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## Understanding the implementation and adoption of an information technology intervention to support medicines optimisation in primary care: qualitative study using strong structuration theory



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3 **Understanding the implementation and adoption of an information technology intervention to**  
4 **support medicines optimisation in primary care: qualitative study using strong structuration**  
5 **theory**  
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## ABSTRACT

### Objectives

Using strong structuration theory, we aimed to understand the adoption and implementation of an electronic clinical audit and feedback tool to support medicines optimisation for patients in primary care.

### Design

Qualitative case study design. Transcripts were analysed using thematic analysis.

### Setting

Clinical commissioning group in the South of England.

### Participants

Four focus groups and six semi-structured interviews were conducted with eighteen participants purposively sampled from a range of stakeholder groups (general practitioners, pharmacists, patients and commissioners).

### Results

Using the system could lead to improved medication safety but use was determined by broad institutional contexts, by the perceptions, dispositions and skills of users and by the structures embedded within the technology. These included: perceptions of the system as new and requiring technical competence and skill; the adoption of the system for information gathering; and interactions and relationships that involved individual, shared or collective use. The dynamics between these external, internal and technological structures affected the adoption and implementation of the system.

### Conclusions

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3 Successful implementation of information technology interventions for medicines optimisation will  
4 depend on a combination of the infrastructure within primary care, social structures embedded in the  
5 technology and the conventions, norms and dispositions of those utilising it. Future interventions,  
6 using electronic audit and feedback tools to improve medication safety, should consider the  
7 complexity of the social and organisational contexts and how internal and external structures can  
8 impact upon the use of the technology in order to support effective implementation.  
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### 15 **Strengths and limitations of this study**

- 16  
17 • This is the first study to explore the implementation of electronic audit and feedback systems  
18 to improve medication safety in primary care using strong structuration theory.  
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- 20  
21 • Strong structuration theory was found to be particularly valuable for unpicking why the  
22 system was used and the different motivations, ambitions, aims and attitudes of a range of  
23 stakeholders.  
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- 25  
26 • Strong structuration theory also revealed the complex contextual background in which the  
27 system was implemented and how that implementation was informed by wider contexts.  
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- 29  
30 • This work should inform policy makers, information technology system designers and those  
31 working in primary care about how to optimise the implementation of such systems in the  
32 future.  
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### 43 **INTRODUCTION**

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45 Prescribing of medicines to patients is the most common clinical intervention in primary care.  
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47 However, with high volumes of medicines prescribed in primary care [1], the prevalence of repeat  
48 prescribing and the increased burden and complexity of multimorbidity and related polypharmacy  
49 [2,3], there is an increased likelihood that prescribing or monitoring errors can occur [4,5]. Recent  
50 studies using prescribing safety indicators to investigate the prevalence of hazardous prescribing in  
51 primary care found 5.2 to 5.5% of patients to be at risk of potentially hazardous prescribing and 7.6  
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3 to 11.8% of patients not receiving recommended monitoring tests [6,7]. Some medication errors may  
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5 not lead to harm; however, approximately 13% of patients have experienced an adverse drug event  
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7 after receiving prescription medication in primary care, and many of those have been serious enough  
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9 for patients to seek medical assistance at hospital [8,9]. The monitoring of patients in receipt of  
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11 prescription medication is therefore considered important in order to avoid potentially serious adverse  
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13 drug events.

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16 Healthcare information technology (IT) systems may be useful for monitoring such medication usage.  
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18 However, the implementation of such IT has not always been successful, with technology being  
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20 resisted, not used effectively or used differently than was planned. Previous research has suggested  
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22 that reasons for this might reside in the design and functionality of the technology. Poorly designed or  
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24 implemented IT systems have been seen to create cognitive overload [10], and disrupt workflow [11].  
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26 Furthermore, IT systems may be utilised in ways unintended by developers in order to overcome  
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28 problems with design. [12-14]. Such tailoring of systems suggests a dynamic where implementation  
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30 involves interpretation and adaptation of systems to fit existing work practices, or changes to work  
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32 practices in order to adapt to the new system [15-20].

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35 This dynamic has been understood from a sociotechnical perspective, in which IT interventions are  
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37 seen as being shaped by interactions between the technology, the users and social and organisational  
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39 processes [21-23]. Such interactional views, rather than focusing only upon the functionality of  
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41 systems, take into consideration the complex nature of healthcare and the cultural, social and  
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43 organisational aspects of the workplaces [18, 24].

