid diagnostic test (RDT). *Defining and Defeating the Intolerable Burden of Malaria III: Progress and Perspectives: Supplement to Volume 77 (6) of American Journal of Tropical Medicine and Hygiene*.

World Health Organization (2014a). Emergence and spread of Artemisinin resistance calls for intensified efforts to withdraw oral Artemisinin-based monotherapy from the market. Technical report, World Health Organization.

World Health Organization (2014b). *Malaria rapid diagnostic test performance: summary results of WHO product testing of malaria RDTs: Round 1-5 (2008-2013)*. World Health Organization.

World Health Organization (2022). *World Malaria Report 2022*.

World Health Organization et al. (2021). *World Malaria Report 2021*.

Tables and Figures

Table 1: Randomization Verification: Clinic Census and Health Worker Pre-Training Survey

	(1) Basic Training Mean	(2) Extended Provider Training	(3) N
A. Provider-Reported Clinic Characteristics			
Average Patient Load	30.371	-1.192	57
	[22.172]	(1.207)	
Clinic Has Microscopy	0.897	-0.111	57
	[0.310]	(0.094)	
Fraction Patients Tested with RDT	0.648	0.065	57
	[0.221]	(0.057)	
Fraction Patients Tested with Microscopy	0.473	-0.134	57
	[0.306]	(0.083)	
Fraction Tested Malaria Positive	0.543	0.062	57
	[0.196]	(0.048)	
B. Provider Attendance			
Number of Staff Attended per Clinic	3.862	0.000	58
	[0.441]	(0.158)	
Pre-Tests Submitted per Clinic	2.793	-0.061	58
	[1.424]	(0.558)	
Post tests submitted per clinic	3.897	-0.172	58
	[0.900]	(0.293)	
C. Provider Pre-Test Knowledge			
Knows Malian Malaria Policy	0.519	-0.045	160
	[0.503]	(0.095)	
Correct Meds for Simple Malaria Treatment	0.568	-0.038	160
	[0.498]	(0.111)	
RDT Detection Rate w. Low Parasite Load 90% or Higher	0.111	0.082	160
	[0.316]	(0.052)	
RDT Detection Rate w. High Parasite Load 90% or Higher	0.333	0.195	160
	[0.474]	(0.128)	
Correct Symptoms Severe Malaria	0.506	-0.024	160
	[0.503]	(0.108)	
Correct Time Interval to Read RDT	0.136	0.026	160
	[0.345]	(0.092)	
Number of Correct Answers	2.173	0.197	160
	[1.473]	(0.384)	

Notes: Panel A uses clinics census information (one observation missing). Panels B and C use the health worker pre-training survey. Robust standard errors clustered at the clinic-pair level in parentheses, standard deviation in brackets. All regressions include strata fixed effects. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table 2: Effect of Extended Provider Training on Learning: Provider Post-Training and Clinic Endline Surveys

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Beliefs About RDTs				Beliefs About Microscopy Tests			
	RDT Beliefs Index	Share RDT Positive Simple Malaria	Share RDT Positive Severe Malaria	Share RDT Negative No Malaria	Microscopy Beliefs Index	Share Microscopy Positive: Simple Malaria	Share Microscopy Positive: Severe Malaria	Share Microscopy Negative: No Malaria
A. Data from Post-Training Survey								
Extended Training	0.312***	0.200***	0.071***	0.046	0.027	-0.002	-0.005	0.037
	(0.071)	(0.038)	(0.019)	(0.041)	(0.116)	(0.035)	(0.028)	(0.048)
Mean (Basic Training)	0.000	0.599	0.888	0.863	0.000	0.846	0.921	0.829
N	205	198	196	176	201	197	195	173
B. Data from Provider Follow-Up Survey								
Extended Training	0.406***	0.158**	0.072**	0.038	0.277*	0.055	0.024	0.065
	(0.129)	(0.071)	(0.028)	(0.025)	(0.159)	(0.050)	(0.016)	(0.047)
Mean (Basic Training)	0.000	0.560	0.889	0.938	0.000	0.840	0.954	0.868
N	85	85	85	85	85	85	85	85

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata fixed effects. Additional covariates are selected using double lasso, from the set of all characteristics listed in Table 1 as well as their pairwise interactions. Missing variables for all characteristics are dummied out and recoded to the mean prior to forming interactions. We include these missing dummies in the potential covariate set and the set of pairwise interactions. Sample in both panels limited to providers who attended the training. Index components are standardized relative to the basic provider training mean. In cases where some (but not all) index components for a respondent are missing, missing components are imputed to the treatment group mean prior to standardization. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table 3: Effect of Extended Provider Training and Patient Information on Malaria Testing at the Clinic

	(1) Any Malaria Test	(2) RDT Only	(3) Microscopy Only	(4) Multiple Tests
Extended Training	-0.0257	0.116**	-0.0919	-0.0475**
	(0.0547)	(0.0486)	(0.0729)	(0.0198)
Patient Information	-0.0613***	-0.0432**	-0.0171	0.00632
	(0.0177)	(0.0189)	(0.0245)	(0.00837)
Mean (Basic Training, No Pat. Info.)	0.58	0.21	0.25	0.07
N	1973	1973	1973	1973

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata and survey date fixed effects. Additional covariates are selected using double lasso, from the set of all covariates listed in Table 1 and all individual-level characteristics in Table A4 (excluding predicted malaria risk and characteristics only measured at the home survey) as well as the square of patient age and illness duration. We also include pairwise interactions of the aforementioned characteristics. Missing values for all characteristics are dummied out and recoded to the mean prior to forming interactions. Missing dummies are also included in the potential covariate set and set of pairwise interactions. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table 4: Effect of Extended Provider Training and Patient Information on the Allocation of Malaria Treatment

	(1) Full Sample	(2) Has Valid Home-Based RDT	(3)
	Expected Match	Expected Match	Actual Match
Extended Training	0.0664**	0.0671**	0.131***
	(0.0336)	(0.0292)	(0.0427)
Patient Infomation	0.00191	0.0124	-0.00943
	(0.0171)	(0.0169)	(0.0339)
Mean (Basic Training, No Pat. Info.)	0.44	0.41	0.43
N	1971	1093	1093

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata and survey date fixed effects. Additional covariates are selected using double lasso, from the set of all covariates listed in Table 1 and all individual-level characteristics in Table A4 (excluding predicted malaria risk and characteristics only measured at the home survey) as well as the square of patient age and illness duration. We also include pairwise interactions of the aforementioned characteristics. Missing values for all characteristics are dummied out and recoded to the mean prior to forming interactions. Missing dummies are also included in the potential covariate set and set of pairwise interactions. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table 5: Effect of Extended Provider Training and Patient Information on Patient Satisfaction

	(1) Overall Index	(2) Testing Sub-Index	(3) Medications Sub-Index
Extended Training	-0.0921**	-0.0994***	-0.0806
	(0.0448)	(0.0357)	(0.0904)
Patient Information	0.0326	0.0386	0.00795
	(0.0237)	(0.0316)	(0.0328)
Mean (Basic Training, No Pat. Info.)	0.00	0.00	0.00
N	1429	1419	1418

