The social role of C-reactive protein point-of-care testing to guide antibiotic prescription in Northern Thailand

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ABSTRACT

New and affordable point-of-care testing (POCT) solutions are hoped to guide antibiotic prescription and to help limit antimicrobial resistance (AMR)—especially in low- and middle-income countries where resource constraints often prevent extensive diagnostic testing. Anthropological and sociological research has illuminated the role and impact of rapid point-of-care malaria testing. This paper expands our knowledge about the social implications of non-malarial POCT, using the case study of a C-reactive-protein point-of-care testing (CRP POCT) clinical trial with febrile patients at primary-care-level health centres in Chiang Rai province, northern Thailand. We investigate the social role of CRP POCT through its interactions with (a) the healthcare workers who use it, (b) the patients whose routine care is affected by the test, and (c) the existing patient-health system linkages that might resonate or interfere with CRP POCT. We conduct a thematic analysis of data from 58 purposively sampled pre- and post-intervention patients and healthcare workers in August 2016 and May 2017.

We find widespread positive attitudes towards the test among patients and healthcare workers. Patients' views are influenced by an understanding of CRP POCT as a comprehensive blood test that provides specific diagnosis and that corresponds to notions of good care. Healthcare workers use the test to support their negotiations with patients but also to legitimise ethical decisions in an increasingly restrictive antibiotic policy environment. We hypothesise that CRP POCT could entail greater patient adherence to recommended antibiotic treatment, but it could also encourage riskier health behaviour and entail potentially adverse equity implications for patients across generations and socioeconomic strata. Our empirical findings inform the clinical literature on increasingly propagated point-of-care biomarker tests to guide antibiotic prescriptions, and we contribute to the anthropological and sociological literature through a novel conceptualisation of the patient-health system interface as an activity space into which biomarker testing is introduced.

1. Introduction

Antibiotics procured through formal and informal channels are popularly over- and misused across high-, middle-, and low-income countries, which contributes to the development of antimicrobial resistance (AMR) and potentially to the spread of resistant bacteria across the world (Butler et al., 2009; Kumarasamy et al., 2010; Morgan et al., 2011). A range of antibiotic policies and interventions have emerged to improve clinical antibiotic prescriptions worldwide (Davey et al., 2017), including biomarker tests to inform healthcare workers' (HCWs') prescription decisions (Nora et al., 2017). C-reactive protein (CRP) as a biomarker of bacterial infection is one of these interventions (Lubell et al., 2015), and new point-of-care testing (POCT) solutions are hoped to become an additional tool for low- and middle-income countries (LMICs) to limit the growing problem of AMR (Do et al., 2016; Drain et al., 2014; Lubell and Althaus, 2017).

In the context of AMR, host-response biomarkers such as CRP aim at identifying patients requiring an antibiotic while helping to rule out antibiotic prescriptions when an illness is caused by a mild bacterial infection or by a viral infection (for which antibiotic treatment would be ineffectual) (Aabenhus et al., 2014, 6). As a diagnostic tool, CRP POCT can therefore indicate whether an antibiotic might be needed, but it does not provide information about which specific antibiotic would be best suited for treating the patient (Lubell et al., 2015). A review by Aabenhus et al. (2014, 6) also lists a range of potential disadvantages of such point-of-care tests, including "suboptimal use of time, costs, handling errors, patient dissatisfaction and false negative values that can lead to lack of necessary antibiotic treatments or false positive values that may increase inappropriate antibiotic use." The rationale behind their introduction is therefore not that they are perfect diagnostic devices, but that they can aid and support clinical diagnosis in a resource-poor environment of high or ill-targeted antibiotic use until superior and affordable pathogen-specific tests become available (Lubell and Althaus, 2017).

While the recent sociological and anthropological literature on rapid diagnostic testing for malaria has expanded our understanding of POCT technologies in LMIC health systems, very little experience exists with non-malaria POCT. This study examines the case of Chiang Rai in northern Thailand, where we collected qualitative data from 58 fever patients and healthcare workers alongside a clinical trial of CRP POCT to reduce antibiotic prescriptions. Our exploratory research question is, "*What role does CRP POCT play in primary-care-level antibiotic prescription within an existing system of practices at the patient-health system interface?*", for which we draw on a novel analytical framework that borrows arguments from the treatment-seeking behaviour, street-level bureaucracy, and actor-network theory literature. We respond thereby to recent calls from both social scientists (e.g. Chandler et al., 2016) and medical researchers (e.g. Zellweger et al., 2017) for a greater involvement of the social sciences in antimicrobial resistance research.