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46 One way that sociotechnical theory has been developed and applied to the implementation of health  
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48 care is through strong structuration theory [24]. Strong structuration theory understands the  
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50 implementation of technology in terms of the ways it will be used or not and how actors draw upon  
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52 particular resources to do so [25]. From a strong structuration viewpoint the implementation of  
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54 healthcare IT is dependent upon a dynamic interplay of external structures, internal structures and the  
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56 technology. External structures are built through social positions, practices and networks of social  
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3 relations. They could include local and national infrastructures such as national guidelines, political,  
4 economic and institutional contexts, professional codes of practice, as well as local work practices and  
5 interactions among stakeholders [25, 26]. Internal structures are manifest in two ways: firstly, as the  
6 skills, dispositions, ambitions, values and past experiences of actors; and secondly as the actors'  
7 knowledge of rules, conventions, obligations and social norms, which may involve partial  
8 understandings and past experiences, that inform how one is supposed to act [25-27]. Technology is  
9 seen as an equal actor within this, since technology has social structures built into it through  
10 procedures, material properties and standards that can enable or constrain use [25, 26, 28].  
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12 Technology can be therefore seen as shaping human actions by making certain actions possible [29].

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22 This study examines the implementation of a new electronic medicines optimisation system (EMOS)  
23 in primary care that allows different stakeholders - general practitioners, Clinical Commissioning  
24 Group (CCG) managers, pharmacists, general practice managers, and patients - access to real time  
25 anonymized patient data including medical diagnoses, prescribed medications and laboratory test  
26 results. This facilitates electronic clinical audits to identify patients who are at risk of a medication-  
27 related adverse event, such as those who are on inappropriate combinations of drugs or who have not  
28 received appropriate monitoring. Within a health locality, the EMOS also allows clinicians and  
29 managers to audit prescribing practices across general practices and make comparisons against  
30 national guidelines. Patients have access to the system through a patient passport which allows them  
31 to view their medications and test results. Strong structuration theory has been previously used to  
32 understand the ways a large scale healthcare IT intervention, designed to assist patients and GPs to  
33 book hospital outpatient appointments, was resisted or adopted [28]. Using strong structuration theory  
34 we aimed to understand the implementation and adoption of the EMOS in primary care settings.

## 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 **METHODS**

### 50 51 52 **Study design and setting**

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56 We used a case study design. The study case was a Clinical Commissioning Group (CCG) in the  
57 South of England, which was chosen because it was an early adopter of the EMOS and had all general  
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practices signed up to the system. In the English National Health Service (NHS), a Clinical Commissioning Group (CCG) is a clinically-led statutory NHS body responsible for the planning and commissioning of health care services for their local area, and cover groups of general practices within a local area. The sampling frame was people within the CCG's geographical area who represented the stakeholder groups. This included doctors, pharmacists, general practice managers and patients.

### Recruitment and data collection

Individual participants were recruited on a purposive basis via the CCG or through community pharmacy networks, to represent the different stakeholder groups (see Table 1).

Table 1 – Case study participants

Participants	Role	Use of EMOS
<b>Interviews</b>		
GP1-INT	General Practitioner	In general practice and as prescribing lead of Clinical Commissioning Group (CCG) medicines management team
GP2	General Practitioner	In general practice and as respiratory lead at CCG
GP3	General Practitioner	In general practice
CCGP1 (additional observation as part of interview)	CCG Pharmacist	Medication reviews in care homes
CCGP2	CCG Pharmacist	CCG medicines management team
<b>Focus group A - General Practitioners</b>		
GP4	General Practitioner	In general practice
GP1-FG	General Practitioner	In practice and as prescribing lead of CCG medicines management team
<b>Focus group B – Community Pharmacists</b>		
CP1	Community Pharmacist	Aware of, but no access
CP2	Community Pharmacist	Aware of, but no access
CP3	Community Pharmacist	Aware of, but no access
CP4	Community Pharmacist	Aware of, but no access
<b>Focus Group C – Patients</b>		
Pt1	Patient	Access through patient passport
Pt2	Patient	Access through patient passport
Pt3	Patient	Access through patient passport

Pt4	Patient	Access through patient passport
<b>Focus Group D - General practice managers</b>		
GPM1	General Practice Manager	In general practice
GPM2	General Practice Manager	In general practice
GPM3	General Practice Manager	In general practice
GPM4	General Practice Manager	In general practice
<b>Declined to participate.</b>		
A number of possible participants were approached but declined to participate. Predominantly this was for reasons of time, workload or lack of use of the system. These included 2 pharmacist technicians, 2 GPs, 2 community pharmacists and 8 general practice managers.		

