

BMJ Open Utilisation of diagnostics in India: a rapid ethnographic study exploring context and behaviour

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ABSTRACT

Objectives To explore factors that influence behaviour in the utilisation of diagnostics by caregivers of sick children. Utilisation is defined as a caregiver assisting a child to get diagnostic tests done and return for follow-up of results. Understanding these experiences may help inform the development of interventions and implementation strategies to improve the use of diagnostics, thereby target treatment and optimise antibiotic use.

Design A rapid ethnographic qualitative study using 3 months of unstructured observations, 1 month of structured observations of diagnostic utilisation and 43 semi-structured interviews. Transcripts were coded and analysed using inductive thematic analysis. Findings were explored from a behavioural perspective through the lens of the 'Capability, Opportunity, Motivation and Behaviour' (COM-B) model for understanding behaviour. The multiple methods of investigation applied allowed for triangulation and cross-validation of the findings.

Setting The paediatric outpatient department of a teaching hospital in rural, central India.

Participants Caregivers of sick children attending the paediatric outpatient department who were sent for one or more diagnostic test.

Results Three key themes were identified that influenced caregivers' behaviour. Caregivers trusted and understood the importance of diagnostics but their acceptance wavered depending on the severity of illness and preference to treat their child directly with medicines. Caregivers struggled to access diagnostics, describing delays in testing, receiving results and follow-up, further complicated by travel time, distance and competing priorities such as work. Diagnostics were relatively cheap compared with other healthcare facilities however, the cost of the test, travel expenses and wages lost for missing work, were barriers to getting the tests done and returning for follow-up.

Conclusions Diagnostics are generally accepted and their purpose understood, however, the organisation of diagnostic services, direct and indirect costs hinder caregivers from using diagnostics. Improvements in accessibility and affordability may increase caregiver motivation to use diagnostics and return for follow-up.

INTRODUCTION

Antibiotic resistance (ABR) is a complex global health threat which requires multi-faceted solutions.^{1 2} Diagnostics have been

Strengths and limitations of this study

- A combination of unstructured and structured observations and semi-structured interviews allowed for triangulation and cross-validation of the results.
- Two of the authors were from the study setting enabling a deep understanding of the context while the other two authors' outside eyes provided new perspectives and insight. The combination of the team allowed for reflexivity and strengthened the analysis.
- The use of a comprehensive behaviour change framework provided a structure to conduct a behavioural analysis and reflect on the contextual, organisational and interpersonal factors which influence the utilisation of diagnostics.
- The structured observations were done over a short period of time, missing the seasonality of disease, however, these were done to gain understanding of the context, not to be a representative sample.
- Additional qualitative interviews with physicians, laboratory technicians and hospital management, as well as quantitative research of the socio-economic factors influencing diagnostic use and follow-up would broaden understanding on the topic.

repeatedly recognised as a tool to improve patient outcomes and antibiotic use,^{3–5} one of the key strategies of the Global Action Plan.⁶ The use of principles from the social and behavioural sciences have been suggested as a method to drive sustainable change for ABR.^{7–10}

In low- and middle-income countries (LMICs), diagnostic uncertainty fuels antibiotic prescribing as healthcare providers fear missing to treat a potentially life-threatening condition since their patients may not be able to return for care if the illness persists or deteriorates.^{11 12} Diagnostic tests supplement patient history and clinical findings with critical information to assist healthcare providers in making treatment decisions.³ Unfortunately, several barriers exist to uptake and appropriate use of diagnostics in LMICs. Available products are often not adapted for weak healthcare systems which

lack funds, laboratory capacity and sufficiently trained staff or patients who suffer from high out of pocket expenditures, long travel distances and waiting times.^{13 14} As novel diagnostic platforms are being developed and legacy technologies tested in LMICs, as tools to address ABR, it is essential to ensure the needs of their end-users are taken into consideration.^{3 14 15} Furthermore, if we aim to support the adoption of diagnostics into sustainable clinical practice, guidance is needed on how to develop tailored implementation strategies.