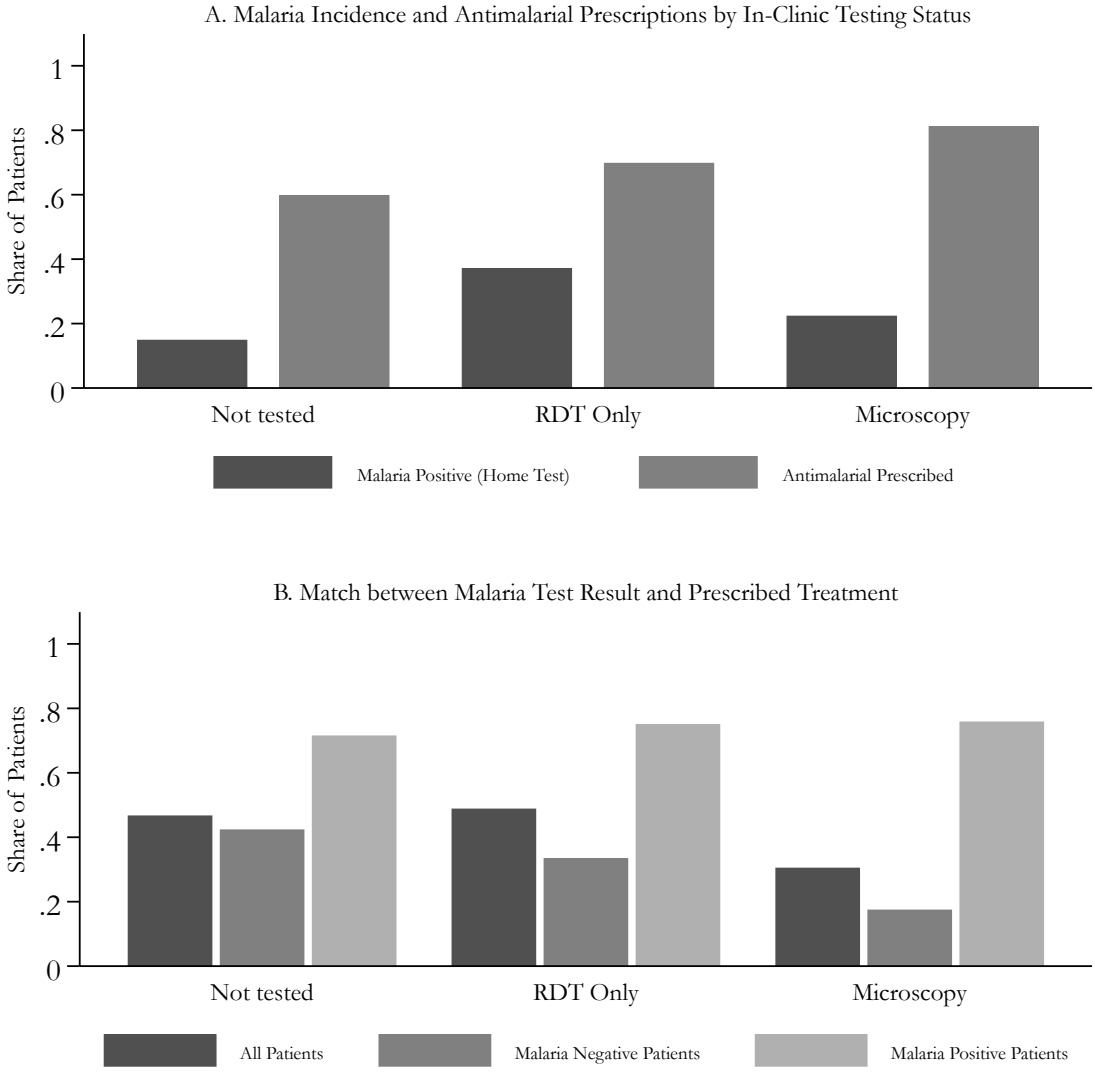
Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata and survey date fixed effects. Additional covariates are selected using double lasso, from the set of all covariates listed in Table 1 and all individual-level characteristics in Table A4 (excluding predicted malaria risk and characteristics only measured at the home survey) as well as the square of patient age and illness duration. We also include pairwise interactions of the aforementioned characteristics. Missing values for all characteristics are dummied out and recoded to the mean prior to forming interactions. Missing dummies are also included in the potential covariate set and set of pairwise interactions. Index components are standardized relative to the basic provider training mean. In cases where some (but not all) index components for a respondent are missing, missing components are imputed to the treatment group mean prior to standardization. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table 6: Effect of Extended Provider Training on Patient Satisfaction by Accuracy of Pre-Consultation Malaria Beliefs

	(1) Full Sample	(2) Has Valid Home-Based RDT	(3) Has Valid Home-Based RDT
	Overall Satisfaction Index	Overall Satisfaction Index	Overall Satisfaction Index
Extended Training	-0.154**	-0.161**	-0.129*
	(0.0695)	(0.0791)	(0.0688)
Extended Training × Prior-Risk Match	0.128*	0.162**	0.0874
	(0.0659)	(0.0766)	(0.0587)
Match: Malaria Prior and Malaria Risk	-0.114**	-0.0935	-0.0481
	(0.0475)	(0.0578)	(0.0453)
P-value: ET + ET × Prior Match = 0	0.532	0.985	0.326
Prior Match Measure	Expected Prior Match	Expected Prior Match	Actual Prior Match (Home RDT)
Mean (Basic Training, No Pat. Info.)	0.00	-0.02	-0.02
N	1429	1092	1092

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. Standard errors for regressions that include a derivative of predicted malaria risk in the set of independent variables are bootstrapped using 500 replications to account for the fact that predicted malaria risk is a generated regressor. All regressions include strata and survey date fixed effects. Additional covariates are selected using double lasso, from the set of all covariates listed in Table 1 and all individual-level characteristics in Table A4 (excluding predicted malaria risk and characteristics only measured at the home survey) as well as the square of patient age and illness duration. We also include pairwise interactions of the aforementioned characteristics. Missing values for all characteristics are dummied out and recoded to the mean prior to forming interactions. Missing dummies are also included in the potential covariate set and set of pairwise interactions. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Figure 1: Malaria Incident, Antimalarial Prescriptions, and Match Between Underlying Illness and Treatment



Notes: Sample limited to the subset of patients who consented to take an RDT during the home follow-up survey in the Basic Training group. Panel A graphs malaria positivity (measured in home RDT) and receipt of antimalarial prescriptions (recorded during the clinic survey), by type of malaria test conducted at the clinic (recorded during the clinic survey). Overall positivity rate is 23.12% in the control group. Panel B graphs the match between true malaria status (measured in home RDT) and receipt of antimalarial prescription by type of malaria test at the clinic. The share of patients prescribed an antimalarial is 69.36% in the control group.

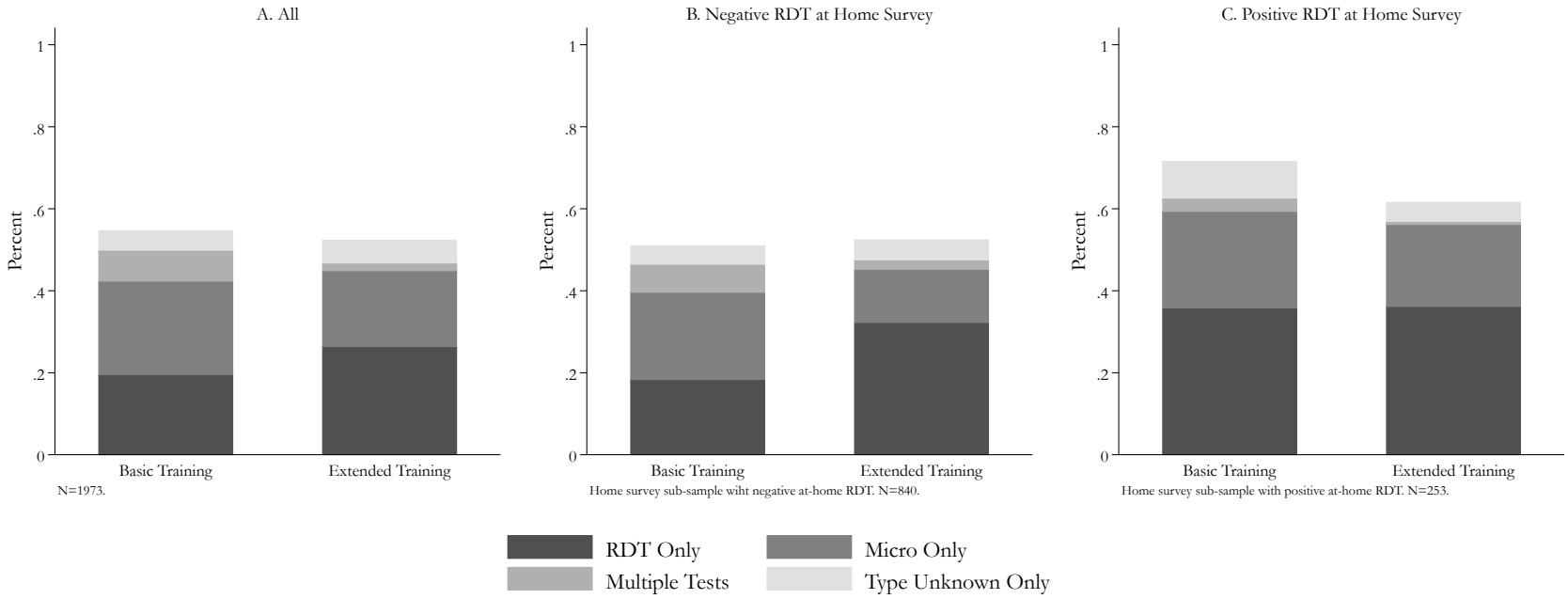
Figure 2: Within-CSCOM Randomization Design