Potential participants were contacted by telephone or email. Five semi-structured interviews (lasting between 20-50 minutes) were conducted with three GPs and two CCG pharmacists, who were known to be using the system, between August and December 2014. Four homogeneous focus groups (lasting between 57-112 minutes) were conducted between September and December 2014, each with a specific group of stakeholders: GPs (2); community pharmacists (4); patients (4); and general practice managers (4). No repeat interviews were conducted. In the interviews and focus groups we explored experiences of working with the EMOS, perceptions of the system, benefits and drawbacks, the organisational structures and roles required for its use and the circumstances under which it was considered most effective. Data collection continued until saturation was reached and no new themes emerged from the interviews and focus groups. The interviews and focus groups were carried out by a male research associate in medication safety trained and experienced in qualitative health research who holds an MSc in Health Psychology (MJ). The focus groups were co-facilitated by a female freelance research pharmacist experienced in qualitative methodology and who holds a PhD in Medicines Safety in Primary Care (RLH). The researchers were not known to the participants prior to the study. Four interviews were conducted by telephone and one at the CCG offices. The focus groups were conducted at the CCG offices or at a local hotel solely with the participants, RLH and MJ present. All participants gave written informed consent to take part in the study, and for the interviews and focus groups to be audio recorded and transcribed verbatim. Ethical approval for the study was granted by the Preston NHS Research Ethics Committee (reference 14/NW/0113).



## Analysis

The analysis was thematic using a template analysis approach [30]. An a priori set of thematic codes based upon strong structuration theory was developed from the literature [25, 26, 28, 31]. These included: external structures such as national or local infrastructures; interactions, including relationships, conflicts and communication; the internal structures of agents including dispositions, skills, attitudes and cognitive demands; rules and contextuality including routines, social norms and regulations and technological structures including the social structures built into the technology. This set of codes was applied to the transcripts using the QSR NVivo 10 application. The coded extracts were then analysed and emerging themes highlighted which formed the basis of the results detailed below.

## RESULTS

The adoption and implementation of the EMOS was dependent upon a dynamic mix of external structures, internal structures and the material properties embedded in the technology (as illustrated in Figure 1). External infrastructures, the motivations of users and the material properties of the EMOS facilitated information gathering. Perceiving the system as new could lead to resistance and the maintenance of habitual behaviours. Use was dependent upon interactions and relationships between users. Use could be further constrained by conceptualising the system as requiring technical competence.

INSERT FIGURE 1

The ways in which the EMOS was implemented and adopted were conceptualised in four broad thematic categories: Adoption of the system for information gathering; perceptions of the system as new; perceptions of the EMOS as requiring technical competence; and the interactions and relationships that involved individual or collective use of the technology.

### *Adoption of the system for information gathering*

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3 The EMOS facilitated the efficient acquisition of information relating to the appropriateness of  
4 prescribing for individual patients. External structures provided the conditions for the use of the  
5 technology; specifically through the requirements of national policies relating to safe medicines use as  
6 set down by national infrastructures and the CCG's responses to those requirements. The CCG was  
7 motivated to carry out audits of prescribing, and much of the data extracted through such audits were  
8 used to benchmark the CCG against these national policies and targets. This auditing was in turn  
9 determined by the policy and institutional climate that required the reporting of such auditing, the setting  
10 of certain guidelines and targets, and the adherence to those. This further led to the CCG utilising the  
11 technology in a local context to monitor prescribing behaviour in practices in response to local  
12 initiatives. External structures such as national or local "initiatives" worked with the internal structures  
13 (in this instance the motivations of the CCG to report in response to these "initiatives") and the material  
14 properties of the technology, to more swiftly identify patients registered with general practices that met  
15 the relevant prescribing safety audit. The technology shaped the ability to do this; the material  
16 properties of the system allowing for extensive searches of electronic health records across multiple  
17 general practices in a relatively short space of time. According to the following extract from an  
18 interview with a CCG pharmacist the technological structures enabled the collection of data in a more  
19 efficient and timely fashion.

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*" [...]it's a way of being able to gather pseudo-anonymised individual patient data and relate it to  
ideas and thoughts around initiatives that CCG or the medicines management team are looking at  
that perhaps has been identified or highlighted nationally, or locally and it can all be done  
relatively quickly within a few seconds if necessary. So you don't have to trawl round 17 different  
practices (CCGP2)*

Centrally, in a form of pay for performance initiative, the CCG made the EMOS part of a "GP  
incentive scheme to engage with alerts in a meaningful way" (GP1-INT) and this was conceptualised  
as "trying to sort of get some more traction" (GP1-INT). Guidelines and documents concerning  
strategies for prescribing framed the possibilities for use "to actually monitor the progress against a  
sort of target outcome" (GP1-INT). The functionality within the EMOS allowed for the benchmarking