Efforts to employ behaviour change techniques for ABR are beginning to emerge.^{16–20} Some researchers caution that the problem of ABR is reduced to a matter of individual behaviour and ask us instead to look towards systematic and structural hindrances to change.^{21 22} We challenge this perspective as we believe a comprehensive behaviour change framework allows us to examine the wide-ranging contextual, organisational and interpersonal factors which influence why people act in the way that they do. And in turn, such a framework may identify appropriate interventions which do not target the individuals themselves, rather aim to support individuals to perform a desired behaviour. The Behaviour Change Wheel is a theory-driven, evidence-based framework for the design and evaluation of behaviour change interventions.²³ It is accompanied by a robust guide²⁴ which provides step by step navigation through three stages of the process. The flexible yet coherent method begins with a formative behavioural analysis to identify the needs of a target population (stage 1), to enhance the choice of appropriate interventions (stage 2) and tailored implementation strategies (stage 3).²⁴

We, therefore, advocate for the use of the Behaviour Change Wheel as a systematic tool to support action on ABR including the adoption of diagnostics into sustainable clinical practice. This study embarks on the first stage of the Behaviour Change Wheel as part of a larger project to improve the use of diagnostics to target antibiotic use at RD Gardi Medical College in India. The aim of the study is to explore factors that influence behaviour in the utilisation of diagnostics by caregivers of sick children attending the paediatric outpatient department.

MATERIALS AND METHODS

Our study employed a rapid ethnographic approach²⁵ consisting of unstructured observations, structured observations and semi-structured interviews, to capture the complexities of diagnostic service provision and the contextual and behavioural factors shaping diagnostic use and delivery in a short time frame. This study follows the Standards for Reporting Qualitative Research.²⁶

Patient and public involvement

Patients and the public were not involved in the design, implementation, analysis or dissemination of the study.

Participants, sampling and data collection

Unstructured observations of patient consultations and diagnostic services were conducted at the paediatric

outpatient department from October to December 2018 by the first author (BH), a global health professional from Sweden.^{25 27} The focus was on the interactions between the caregivers and physicians as they assessed the children, tried to determine the cause of illness, ordered diagnostics and prescribed medication, during initial and follow-up visits. Time was also spent exploring the pathways patients and caregivers take through the hospital to the registration counter, outpatient department, payment counter, in-house pharmacy and various testing rooms to become familiar with the logistics caregivers must endure to complete the tests, receive results and eventual treatment. Discussions were held with physicians, nurses, pharmacists, laboratory technicians and orderlies. A research assistant interpreted from Hindi to English during patient consultation, while discussions with hospital staff were held directly in English. Field notes were taken to document the observations.

Structured observations of the utilisation of diagnostics were conducted by a research assistant from the study setting for the month of December 2018.^{27 28} Each time a patient was sent for one or more diagnostic test, the time, date and type of tests ordered were entered into a data entry log. When patients returned for follow-up, the time and date were again noted. If patients did not return, the registration logbooks were reviewed to assess if patients had done the tests. The structured observations focused on routine blood, urine and stool tests, as well as X-rays, ultrasound, ECG and electroencephalogram. Non-routine diagnostics and any test which was considerably more expensive, such as MRI with a cost of INR2000/US\$27, were excluded.

Semi-structured interviews were conducted with caregivers of children who had been sent for diagnostics. The second author (AM), a research assistant from the study setting with medical and public health training, led the interviews. A semi-structured topic guide (see online supplemental file S1) was prepared based on the literature and observations. The guide was translated from English to Hindi then piloted and modified as necessary before starting the interviews. Participants were purposely sampled from the structured observations, meaning caregivers of children who had been sent for diagnostic testing. The first round of interviews (n=30), recruited caregivers directly after patients were sent for diagnostics but before the tests were done and were conducted in private rooms at the hospital. A second round of interviews (n=13), recruited caregivers who had not returned for follow-up five or more days after the initial visit. These participants were contacted by phone then interviewed at home, using an updated version of the interview guide, with additional questions to explore why they had not done the tests and/or not returned for follow-up. Informed consent was obtained from all interview participants by signature or ink fingerprint for illiterate participants. Caregivers were assured that their responses would not affect the subsequent care of their child. Interviews continued until saturation,²⁹ that is, the team agreed no new information emerged. Interviews

were done in Hindi, audio recorded, transcribed verbatim, then translated to English and reviewed for quality of translation by the third author (AP), a paediatrician from the study setting with experience in qualitative research.