	WEEK 1							WEEK 2						
CSCOM Number	Mon	Tues	Weds	Thurs	Fri	Sat	Sun	Mon	Tues	Weds	Thurs	Fri	Sat	Sun
1	C	--	PV	--	DV	--	--	PI	--	PI-PV	--	PI-DV	--	--
2	DV	--	C	--	PV	--	--	PI-DV	--	PI	--	PI-PV	--	--
3	PV	--	DV	--	C	--	--	PI-PV	--	PI-DV	--	PI	--	--
4	C	--	DV	--	PV	--	--	PI	--	PI-DV	--	PI-PV	--	--
5	DV	--	PV	--	C	--	--	PI-DV	--	PI-PV	--	PI	--	--
6	PI	--	PI-PV	--	PI-DV	--	--	C	--	PV	--	DV	--	--
7	PI-DV	--	PI	--	PI-PV	--	--	DV	--	C	--	PV	--	--
8	PI-PV	--	PI-DV	--	PI	--	--	PV	--	DV	--	C	--	--
9	PI	--	PI-DV	--	PI-PV	--	--	C	--	DV	--	PV	--	--
10	PI-DV	--	PI-PV	--	PI	--	--	DV	--	PV	--	C	--	--
11	--	C	--	PV	--	DV	--	--	PI	--	PI-PV	--	PI-DV	--
12	--	DV	--	C	--	PV	--	--	PI-DV	--	PI	--	PI-PV	--
13	--	PV	--	DV	--	C	--	--	PI-PV	--	PI-DV	--	PI	--
14	--	C	--	DV	--	PV	--	--	PI	--	PI-DV	--	PI-PV	--
15	--	DV	--	PV	--	C	--	--	PI-DV	--	PI-PV	--	PI	--
16	--	PI	--	PI-PV	--	PI-DV	--	--	C	--	PV	--	DV	--
17	--	PI-DV	--	PI	--	PI-PV	--	--	DV	--	C	--	PV	--
18	--	PI-PV	--	PI-DV	--	PI	--	--	PV	--	DV	--	C	--
19	--	PI	--	PI-DV	--	PI-PV	--	--	C	--	DV	--	PV	--
20	--	PI-DV	--	PI-PV	--	PI	--	--	DV	--	PV	--	C	--

LEGEND	
--	No data collection or interventions at CSCOM
C	Data collection at CSCOM, no interventions
DV	Doctor vouchers and data collection at CSCOM
PV	Patient vouchers and data collection at CSCOM
PI	Patient information and data collection at CSCOM
PI-DV	Patient information, doctor vouchers, and data collection at CSCOM
PI-PV	Patient information, patient vouchers, and data collection at CSCOM

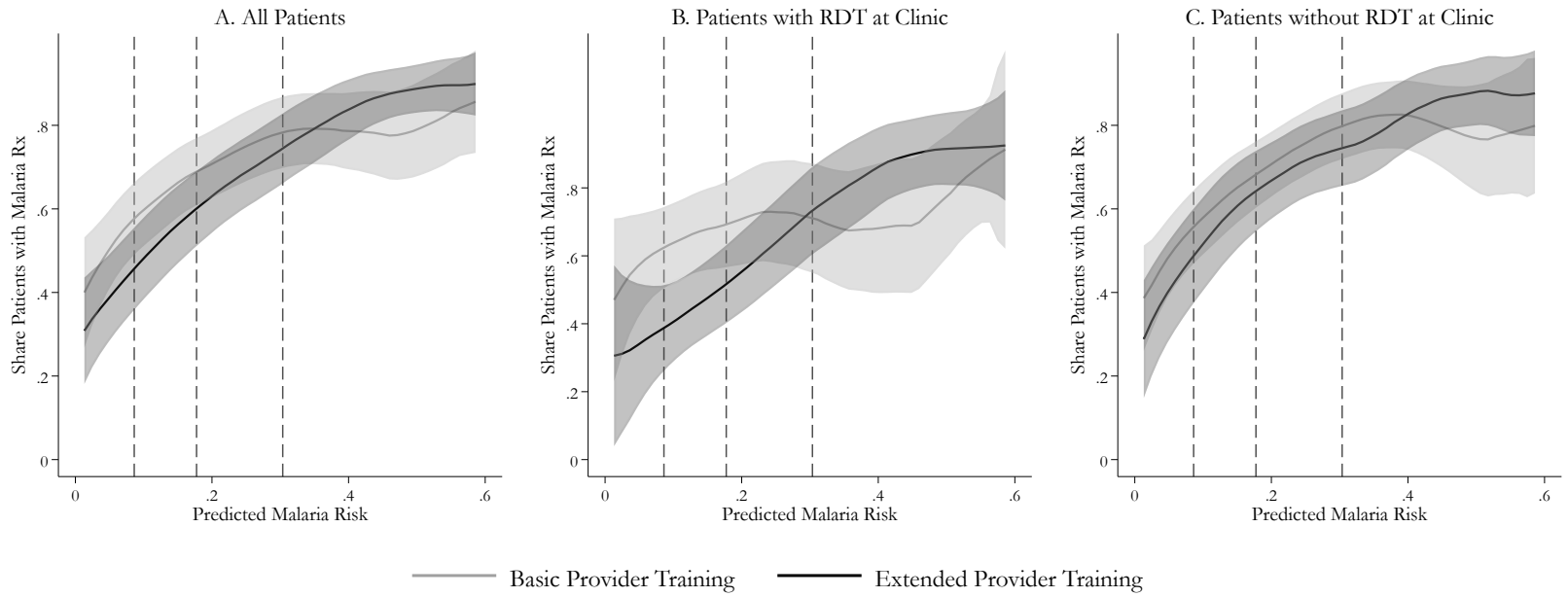
Notes: The interventions listed above ran between November 14-December 30 2016 in three two-week blocks, with 20 CSCOMs active in each two-week block.

Figure 3: Effect of Extended Provider Training on Testing at the Clinic



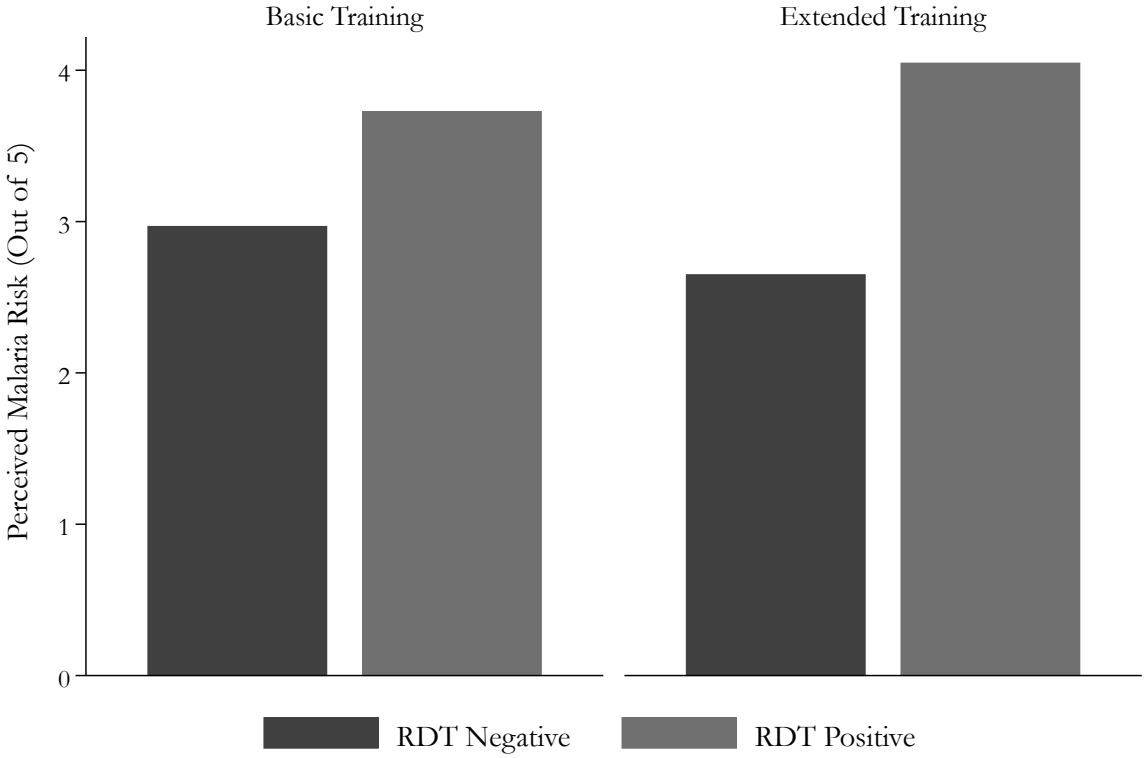
Notes: Data from patient reports of malaria tests received at the clinic, by RDT test result at the home follow-up survey.