Our analysis will demonstrate that CRP POCT is introduced into a context of existing antibiotic-related practices. The test becomes redefined in relation to these practices, but it also alters them. Patients' views are thus influenced by an understanding of CRP POCT as a comprehensive blood test that provides specific diagnoses and that corresponds to notions of good care. Healthcare workers use the test to support their negotiations with patients but also to legitimise ethical decisions in an increasingly restrictive antibiotic policy environment. Commonly found positive attitudes, reassurance, and trust may therefore support the tests' primary objective to reduce unnecessary antibiotic prescriptions, but they can also mask the unintended social consequences of altering the patient-health system relationship.

2. Literature and framework

2.1. Related literature

The clinical literature has been considering the role of biomarkers such as CRP or procalcitonin to inform and guide antibiotic prescriptions in hospitals and primary care settings in high- as well as low- and middle-income contexts (Hildenwall et al., 2017; Lubell et al., 2015; Nora et al., 2017). This has led to the development of interventions using biomarker point-of-care tests like CRP to target and reduce antibiotic prescriptions for unspecified fevers and acute respiratory infections (Aabenhus and Jensen, 2016; Aabenhus et al., 2014; Davey et al., 2017). The growing number of clinical trials primarily from high-income contexts thereby indicates moderate effectiveness of CRP testing in reducing clinically unnecessary antibiotic prescriptions (Aabenhus et al., 2014; Cals et al., 2010; Cooke et al., 2015; Do et al., 2016), making these point-of-care tests a promising and economical addition to a necessarily broad portfolio of strategies to address antimicrobial resistance in LMIC settings with resource constraints and scarce laboratory capacity (Aabenhus and Jensen, 2016; Drain et al.,

2014; Lubell and Althaus, 2017). A small number of clinically oriented qualitative and mixed-method studies from high-income countries complement the clinical trials, focusing on CRP POCT adoption barriers and the attitudes and practices of participating healthcare workers (Bustinduy et al., 2017; Hardy et al., 2017; Huddy et al., 2016; Van den Bruel et al., 2016).

Despite the growing interest in the subject, we are not aware of social research studies on point-of-care biomarker testing to guide antibiotic prescriptions in LMICs. A related body of literature has explored this subject in greater depth, namely anthropological and sociological research on rapid diagnostic testing (RDT) for malaria in low- and middle-income Africa and Asia. Studies in this area pay closer attention to the social processes underlying the introduction of a new test into an established system of healthcare practices, which can lead to unforeseen implementation challenges and consequences of seemingly simple testing technologies (Beisel et al., 2016, 2; Chandler et al., 2011, 13). Themes that have been addressed in this body of work include, for example, healthcare providers' adherence to test results (Burchett et al., 2017; Umlauf, 2017); the implementation of diagnostic tests in private pharmacies and antimalarial-selling stores (Hutchinson et al., 2015, 2017; Visser et al., 2017); the social processes and values associated with the process of testing (Chandler et al., 2012; Hutchinson et al., 2015, 2017); or the potentially adverse effect of increasing antibiotic prescription to compensate for lower antimalarial treatment (Hopkins et al., 2017). These studies share an appreciation that RDTs' introduction, integration, and possible interference with existing social settings can yield unintended consequences for clinical practice, healthcare-seeking behaviour, and the conceptualisation of the test itself. Based on this literature, we could expect similar dynamics in CRP POCT in LMIC settings. However, no research has yet explored whether non-malarial point-of-care biomarker testing in the context of AMR is subject to similar processes. The research gap could be attributed to the lack of analytical guidance of how the introduction of a test at the patient-health system interface could be conceptualised. We respond to this conceptual challenge through our activity space framework.

2.2. Analytical framework

Our study considers the introduction of CRP POCT at the patient-health system interface. We define this interface as a healthcare "activity space;" that is, a social space in which patients navigate a healthcare landscape that contains numerous and diverse health system actors, not all of which patients will know or prefer. The introduction of a point-of-care biomarker test may change the behaviours of both patients and healthcare providers, but it may also fail to do so in light of existing healthcare-seeking patterns and healthcare solutions like pharmaceutical use or other diagnostic tests. We chose the activity space framing of our analysis to study the interaction of the test with (a) the healthcare workers who use it, (b) the patients whose routine care is affected by the test, and (c) the existing patient-health system linkages that might resonate or interfere with CRP POCT.

An activity space is not a theory but an analytical domain. In order to structure and guide our analysis, we borrow specific elements from different bodies of social theory, namely from treatment-seeking behaviour to explore patient behaviour in pluralistic health systems, from street-level bureaucracy to analyse the behaviour of frontline healthcare workers who face pressure from policies and guidelines as well as from their patients, and from actor-network theory to consider the role of CRP POCT in an existing network of behaviours and practices that can shape not only the impact but also the meaning of the test (summarised in Fig. 1 and described below). Drawing on these different bodies of literature does not mean that we aim at harmonising them. Rather, we follow a constructive approach that borrows from these theoretical strands and situates the CRP POCT in its social environment to understand its meaning as well as its possible (social) implications.

We adopt elements from the following three bodies of literature to