Data analysis

The unstructured observations and their respective field-notes were used to perform a descriptive analysis of the social, cultural and behavioural aspects of the study setting, to structure the interview guides, cross-check findings and provide insight into the latent content of the interview data.^{27 28 30} Observations were analysed separately from the interviews because they focused more broadly on the context than the perspectives of the individual caregivers. Messy, ordered and relation situational maps were used to capture important elements of the setting, stimulate analytical insight and reflect on what matters.³¹ Descriptive statistics were used to quantitatively characterise the findings from the structured observations. For the interview data, an inductive thematic analysis³² was conducted. In line with the ethnographic approach, we chose an inductive process because we wanted to be able to lift what was most important to the participants, without being restricted by a preset framework which might cause us to overlook something. Coding was done iteratively in Microsoft Word. Codes were initially sorted and resorted in Microsoft Excel then printed. Once on paper, the sorting was refined and similar codes were grouped into categories. Finally, the overarching themes binding the categories were developed. This process was led by BH with review, discussion and adjustment at each step of the process together with the last author (AB), a researcher with expertise in behaviour change and implementation. Throughout the process, AM and AP were consulted to ensure appropriate interpretation of the contextual data. The findings were discussed within the author group until consensus was reached. Finally, we discuss our inductive findings through the lens of the ‘Capability, Opportunity, Motivation and Behaviour’ (COM-B) model for understanding behaviour which posits that capability, opportunity and motivation are needed to perform a specific desired behaviour (figure 1).²³ COM-B is part of stage 1 of the Behaviour Change Wheel, and

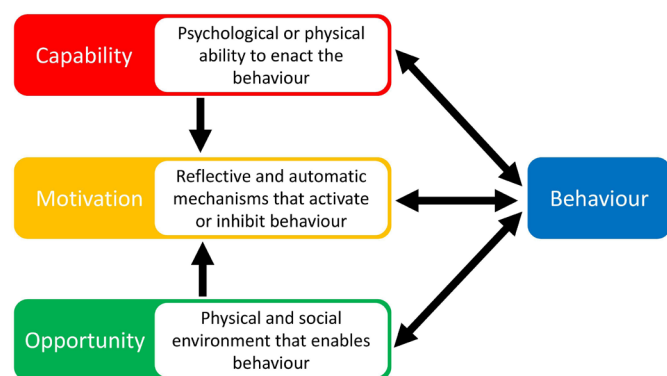


Figure 1 COM-B model for understanding behaviour of the behaviour change wheel.²³ COM-B, capability, opportunity, motivation-behaviour.

reflecting on our results through COM-B will inform our future work to choose appropriate interventions and implementation strategies.²³ In our study, the desired behaviours in the utilisation of diagnostics were defined as a caregiver assisting a child to have diagnostics done and return to the department for follow-up of results.

RESULTS

Unstructured observational findings on the study setting

RD Gardi Medical College is a charitable, tertiary-teaching hospital in Madhya Pradesh, one of the poorer states in India. The hospital caters predominately to a rural population of labourers earning a daily wage of about INR150/US\$2 a day. The paediatric outpatient department is staffed by one to two physicians per day who working on a rotating schedule of 2 days a week, from Monday to Saturday, 9:00–13:00 and 14:00–17:00.

Upper respiratory tract infections, diarrhoea and fever are the most common presenting complaints in the paediatric outpatient department. In cases of suspected infection, physicians routinely order a complete blood count, and depending on the presenting symptoms also routine urine and microscopy, chest X-ray, ultrasound, routine stool and microscopy, Widal test for typhoid or malaria microscopy. All these tests are available free of charge except for complete blood count and Widal test which each cost about INR100/US\$1.36. Currently, no tests are done at the point of care. Blood samples are taken by a phlebotomist in a sample room then sent to the laboratory in the adjacent building for analysis. All other tests are done in individual testing rooms spread out throughout the hospital.