Figure 4: Effect of Extended Provider Training on Allocation of Malaria Treatment at the Clinic



Notes: Outcome in all panels is whether a patient was prescribed an antimalarial. Results from local linear regressions. Graphs omit results for top and bottom 2.5 percent of malaria risk distribution to avoid influence of outliers. Vertical dashed lines indicate 25th, 50th, and 75th percentiles of predicted malaria risk respectively. Shaded areas give 90% confidence intervals, based on bootstrapped standard errors clustered at the clinic-pair level. To account for the fact that predicted malaria risk is a generated regressor, we re-calculate predicted risk for each bootstrap replication.

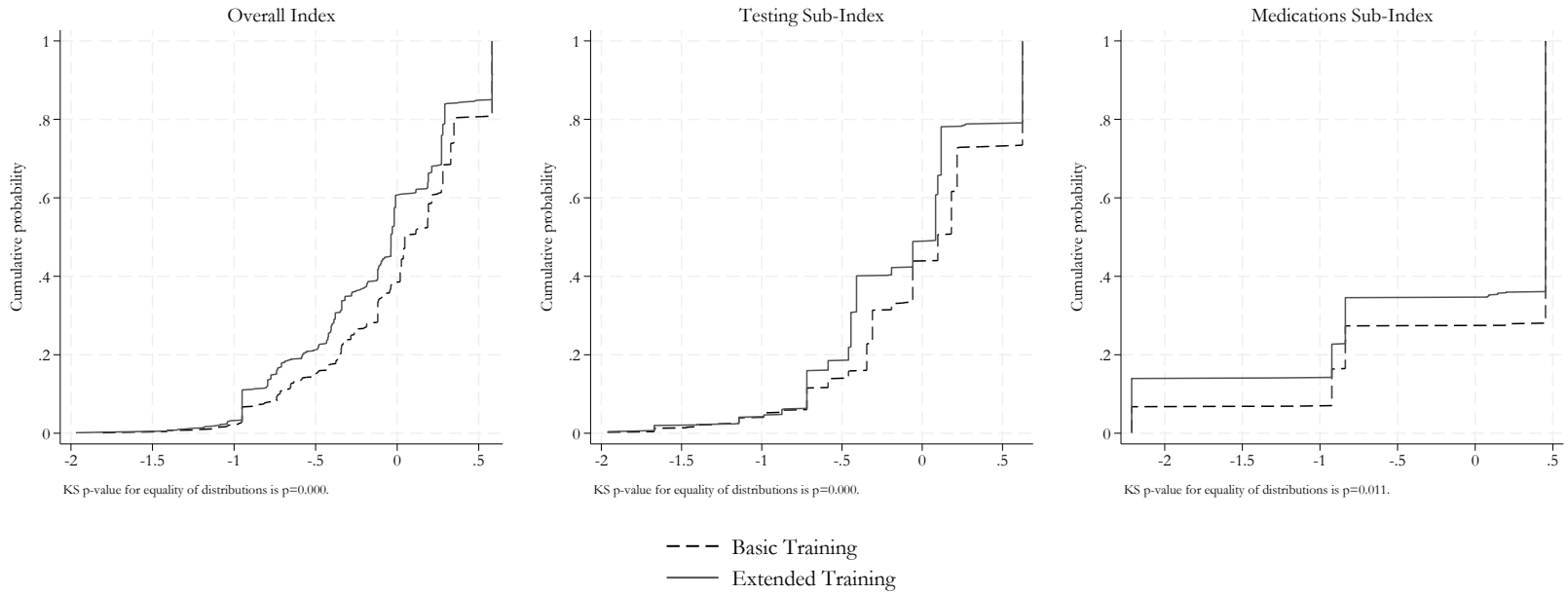
Figure 5: Effect of Extended Training on Perceived Malaria Risk, by Home RDT Result



Coefficient and p-value on Provider Training x RDT result difference-in-difference is 0.516 (p=0.097).

Notes: Data from ex-ante patient predictions of their RDT test results at home survey. Patients were asked to score risk on a scale of 1 to 5, with 1 being definitely malaria negative, 2 being malaria negative more likely, 3 being positive/negative equally likely, 4 being malaria positive more likely, and 5 being definitely malaria positive. The graph shows average patient scores by provider training arm and actual home RDT result.

Figure 6: Effect of Extended Provider Training on Patient Satisfaction



Notes: Patient satisfaction data from home follow-up of the patient survey.

ONLINE APPENDIX

A Additional Results

Table A1: Provider Beliefs in the Control Group: Health Worker Post-Intervention Survey

	(1) N	(2) Mean	(3) SD
Panel A. Malaria Prevalence and Pressure			
Malaria Prevalence: General Population	43	0.277	0.226
Malaria Prevalence: CSCom Patients	43	0.443	0.200
Feels Pressure from Patients to Prescribe Unnecessary Medication	43	0.512	0.506
Feels Pressure: Antimalarials	22	0.682	0.477
Panel B. Confidence in RDT			
Uses RDT to Diagnose Malaria	43	0.977	0.152
Positive out of 100: Simple Malaria	43	55.953	32.969
Patients with Positive RDT out of 100 with Severe Malaria	43	88.884	16.449
Would Treat Relative with Negative RDT	43	0.465	0.505
Panel C. Confidence in Microscopy Test			
Uses Microscopy to Diagnose Malaria	43	0.698	0.465
Patients with Positive Microscopy Test out of 100 with Simple Malaria	43	83.977	21.381
Patients with Positive Microscopy Test out of 100 with Severe Malaria	43	95.442	8.525
Would Treat Relative with Negative Microscopy Test	43	0.326	0.474

Notes: Results from post-intervention health worker survey. Sample limited to clinics that received the basic provider training. Malaria prevalence refers to prevalence estimated by the health worker. A health worker is coded as feeling pressure to prescribe if s/he answers yes to the question: Do you ever feel pressure from patients to prescribe certain medicines when you think they are not necessary? Providers answering yes were then asked to specify which medications. Antimalarial also includes quinine.

Table A2: Consultation Waiting Time and Patient Information Implementation

	(1) Control Mean	(2) Patient Info Mean	(3) N
Minutes Waiting for Consult^{+}	17.328	17.994	1427
	[18.563]	[19.272]	
Watched the Entire Video*		0.892	686
		[0.310]	
Minutes Watched (if Partial)*		4.069	60
		[1.589]	

Notes: Standard deviations in brackets. $^{+}$ Indicates that variable was recorded in the home survey only. * Indicates that the variable comes from administrative records of intervention officers.

Table A3: Selection into Sample by Treatment

	(1)	(2)	(3)	(4)
	Full Sample		Selected: Home Survey	
	Took Home Survey	Took Home-Based RDT	Took Home Survey	Took Home-Based RDT
Extended Training	-0.0260	0.0106	-0.00535	0.0253
	(0.0278)	(0.0333)	(0.0205)	(0.0358)
Patient Information	-0.0204	-0.00419	0.000465	0.0141
	(0.0186)	(0.0170)	(0.0162)	(0.0192)
Mean (Basic Training, No Pat Info)	0.74	0.54	0.87	0.64
N	1973	1973	1669	1669

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include survey date fixed effects. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table A4: Demographic Characteristics and Randomization Verification