Physicians order diagnostics for about half of their patients and frequently prescribe medicine to alleviate symptoms but wait for test results to prescribe treatment of the illness. Physicians speculate that only about half of the patients whom they send for diagnostics end up returning for follow-up. Additional details describing the study setting, including a figure depicting patient flow through the hospital, can be found in online supplemental file S2.

Structured observations

Over the course of a 1-month period, 129 paediatric outpatients were prescribed a total of 245 diagnostics (table 1). December tends to be a slower time of the year at the hospital due to seasonality. This was seen by lower than average attendance to the outpatient department. However, of the 129 patients who were prescribed diagnostics, 57% (n=73) were prescribed two or more diagnostics, 39% (n=50) of the caregivers received results and returned for follow-up on the same day, 15% (n=20) returned on another day, and 46% (n=59) never returned for follow-up.

Semi-structured interviews

Forty-three interviews were conducted with caregivers. Interviews ranged from 7 to 36 min in length. Children

Table 1 Utilisation of diagnostics

	N	(%)
Patients sent for one or more diagnostic	129	(100)
Test completion and follow-up		
Diagnostic(s) done and returned for follow-up	69	(53)
Diagnostic(s) done, but did not return for follow-up	25	(19)
Diagnostic(s) not done	35	(27)
No of diagnostic tests ordered		
1	56	(43)
2	45	(35)
3	20	(16)
4	4	(3)
5 or more	4	(3)
Time from ordering of test to follow up		
<2 hours	15	(12)
2–4 hours	28	(22)
4–7 hours	7	(5)
The next day	12	(9)
2 days later	8	(2)
No follow-up	59	(46)
Types of diagnostics ordered		
Blood tests		
Complete blood count	71	(55)
Liver function tests	15	(12)
Hormonal assays	12	(9)
Widal (typhoid)	3	(2)
Electrolyte tests	3	(2)
Malaria rapid diagnostic test	2	(2)
C reactive protein	1	(1)
HIV	1	(1)
HBsAg (Hepatitis B)	1	(1)
Other blood tests	5	(4)
Urine tests		
Urine routine and microscopy*	36	(28)
Renal function tests	6	(5)
Urine culture	5	(4)
X-ray (Chest)	31	(24)
Ultrasound	29	(22)
Electroencephalogram	9	(7)
Stool routine and microscopy*	7	(5)
Mantoux/CB-NAAT (tuberculosis)	6	(5)
Electrocardiogram	2	(2)

*Routine urine and stool tests include the physical, chemical and microscopic examination of urine or stool. CB-NAAT, Cartridge-based nucleic acid amplification; HBsAg, Hepatitis B virus surface antigen.

Table 2 Interview participant characteristics

	N	(%)
Participants per interview		
One caregiver	19	(44)
Two caregivers	20	(47)
Three caregivers	4	(9)
Gender		
Men	28	(39)
Women	44	(61)
Relationship to child		
Parent	49	(68)
Grandparent	8	(11)
Aunt/uncle	12	(17)
Other relative	3	(4)
Residence		
Rural	57	(79)
Urban	15	(21)

were frequently accompanied by multiple caregivers to the hospital. All caregivers present were invited to join the interviews and all invited agreed to participate (table 2). The analysis of interview data identified three key themes summarising factors influencing caregivers' utilisation of diagnostic tests (table 3). Below, detailed results for each theme are presented through their corresponding categories. An example of the thematic analysis process including additional quotes is available as online supplemental file S3.

Theme 1: Diagnostic acceptability wavers on caregiver preference and assessment of need

Almost all participants understood that diagnostics help physicians determine the cause of illness and provide appropriate treatment to the child. Tests were a valuable tool to target treatment so an illness would not develop into something more severe, which would be more difficult and expensive to treat.

'After tests, we come to know what the problem is. The doctor can understand the disease with the help of tests. [...] He will give treatment according to diagnosis.' -Father, interview 11

Most participants had confidence in the physician's expertise and the care provided. Caregivers perceived the hospital as a full-service, high-quality facility providing care at a fraction of the cost of other private facilities. A few caregivers were afraid of subjecting their children to the tests. Despite this, caregivers expressed their intention to follow the advice of the physician, trusting it would benefit their child.