	(1)	(2)	(3)	(4)	(5)
		Regression Coefficients		P-Values	
	Control Mean	Patient Info	Extended Training	Joint Test PI=ET=0	N
A. Sample Frame (Clinic × Day-Level Observations)					
Number Eligible Logged Patients	5.89	0.071	0.357	0.775	283
	[3.23]	(0.261)	(0.57)		
B. Patient Characteristics					
Number of symptoms	3.42	0.065	0.165	0.355	1973
	[1.57]	(0.06)	(0.188)		
Fever	0.828	-.035**	-.007	0.072*	1973
	[0.378]	(0.015)	(0.028)		
Chills or Excessive Sweating	0.236	0.001	0.053	0.383	1973
	[0.425]	(0.02)	(0.045)		
Nausea, Vomiting, or Diarrhea	0.458	0.002	0.082**	0.087*	1973
	[0.499]	(0.019)	(0.035)		
Poor Appetite	0.483	0.006	0.021	0.868	1973
	[0.5]	(0.022)	(0.046)		
Headache	0.583	0.037	0.001	0.446	1973
	[0.494]	(0.029)	(0.036)		
Cough	0.376	0.015	0.005	0.758	1973
	[0.485]	(0.022)	(0.028)		
Weakness/Fatigue	0.458	0.039	0.01	0.248	1973
	[0.499]	(0.023)	(0.067)		
Duration of Illness in Days	4.09	0.178	0.513**	0.037**	1973
	[4.38]	(0.182)	(0.192)		
Age	16.8	1.62**	-.175	0.133	1973
	[15.5]	(0.784)	(0.804)		
Under 5 Years Old	0.308	-.037**	0.016	0.103	1973
	[0.462]	(0.018)	(0.024)		
Male	0.429	0.003	-.023	0.618	1973
	[0.495]	(0.022)	(0.023)		
Pregnant (Females Only)	0.1	-.033**	0.031	0.015**	1101
	[0.301]	(0.012)	(0.02)		
Positive RDT (Home Test)$^{+}$	0.219	-.016	-.021	0.767	1093
	[0.414]	(0.032)	(0.039)		
Predicted Malaria Risk	0.205	-.003	0.01	0.55	1973
	[0.153]	(0.006)	(0.012)		
C. Respondent and Household Characteristics					
Suspects Malaria	0.587	-.021	-.014	0.765	1973
	[0.493]	(0.032)	(0.056)		
Patient Answered Clinic Survey	0.464	0.039	0.004	0.249	1973
	[0.499]	(0.023)	(0.026)		
Male	0.312	-.003	-.035	0.474	1973
	[0.464]	(0.024)	(0.029)		
Bambara	0.4	-.038*	0.026	0.093*	1971
	[0.49]	(0.021)	(0.025)		
Speaks French	0.532	0.037	-.045	0.313	1973
	[0.499]	(0.03)	(0.035)		
Literate (in French)	0.287	0.048**	-.092**	0.04**	1973
	[0.453]	(0.022)	(0.043)		
Primary School or Less	0.433	-.044*	0.055*	0.075*	1973
	[0.496]	(0.023)	(0.03)		
Household Size^{+}	9.95	0.491	1.42*	0.13	1430
	[8.18]	(0.517)	(0.752)		
Share HH Under 15^{+}	0.417	-.01	0.002	0.611	1427
	[0.2]	(0.011)	(0.018)		
Share HH Working^{+}	0.27	-.002	-.021	0.573	1427
	[0.191]	(0.012)	(0.019)		
Household Income Per Capita^{+}	22963	963	-2774	0.356	1374
	[24675]	(1410)	(1896)		
Rental Value Home^{+}	60970	3122	6335	0.248	1408
	[76888]	(4045)	(5820)		
Mosquito Nets Per Capita^{+}	0.488	0.002	-.041	0.423	1424
	[0.349]	(0.019)	(0.032)		

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata and survey date fixed effects. $^{+}$ indicates that variable was recorded in the home survey only. Variables measured in CFA and duration of illness top-coded at the 99th percentile. CFA610 ≈ USD1. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table A5: Predicting RDT Positivity With Observables

	(1) RDT Positive
Fever	0.373**
	(0.168)
Chills or Excessive Sweating	0.189*
	(0.108)
Nausea, Vomiting, or Diarrhea	0.381***
	(0.0960)
Reduced Appetite	0.00691
	(0.102)
Headache	0.240*
	(0.126)
Cough	-0.159**
	(0.0783)
Weakness, Fatigue, or Reduced Consciousness	0.139
	(0.0976)
Duration of Illness in Days	-0.0182**
	(0.00908)
Age Patient	-0.00339
	(0.00562)
Patient Under 5 Years Old	-1.378***
	(0.216)
Under 5 × Age	0.226**
	(0.0969)
Patient is Male	1.051**
	(0.414)
Patient is Pregnant	-0.348*
	(0.205)
Ethnic group: Bambara	0.124
	(0.0854)
Respondent Speaks French	-0.223
	(0.138)
Respondent is Literate in French	-0.510***
	(0.144)
Respondent Has Primary Education or Less	-0.140
	(0.120)
Patient Answered Clinic Survey	-0.367**
	(0.174)
Pseudo R-Squared	0.141
N	1093

Notes: Standard errors clustered at the clinic level in parentheses. Respondent refers to individual who answered clinic survey. ***, **, and * indicate significance at the 1, 5, and 10 percent significance levels respectively.

Table A6: Effect of Extended Provider Training on the Allocation of Malaria Treatment

	(1)	(2)	(3)	(4)	(5)
	Full Sample		Has Valid Home-Based RDT		
	Prescribed Anti-malarial	Prescribed Anti-malarial	Prescribed Anti-malarial	Prescribed Anti-malarial	Prescribed Anti-malarial
Extended Training	-0.124*	-0.141*	-0.0911	-0.114	-0.0896
	(0.0718)	(0.0769)	(0.0713)	(0.0748)	(0.0570)
Extended Training × Malaria Risk	0.107*	0.293**	0.0980	0.282*	0.189**
	(0.0574)	(0.139)	(0.0642)	(0.165)	(0.0747)
Malaria Risk Measure	0.150***	0.622***	0.157***	0.635***	0.103**
	(0.0407)	(0.104)	(0.0504)	(0.124)	(0.0470)
ET + ET × Risk = 0	0.803	0.161	0.918	0.200	0.158
Malaria Risk Indicator	Above Median Malaria Risk	Predicted Malaria Risk	Above Median Malaria Risk	Predicted Malaria Risk	RDT Positive
Mean (Basic Training, No Pat. Info.)	0.67	0.67	0.71	0.71	0.71
N	1971	1971	1093	1093	1093

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. Standard errors for regressions that include a derivative of predicted malaria risk in the set of independent variables are bootstrapped using 500 replications to account for the fact that predicted malaria risk is a generated regressor. All regressions include strata and survey date fixed effects. Additional covariates are selected using double lasso, from the set of all covariates listed in Table 1 and all individual-level characteristics in Table A4 (excluding predicted malaria risk and characteristics only measured at the home survey) as well as the square of patient age and illness duration. We also include pairwise interactions of the aforementioned characteristics. Missing values for all characteristics are dummied out and recoded to the mean prior to forming interactions. Missing dummies are also included in the potential covariate set and set of pairwise interactions. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table A7: Impacts of Extended Provider Training and Patient Information on Other Aspects of Care

	(1)	(2)	(3)	(4)	(5)
	Clinic Survey			Home Survey	
	Number of Medications Prescribed	Number of Medications Prescribed Excluding Antimalarial	Prescribed Antibiotic	Time Waiting at Clinic	Time Consulting with Provider
Extended Training	-0.0698	-0.0853	-0.0200	-0.707	-1.081
	(0.165)	(0.123)	(0.0474)	(1.471)	(0.822)
Patient Infomation	0.101	0.106	-0.0410*	0.479	-0.363
	(0.0728)	(0.0688)	(0.0209)	(0.983)	(0.627)
Mean (Basic Training, No Pat. Info.)	3.78	3.00	0.64	18.25	13.42
N	1971	1971	1971	1427	1427

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata and survey date fixed effects. Additional covariates are selected using double lasso, from the set of all covariates listed in Table 1 and all individual-level characteristics in Table A4 (excluding predicted malaria risk and characteristics only measured at the home survey) as well as the square of patient age and illness duration. We also include pairwise interactions of the aforementioned characteristics. Missing values for all characteristics are dummied out and recoded to the mean prior to forming interactions. Missing dummies are also included in the potential covariate set and set of pairwise interactions. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table A8: Effect of Extended Provider Training and Patient Information on Satisfaction Index Components