Caregivers reflected on the severity of their child's illness. Some assessed their child to be 'not so sick' and skipped the tests but planned to do them if child's condition deteriorated. If they did the test but then the child

Table 3 The three key themes and their underlying categories derived from the analysis

Themes	Categories
Diagnostic acceptability wavers on caregiver preference and assessment of need	Understand the purpose and importance of the tests Trust in care and treatment Severity of illness Preference for medicines instead of tests
Organisation of diagnostic services inadequately meets caregiver needs	Navigating the way around the hospital Long lines, waiting times and the need to return Limited transportation options Reports shown hospital staff other than the physician from initial visit Competing priorities and obligations
Direct and indirect costs of diagnostics impact affordability for caregivers	Cost of diagnostic tests Travel expenses Lost wages Combining providers to maximise care for limited resources

felt better, they may have skipped returning for follow-up. A few families had been staying at the hospital with another sick relative when their child fell ill, so they went for a convenient, free check-up at the outpatient department. Even though they were still staying at the hospital, caregivers did not return for follow-up if they deemed their child to be ‘not so sick’.

‘The doctor told for a blood test, but I thought my child is looking normal and is having slight cough and cold, so there is no need for test.’ -Mother, interview 41

Medicines played an important role in the care and treatment of children. Tests were sometimes seen as an intermediary step to treatment which could be bypassed for children who were ‘not so sick’. Families with limited money had to choose between paying for tests or medicines. Treating directly with medicines, especially those for symptom alleviation, would save time, money, and help their children feel better sooner. Some participants chose to try the medicines first and, if needed, return for the test.

‘I thought that the prescribed bottle of medicine would give him relief, so I avoided the tests.’ -Mother, interview 34

Theme II: Organisation of diagnostic services inadequately meets caregiver needs

A handful of caregivers expressed difficulties in finding their way around the hospital to the respective testing rooms. Each room is labelled with a sign outside the door but the hospital is vast, and there are no directional markings or maps to refer to. A few participants were concerned this was particularly challenging for the uneducated and illiterate.

Caregivers hoped for a swift process so their child could begin the road to recovery. Treatment at the study site was

slower than other private facilities. While some waiting was expected, crowds and queues caused some families to wait for hours and others to skip the tests entirely. Caregivers who arrived early in the morning might reach follow-up in the afternoon but most had to return for results and follow-up on another day.

‘Sometimes there is a waiting of 25–50 patients. So poor people have to keep waiting for hours there hungry and thirsty, sometimes they go home before their turn comes. [...] If we can collect reports on the same day then it will be good. Its ok to wait 1–2 hours, but same day is important.’ -Mother, interview 42

Participants described the time and distance it took to reach the hospital. A few lived close enough to walk, some had their own motorbike but most had to take public transportation and the bus schedules dictated how late they could stay at the hospital. Caregivers were concerned about travelling long distances with their sick children.

Some caregivers picked up their reports directly from the laboratory or testing room as soon as they were available and returned for follow-up at the outpatient department regardless of which physician was on staff. Others asked a lab technician or another member of the hospital staff to interpret the test results if they knew their original physician was not attending the clinic when they returned or if the outpatient department was closed at the time they received their reports. If there was nothing serious, caregivers skipped returning to the physician for follow-up.

Time spent travelling and at the hospital was time taken away from work, farming, household activities, and school for the children. Caregivers missed work, rearranged their schedules or received help to cover their obligations to bring their child to the hospital for the initial visit. If they had to come back for a return visit, they were forced

to choose between continuing the care for their child and their other competing priorities.

'We do not have time to come again and again to the hospital, if we keep on doing this who will do our work?' -Mother, interview 32

Theme III: Direct and indirect costs of diagnostics impact affordability for caregivers

Diagnostics were relatively cheap at the study site compared with other healthcare facilities in Ujjain. However, the poorest participants still had troubles to pay. Caregivers who did not have enough money had no choice but to return home without having the tests done. Many hoped to return when they managed to save or borrow money.

In addition to the cost of the tests, caregivers incurred additional travel expenses. Repeated trips multiplied the costs. For those who lived close by, the travel expenses were often manageable, however those coming from a greater distance felt the cost to return for a second visit to be a burden.

'For one trip we need to burn up petrol of 150 rupees and if we need to return two to three times then it will cause great loss.' -Mother, interview 14

On top of the cost of the tests and the travel expenses, caregivers who had to miss work to take their child to the hospital lost their daily wages. Similar to the travel expenses, the need to return for additional trips, caused additional lost wages.

Caregivers frequently used a combination of healthcare providers while seeking care for one episode of their child's illness. Some had tests done at RD Gardi Medical College, then presented for follow-up at another private provider. Others had been sent for tests by a private provider then presented at the study site hoping to be ordered the same tests at a fraction of the cost. The money saved could be used for follow-up with the original private provider.

'Patients get the tests done at RD Gardi Medical College and then show them to other doctors at private clinics. Tests we can have from anywhere we want.' -Mother, interview 42

DISCUSSION

Our thematic analysis identified a spectrum of factors which may explain why only 53% (n=69) of caregivers used the available diagnostics to their full capacity. We reflect on these phenomena with the help of the COM-B model for understanding behaviour.

Capability can be understood as an individual's psychological and physical capacity to take part in an activity concerned.²³ Caregivers described the journey from the moment they were ordered diagnostics until follow-up as arduous and some expressed concerns about the effort

required to reach the various testing rooms especially for the uneducated. Otherwise, capability did not play a strong role in our setting.

Opportunity relates to all the physical and social factors which lie outside of the individual and make the behaviour possible or prompt it.²³ Opportunity had the strongest influence on caregiver behaviour. It was important for caregivers to conduct the test and complete with the follow-up on the same day as the initial visit. Full queues and long waiting times discouraged caregivers. Bus schedules dictated how late they could stay and wait. Returning for follow-up on a separate occasion placed an additional burden on the family as they tried to juggle competing priorities and their travel expenses and lost wages multiplied. The cost of diagnostic testing at the study site was minimal compared with other private facilities but still out of reach for the poorest. Caregivers creatively combined providers to minimise costs and maximise care and treatment for their children.

Motivation refers to conscious decision making, and the emotions and habits that strengthen and direct a behaviour towards a certain goal.²³ Motivation is influenced and may be amplified or deflated by the surrounding capabilities and opportunities. Caregivers had faith in their physician's ability to care for their child and the power of diagnostics to determine the cause of illness. However, the additional time, fees, travel expenses and lost wages incurred by diagnostics caused their motivation to waver. Caregivers wished that treatment could be started as soon as possible so their children would not suffer and were frustrated with prolonged and laborious hospital visits. They reflected over the severity of their child's illness, assessing if it could be managed directly with swift, convenient medical treatment.

Comparison with existing literature

Caregivers had to grapple with long travel distances and waiting times, faced high out of pocket expenditures due to the costs of tests and travel, further burdened by reduced wages for lost time from work. Similar struggles to access healthcare were seen in South India¹¹ and have long plagued LMICs.^{33 34} Caregivers made decisions about healthcare based on trust, reputation and affordability, carefully weighing their symptoms against available health services, echoing findings from another study in Ujjain.³⁵ The same study suggested that to expand access to health services, patients need consultations which combine diagnoses with dispensing of medicines.³⁵ This aligns with our findings from the structured observations that of the 61% (n=79) of caregivers who did not reach follow-up on the day of initial visit, only 31% (n=20) returned for follow-up on another day. And can be explained by our interview findings that returning for follow-up on a separate occasion was burdensome for families. Our study found caregivers avoiding to spend time and money on diagnostics, and combining multiple healthcare providers to meet their needs, reaffirming findings from other studies from India.^{11 36} Caregivers

were accustomed to relying on medicines for a quick relief which was also identified by Chandy and Engel in the practice of purchasing antibiotics to avoid spending extra time and money on consulting physicians or diagnostics in sites across southern India.^{11 36}

Implications for research and practice

Our COM-B analysis suggests strategies targeting access and affordability to have the greatest impact in our setting. Addressing the structural issues of the existing diagnostic services may also enhance caregiver motivation to use the diagnostics instead of shortcutting the route to care with medicines. Directional signs with images in addition to text could facilitate patients getting around the hospital. Expanded opening hours, or follow-up by phone could eliminate the need for some caregivers to make return visits.