	(1) Agrees: Clearly Explained Diagnosis	(2) Agrees: Clearly Explained Test Results	(3) Agrees: Based Treatment on Test Results	(4) Agrees: Should Have Done More Tests	(5) Agrees: Should Have Done Fewer Tests	(6) Agrees: Should Have Given Differ-ent/Additional Medications	(7) Agrees: Should Have Given Fewer Medications
Extended Training	-0.0147	-0.0250	-0.0255	0.0182	0.0221	0.0264	0.0238
	(0.0307)	(0.0386)	(0.0239)	(0.0413)	(0.0376)	(0.0337)	(0.0371)
Patient Information	0.0337	0.00573	-0.0231	-0.0198	-0.0304	0.00359	-0.00736
	(0.0242)	(0.0293)	(0.0237)	(0.0314)	(0.0192)	(0.0253)	(0.0157)
Mean (Basic Training, No Pat. Info.)	0.70	0.71	0.91	0.34	0.18	0.18	0.16
N	1424	850	845	1407	839	1407	1413

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata and survey date fixed effects. Additional covariates are selected using double lasso, from the set of all covariates listed in Table 1 and all individual-level characteristics in Table A4 (excluding predicted malaria risk and characteristics only measured at the home survey) as well as the square of patient age and illness duration. We also include pairwise interactions of the aforementioned characteristics. Missing values for all characteristics are dummied out and recoded to the mean prior to forming interactions. Missing dummies are also included in the potential covariate set and set of pairwise interactions. Outcomes indicating dissatifaction (cols 4-7) are multipled by negative 1 when creating overall satisfaction index. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table A9: Effect of Extended Provider Training and Patient Information on Patient Satisfaction

	(1) Overall Satisfaction Index	(2) Testing Sub-Index	(3) Medications Sub-Index
Extended Training	-0.0879	-0.0847	-0.123
	(0.0590)	(0.0559)	(0.0989)
Patient Information	0.0366	0.0523	-0.0314
	(0.0326)	(0.0389)	(0.0552)
Extended Training × Patient Information	-0.00849	-0.0293	0.0838
	(0.0679)	(0.0731)	(0.0912)
P-Value: ET + ET × PI=0	0.071*	0.013**	0.707
Mean (Basic Training, No Pat. Info.)	0.00	0.00	0.00
N	1429	1419	1418

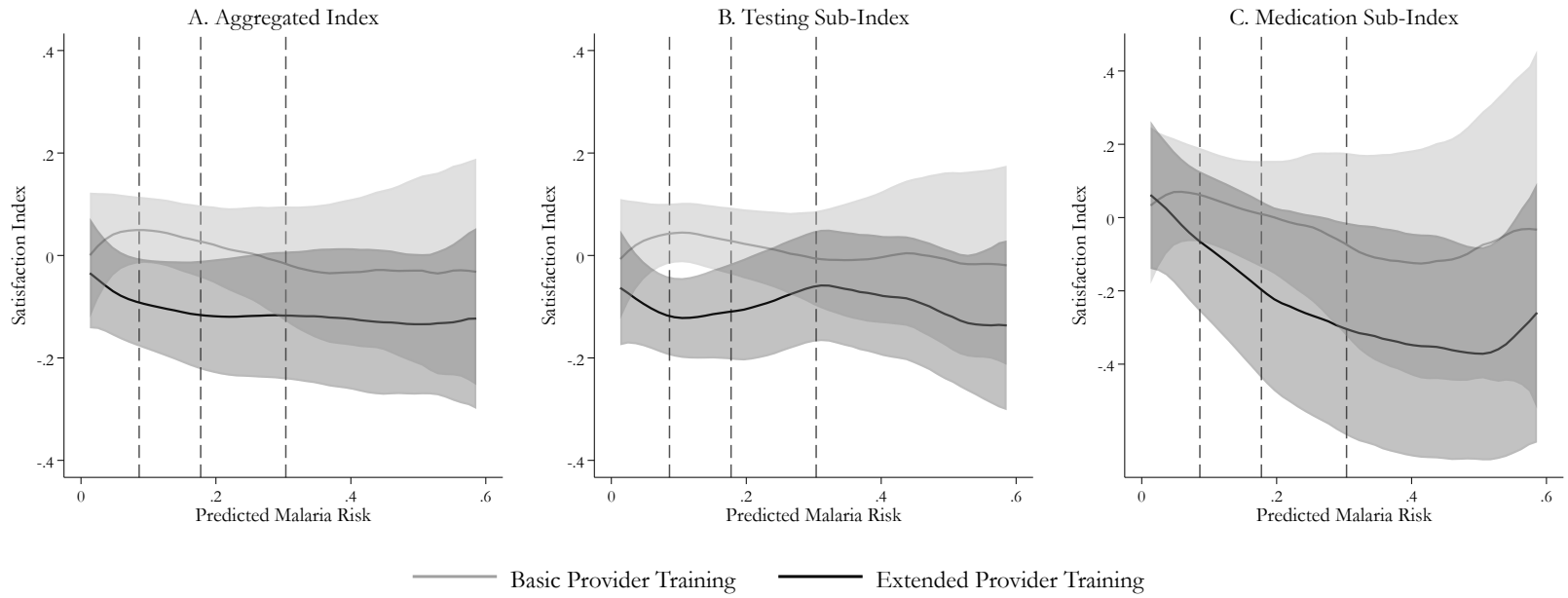
Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata and survey date fixed effects. Additional covariates are selected using double lasso, from the set of all covariates listed in Table 1 and all individual-level characteristics in Table A4 (excluding predicted malaria risk and characteristics only measured at the home survey) as well as the square of patient age and illness duration. We also include pairwise interactions of the aforementioned characteristics. Missing values for all characteristics are dummied out and recoded to the mean prior to forming interactions. Missing dummies are also included in the potential covariate set and set of pairwise interactions. Index components are standardized relative to the basic provider training mean. In cases where some (but not all) index components for a respondent are missing, missing components are imputed to the treatment group mean prior to standardization. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table A10: Effect of Extended Provider Training on Match Between Patient Prior and Prescription by Accuracy of Pre-Consultation Malaria Beliefs

	(1)	(2)	(3)
	Full Sample	Has Valid Home-Based RDT	
	Prescription Matches Malaria Prior	Prescription Matches Malaria Prior	Prescription Matches Malaria Prior
Extended Training	-0.123	-0.156*	-0.129**
	(0.0841)	(0.0880)	(0.0590)
Extended Training × Prior-Risk Match	0.222	0.249	0.183*
	(0.163)	(0.171)	(0.0942)
Match: Malaria Prior and Malaria Risk	0.615***	0.526***	0.0902*
	(0.0836)	(0.0808)	(0.0533)
P-value: ET + ET × Prior Match = 0	0.245	0.318	0.304
Prior Match Measure	Expected Prior Match	Expected Prior Match	Actual Prior Match (Home RDT)
Mean (Basic Training, No Pat. Info.)	0.63	0.66	0.66
N	1971	1093	1093

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. Standard errors for regressions that include a derivative of predicted malaria risk in the set of independent variables are bootstrapped using 500 replications to account for the fact that predicted malaria risk is a generated regressor. All regressions include strata and survey date fixed effects. Additional covariates are selected using double lasso, from the set of all covariates listed in Table 1 and all individual-level characteristics in Table A4 (excluding predicted malaria risk and characteristics only measured at the home survey) as well as the square of patient age and illness duration. We also include pairwise interactions of the aforementioned characteristics. Missing values for all characteristics are dummied out and recoded to the mean prior to forming interactions. Missing dummies are also included in the potential covariate set and set of pairwise interactions. Outcome is equal to one for patients who, pre-consultation, believe they have malaria and are prescribed an antimalarial *or* for patients who believe they do not have malaria and are not prescribed an antimalarial. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Figure A1: Effect of Extended Provider Training on Patient Satisfaction



Notes: Patient satisfaction data from home follow-up of the patient survey. Results from local linear regressions. Graphs omit results for top and bottom 2.5 percent of malaria risk distribution to avoid influence of outliers. Vertical dashed lines indicate 25th, 50th, and 75th percentiles of predicted malaria risk respectively. Shaded areas give 90% confidence intervals, based on bootstrapped standard errors clustered at the clinic-pair level. To account for the fact that predicted malaria risk is a generated regressor, we re-calculate predicted risk for each bootstrap replication.