Point-of-care diagnostics have enormous potential to reduce diagnostic and treatment delays and improve the quality of care in rural outpatient settings.^{5 37} Point-of-care tests, for example, C reactive protein, have shown modest but significant reductions in antibiotic use in several resource-limited settings.^{38–40} The challenge remains of how to cover the cost of such tests? At RD Gardi Medical College, significant resources are wasted when almost half of patients who are sent for diagnostic tests never return for follow-up. Not only are the material, equipment and staff costs related to the diagnostic testing lost but the staff time from the initial patient consultation has also gone to waste when the patient is lost to follow-up. Research examining the incremental costs and potential savings from reallocation of resources is necessary to understand if point of care tests could be economically feasible for patients and the hospital. Unless the issue of cost can be addressed, we will still see people adapting their behaviour to fit their available financial resources.⁴¹

Strengths and limitations

A strength of this study was the application of multiple methods of investigation allowed for triangulation and cross-validation of our findings. Notably, findings from the structured observations were aligned with those from unstructured observations where physicians reported that only about half of the patients, they send for diagnostics return for follow-up of results. Two authors were from the study setting enabling a deep understanding of the context while the other two authors' outside eyes provided new perspectives and insight. The combination of the team allowed for reflexivity and strengthened the analysis. Our study also has important limitations. The unstructured observations have a risk of bias as they were done by one researcher and observations are already subjective in nature. All observations may have been influenced by the Hawthorne effect. We estimate this impact to be minimal as our study was conducted in a teaching hospital where both staff and caregivers are used to having multiple observers during patient consultations. The structured observations were done over a short

period of time, missing the seasonality of disease. While total number and types of tests ordered might differ throughout the year, the purpose was to gain an understanding of the context, not to provide a representative sample. Regarding the interviews, hospital interviews were shorter and less rich in data. Hence, our findings might be weighted towards the fact that home interview participants may have had more to say about the diagnostic services in relation to why they had not done the diagnostics or returned for follow-up. Alternatively, they may have simply felt more comfortable at home and less restricted by time. Additional qualitative interviews with physicians, laboratory technicians and hospital management, as well as quantitative research of the socioeconomic factors influencing diagnostic use and follow-up would broaden understanding on this topic.

CONCLUSIONS

Diagnostics are generally accepted and their purpose understood, however, the organisation of diagnostic services, direct and indirect costs hinder caregivers from using diagnostics.

This study highlights the contextual realities influencing the utilisation of diagnostics in a resource-limited setting. It is a case example of how a rigorous contextual and behavioural analysis can be used to inform the development of interventions and implementation strategies. We hope the method applied and the findings presented will be useful to the wider antimicrobial resistance and global health diagnostic community in the ongoing development of new diagnostic tools, appropriate interventions and implementation strategies targeted at LMICs.

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Contributors BH contributed to conceptualisation of the project, research design, undertook data collection, analysis, wrote the first draft of the manuscript and coordinated its multiple revisions. AM contributed to research design, data collection and interpretation. AP contributed to research design, data collection, analysis and interpretation of the data and critical revision of the manuscript. AB contributed to conceptualisation of the project, research design, analysis and interpretation of the data and critical revision of the manuscript. All authors reviewed and approved the manuscript.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethical approval for the study was granted by the Institutional Ethics committee at RD Gardi Medical College (Number 18/2018).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Data from the structured observations are available on request although access to these data may be subject to Indian Council of Medical Research policies. Data supporting the findings from the interviews are found in the translated quotes as seen in the Results section and the online supplemental material S3. However, to protect the

participants' identities, the full interview data of this study (transcripts and audio files) will not be made available to the public.

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