B Main Results Without Double-Lasso Selected Controls

Table B1: Effect of Extended Provider Training on Learning: Provider Post-Training and Clinic Endline Surveys - No Additional Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Beliefs About RDTs				Beliefs About Microscopy Tests			
	RDT Beliefs Index	Share RDT Positive Simple Malaria	Share RDT Positive Severe Malaria	Share RDT Negative No Malaria	Microscopy Beliefs Index	Share Microscopy Positive: Simple Malaria	Share Microscopy Positive: Severe Malaria	Share Microscopy Negative: No Malaria
A. Data from Post-Training Survey								
Extended Training	0.347***	0.221***	0.071***	0.016	0.027	-0.002	-0.005	0.037
	(0.075)	(0.046)	(0.019)	(0.045)	(0.118)	(0.036)	(0.029)	(0.049)
Mean (Basic Training)	0.000	0.599	0.888	0.863	0.000	0.846	0.921	0.829
N	205	198	196	176	201	197	195	173
B. Data from Provider Follow-Up Survey								
Extended Training	0.380***	0.186**	0.056*	0.039	0.188	0.038	0.008	0.074
	(0.132)	(0.084)	(0.033)	(0.026)	(0.166)	(0.046)	(0.022)	(0.048)
B. Provider Attendance								
Mean (Basic Training)	0.000	0.560	0.889	0.938	0.000	0.840	0.954	0.868
N	85	85	85	85	85	85	85	85

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata fixed effects. Sample in both panels limited to providers who attended the training. Index components are standardized relative to the basic provider training mean. In cases where some (but not all) index components for a respondent are missing, missing components are imputed to the treatment group mean prior to standardization. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table B2: Effect of Extended Provider Training and Patient Information on Malaria Testing at the Clinic: Patient Survey – No Additional Controls

	(1) Any Malaria Test	(2) RDT Only	(3) Microscopy Only	(4) Multiple Tests
Extended Training	-0.0428	0.0525	-0.0359	-0.0667**
	(0.0550)	(0.0565)	(0.0688)	(0.0250)
Patient Information	-0.0699***	-0.0470**	-0.0184	0.00677
	(0.0187)	(0.0202)	(0.0251)	(0.00868)
Mean (Basic Training, No Pat. Info.)	0.58	0.21	0.25	0.07
N	1973	1973	1973	1973

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata and survey date fixed effects. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table B3: Effect of Extended Provider Training and Patient Information on the Allocation of Malaria Treatment – No Additional Controls

	(1) Full Sample	(2) Has Valid Home-Based RDT	(3)
	Expected Match	Expected Match	Actual Match
Extended Training	0.0506	0.0377	0.0888*
	(0.0329)	(0.0336)	(0.0478)
Patient Infomation	0.00134	0.0124	-0.0110
	(0.0177)	(0.0182)	(0.0341)
Mean (Basic Training, No Pat. Info.)	0.44	0.41	0.43
N	1971	1093	1093

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata and survey date fixed effects. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table B4: Effect of Extended Provider Training and Patient Information on Patient Satisfaction – No Additional Controls

	(1) Overall Index	(2) Testing Sub-Index	(3) Medications Sub-Index
Extended Training	-0.0985**	-0.107***	-0.0928
	(0.0395)	(0.0321)	(0.0793)
Patient Information	0.0326	0.0386	0.00797
	(0.0243)	(0.0324)	(0.0335)
Mean (Basic Training, No Pat. Info.)	0.00	0.00	0.00
N	1429	1419	1418

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. All regressions include strata and survey date fixed effects. Index components are standardized relative to the basic provider training mean. In cases where some (but not all) index components for a respondent are missing, missing components are imputed to the treatment group mean prior to standardization. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table B5: Effect of Extended Provider Training on Patient Satisfaction by Accuracy of Pre-Consultation Malaria Beliefs - No Additional Controls

	(1)	(2)	(3)
	Full Sample	Has Valid Home-Based RDT	
	Overall Satisfaction Index	Overall Satisfaction Index	Overall Satisfaction Index
Extended Training	-0.156**	-0.170**	-0.138**
	(0.0634)	(0.0730)	(0.0622)
Extended Training × Prior-Risk Match	0.127*	0.164**	0.0885
	(0.0652)	(0.0759)	(0.0579)
Match: Malaria Prior and Malaria Risk	-0.116**	-0.0934	-0.0480
	(0.0467)	(0.0580)	(0.0455)
P-value: ET + ET × Prior Match = 0	0.420	0.883	0.189
Prior Match Measure	Expected Prior Match	Expected Prior Match	Actual Prior Match (Home RDT)
Mean (Basic Training, No Pat. Info.)	0.00	-0.02	-0.02
N	1429	1092	1092

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. Standard errors for regressions that include a derivative of predicted malaria risk in the set of independent variables are bootstrapped using 500 replications to account for the fact that predicted malaria risk is a generated regressor. All regressions include strata and survey date fixed effects. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

Table B6: Effect of Extended Provider Training on Match Between Patient Prior and Prescription by Accuracy of Pre-Consultation Malaria Beliefs - No Additional Controls

	(1)	(2)	(3)
	Full Sample	Has Valid Home-Based RDT	
	Prescription Matches Malaria Prior	Prescription Matches Malaria Prior	Prescription Matches Malaria Prior
Extended Training	-0.0768	-0.120	-0.113*
	(0.0887)	(0.0941)	(0.0660)
Extended Training × Prior-Risk Match	0.211	0.264	0.237**
	(0.162)	(0.167)	(0.0942)
Match: Malaria Prior and Malaria Risk	-0.282***	-0.352***	-0.139*
	(0.107)	(0.117)	(0.0728)
P-value: ET + ET × Prior Match = 0	0.126	0.133	0.033**
Prior Match Measure	Expected Prior Match	Expected Prior Match	Actual Prior Match (Home RDT)
Mean (Basic Training, No Pat. Info.)	0.63	0.66	0.66
N	1971	1093	1093

Notes: Robust standard errors clustered at the clinic-pair level in parentheses. Standard errors for regressions that include a derivative of predicted malaria risk in the set of independent variables are bootstrapped using 500 replications to account for the fact that predicted malaria risk is a generated regressor. All regressions include strata and survey date fixed effects. Outcome is equal to one for patients who, pre-consultation, believe they have malaria and are prescribed an antimalarial *or* for patients who believe they do not have malaria and are not prescribed an antimalarial. *, **, and *** indicate significance at the 10, 5, and 1 percent levels respectively.

C Additional Information

C.1 Patient Information Video

Below is a full transcript of the patient information video to show the points we wanted to convey to the patients before the consultation with the doctor. These were: the correct diagnosis of malaria by conducting a test, the explanation of how an RDT test works, which is the correct treatment in case of a positive test, to encourage patients to ask questions, and to explain the consequences of taking unnecessary medication.

Transcript of the video []Original version in French]

[Voice-off] (rain images, mosquitoes) Malaria is a common disease during the rainy season in Mali. It is caused by a parasite that enters the blood through the bite of a mosquito. Fortunately, malaria tests can detect the disease, and artemisinin-based combination therapies (ACT) can completely cure the disease.

[Office of the doctor, a mother with her 7-year-old child]

Mother: Hello, doctor.

Doctor: Hello Madam. Take a seat. What brings you here today?

Mother: Ali was very ill for two days. He has a very hot body and does not want to eat. He sweats a lot. I think he could have malaria.

[Silent images: close-up of the sweaty child; view from afar: the mother putting her hand on the forehead of the child and looking worried]

[Voice-off] High fever that comes at regular intervals, chills and excessive sweating, vomiting and nausea are typical symptoms of malaria. Some patients also have diarrhea.

Doctor (standing): His illness could be malaria, but we need to do a blood test to be sure. Indeed, many different diseases have symptoms similar to malaria, for example typhoid fever or pneumonia. It is important to find the true cause of the disease so Ali can get proper treatment.

[Scene: The doctor lays out the test materials on the table.]

Doctor (to child): For this rapid detection test, I am going to prick your finger and take a small amount of blood.

[Scene: Showing the needle and pipette.]

Doctor (in voice off, close up of test): Your blood and this liquid (show solvent) go into the test cassette and will flow to the other end. Look at the two marks C and Pf. A red line should appear where the C is. This shows that blood is flowing correctly in the test cassette and that the test is going well. The mark with the sign "Pf" is the most important. There is a line at this mark which will turn red if the passing blood has been

contaminated with the malaria parasite. You must wait 15 minutes before reading the test result, because all the blood must flow through the test cassette first. If after 15 minutes there is only the red line at the "C" symbol, then we will continue reading the test. If after 30 minutes there is only one line, we can conclude that Ali does not have malaria. Only when there is a red line on the Pf before the end of 30 minutes, that we can conclude that the patient needs treatment for malaria.

Child to mother, moaning: My head really hurts.

Mother: A little patience my son. The doctor will soon prescribe you a medicine against malaria.

Doctor: I understand that you are worried about Ali. But we wouldn't want to treat him for malaria if he has something else, like typhoid fever. Malaria drugs would be of no use, and you would be spending money on treatment he doesn't need. Also, Ali's real illness will get worse during this time. I want him to have the right treatment, so he will be better as soon as possible. I will start the test now and check the time.

[Voice-off] Video showing the image of the policy document and the relevant text of the policy, first without, then with highlights on the relevant passages: It is really important not to start treatment without confirming with a test that the patient has malaria – this is the international standard for malaria care, and it is also Mali's national policy. RDTs are provided free of charge by the government and its partners.

[Voice-off] Video of a doctor drawing blood and a lab technician putting a slide under a microscope and looking through it: If your CSCom has a laboratory, it can do a thick-drop or thin-smear test. This method takes longer than an RDT, at least an hour, but it can tell how many parasites there are in the blood. No matter what test is done, you only need malaria medicine if the test confirms that you have the disease.

[Scene: Doctor and mother again, with the child]

Doctor, looking at his watch: The 15 minutes are up and the test is ready. (Close-up test): Blood has flowed through the test and the line marked âCâ shows that the test is working.

[Scene: Doctor showing test to mother, then close up of test again]

Doctor: Look, there are two lines on this test. This confirms that Ali needs malaria treatment. I'm going to prescribe you an ACT pack. Ali must take the ACT for three days. Even if his health improves, be sure to give him all the tablets at the agreed times. Otherwise, he could have a relapse!

Mother: My neighbor's child had malaria too. He was given an injection (here consider injection and infusion; in Bambara "serum and shot") which had an effect very quickly. Will Ali also receive an injection ("serum and shot")?

Doctor: I'm glad you asked that question. It is a good thing that patients ask questions

during consultations. Itâs true, malaria is sometimes treated with an injection (“serum and shot”). But injections (“serum and shot”) pose more risks than tablets, and they are more expensive. An injection (“serum and shot”) is reserved for what we call severe malaria. Severe malaria has symptoms such as coma, difficulty breathing, or several convulsions over a short period. A sign in small children is that they are unable to nurse. A patient suffering from severe malaria urgently needs to go to the hospital. Severe malaria most often occurs in children under five and pregnant women.

Ali does not show signs of severe malaria, and he can swallow the pills I prescribed. This means that the injection (“serum and shot”) is not necessary.

Mother: Oh, I see.

Doctor: Start taking the ACTs right away. Ali will be much better soon. If his symptoms don’t change, come back to me, so we can make sure he’s on the road to recovery.

Mother: Thank you, doctor. Goodbye!

Doctor: Goodbye. And better health.

[Scene taken from afar: Mother buying tablets at the pharmacy, the child swallowing his first tablet.]

[Voice-off] Remember: Before taking any medicine for malaria, always have your blood tested to confirm malaria. Rapid detection tests are free at the CSCom. The recommended treatment for uncomplicated malaria is a drug called an ACT, taken for three days. In some cases, patients have severe malaria. Severe malaria has specific symptoms that a doctor can diagnose and requires hospitalization at the health center. Injections (“serum and shot”) are for the treatment of severe malaria only or for patients who cannot swallow tablets.

[END]

Figure C1: Patient Information Video Outtakes

Notes: The doctor is about to explain to the mother that a positive test result is needed to treat malaria.

Figure C2: Patient Information Video

Notes: The video included subtitles in case of a noisy environment or sound difficulties.

C.2 Construction of Satisfaction Indices

As described in Section 4, we followed the procedure in (Kling et al., 2007) to construct three standardized indices of patient satisfaction: a sub-index that focuses on satisfaction with tests, a sub-index focused on satisfaction with medications, and an overall satisfaction index that includes both sub-indices and the question about care. Below, we list the individual questions asked in our home survey, and then we explain how the indices were constructed step by step.

Questions to Measure Satisfaction with Testing

- How strongly do you agree or disagree with the statement "The doctor/nurse clearly explained the medical tests and their results to me?"
- How strongly do you agree or disagree with the statement "The doctor/nurse based the treatment decision strongly on the result of my medical tests?" OR How strongly do you agree or disagree with the statement "The doctor/nurse based the treatment decision strongly on the result of [patient name]'s medical tests."
- How strongly do you agree or disagree with the statement "The doctor/nurse should have done additional medical testing before prescribing treatment"?
- How strongly do you agree or disagree with the statement "The doctor/nurse should have carried out fewer tests"?

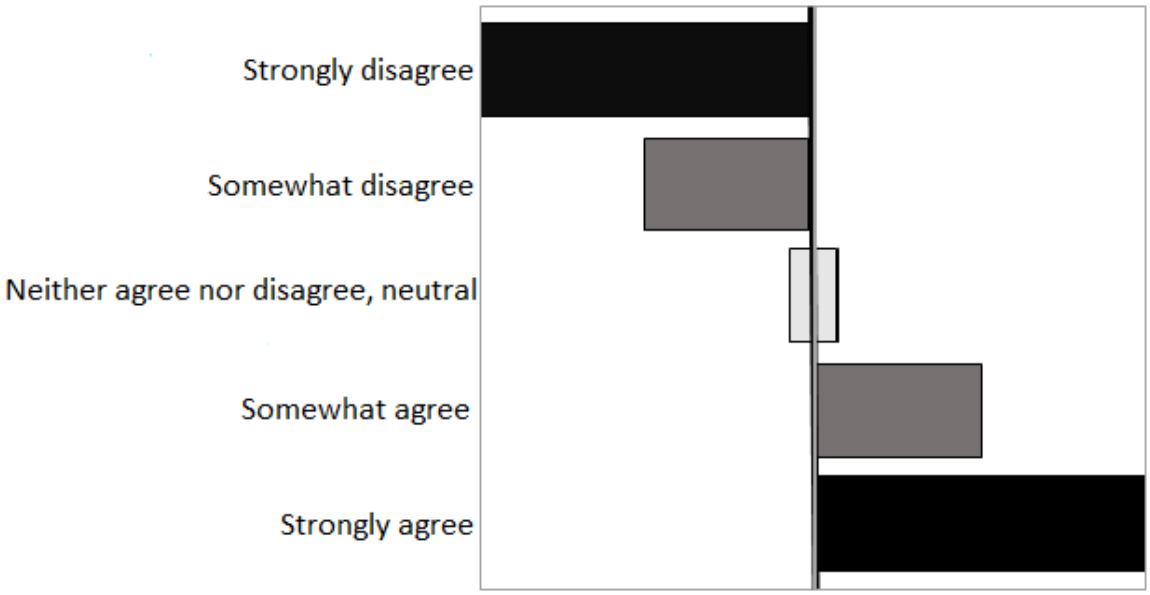
Questions to Measure Satisfaction with Medications

- Think of the treatment you got at the clinic or the drugs the doctor prescribed. How strongly do you agree or disagree with the statement "The doctor should have given me a different or additional treatment or drug.?" OR Think of the treatment the patient got at the clinic or the drugs the doctor prescribed. How strongly do you agree or disagree with the statement "The doctor should have given [patient name] a different or additional treatment or drug.?"
- Think of the treatment you got at the clinic or the drugs the doctor prescribed. How strongly do you agree or disagree with the statement "The doctor should have prescribed fewer drugs"? OR Think of the treatment [patient name] got at the clinic or the drugs the doctor prescribed. How strongly do you agree or disagree with the statement "The doctor should have prescribed fewer drugs"?

Overall Care

- How strongly do you agree or disagree with the statement "The doctor/nurse clearly explained to me what illness I have"? OR How strongly do you agree or disagree with the statement, "The doctor/nurse clearly explained to me what illness [patient name] has"?

To facilitate the understanding of these questions, the surveyors showed the following image:



Construction of Indices We computed dummy variables to indicate *agreement* (strongly agree and somewhat agree) for those statements with a positive implication for quality of care (e.g. "the doctor explained the medical tests and their results"), and *negative of agreement* if the question had a negative implication for quality of care (e.g. "the doctor should have done additional medical testing before prescribing treatment"). We imputed the mean of these dummy variables within each treatment group in case of missing index components (only if at least some components of each index were non-missing values). We then standardized each component relative to the group that received neither the Extended Training nor the Patient Information interventions. Finally, we computed the average of each index's standardized components.