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3 across the CCG. This in turn provided for structures that could be utilised by the CCG to encourage  
4 practices to use the system, and an infrastructure that supported their own activities in monitoring  
5 prescribing behaviour and to *"reward good prescribing"* (GP1-INT).  
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10 *"if there are some practices that are demonstrating very good prescribing, then we've picked*  
11 *those out as well and highlighted those to act as a kind of beacon of hope for everybody else".*  
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14 (CCGP2)  
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17 The system also allowed for communication channels and feedback where contact with practices  
18 would be made through the system or as a result of alerts being sent out by email. Such communication,  
19 between the clinicians placed centrally at the CCG and the individual GP practices, enabled the CCG  
20 to monitor prescribing as *"a way of looking at the map"* (GP2) as well as the use of the system by  
21 *"tracking our advice in those practices"* (GP1-INT). The codes and material properties of the system  
22 facilitated monitoring in that logging on to the system indicated engagement with it. This in turn  
23 allowed the CCG to further monitor and audit prescribing patterns since they could swiftly see which  
24 practices had responded to alerts and *"[could] have some kind of objective measure that [gave them]*  
25 *some idea as to who's perhaps even more engaged than others"* (CCGP2). The ambitions and  
26 motivations of the CCG to monitor prescribing acted as an internal structure to work *"very hard to get*  
27 *the uptake of that better"* (CCGP2) and in *"trying to persuade our clinicians to use it so that we get a*  
28 *much more real time feedback."* (CCGP2). Furthermore this combination of technological  
29 infrastructure and the ambitions of the CCG created a new internal structure in the form of a  
30 convention for using the system.  
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46 *"(When) the GP logs onto the Eclipse system and there's a little tick box to say patient*  
47 *reviewed [...]. Now some practices are doing that as a regular routine exercise, so that means*  
48 *that tracking our advice in those practices is very easy and what it does allow you to do as*  
49 *well is not to send the same alert out to the same practice again"* (GP1-INT).  
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#### 55 ***Perceptions of the system as new*** 56 57 58 59 60

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3 Using the EMOS was characterised as a new practice that would require new approaches. Resistance  
4 towards the system was thus justified by characterising existing behaviours as ingrained. Here habits  
5 and ways of doing things that were presented by one GP as "*the old fashioned way*"(CCGP2),  
6 provided for a limited use of the system. One such disposition was around their prescribing habits  
7 which they described as "*conservative*" (CCGP2). This allowed for a limited use of the EMOS, in  
8 which most alerts would not require action because prescribing behaviour was already "*protective of*  
9 *patients*"(CCGP2). Similarly, as the following extract illustrates, non-use of the system resulted from  
10 habitual accustomed practice of using other systems, pre-existing routines and repetitive ways of  
11 doing things  
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22 *I think the trouble is Eclipse is another thing you have to log into along with the other 20 things*  
23 *you log into every day, and you're so used to using your other clinical system all the*  
24 *time."*(GPM3)  
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29 The CCG pharmacists were concerned that GPs would otherwise avoid using the system. It was  
30 assumed that GPs, in addition to, training on the system, needed persuasion in order to "*just [get] them*  
31 *to use it as habit*" (CCGP1).  
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36 *"but we have had a situation where the GP said, oh, I'm not sure if I'll have time to look on*  
37 *Eclipse, but you can't spoon feed them everything"*(CCGP1)  
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41 Structures could shape the ways things were done. Workplace routines and practices, such as the  
42 prioritisation of work schedules, acted as constraints or enablers to the use of the new system. Here  
43 this GP highlighted contingencies within the structures associated with the "*special circumstances of*  
44 *my workplace*" (GP4) which allowed for a range of actions from side-lining the alert through to  
45 reviewing the patient. In this way the duality of structure - the specific demands of his work - and his  
46 agency - his interaction with the alerts in the EMOS - both governed his act of utilising the system and  
47 the extent and character of that utilisation.  
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3 *"[...] it can depend on the nature of the alerts, how urgent it seems, and the special circumstances*  
4 *of my workplace[...] some things might actually get side-lined for a few weeks if they're not*  
5 *clinically urgent, but [...]the next time I catch up with my paperwork then I'll dig up that*  
6 *alert[...]and review the situation (GP4)*

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12 For the CCG pharmacist, undertaking medication reviews in care homes the system changed the way  
13 they worked because *"if necessary if there's something that comes up on Eclipse whilst we're there we*  
14 *can, rather than having to go back to the surgery first, check it and then make a decision"* (CCGP1). In  
15 this way the technology shaped their actions. Furthermore the technological structures in the EMOS and  
16 the internal structures led to new shared decision making, use and outcome.

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23 *"We can look on Eclipse and most of the time it's on Eclipse and we can answer the question*  
24 *there and then. For example, we had a patient who was on Memantine, who was a really not very*  
25 *well gentleman,[...] so we phoned the GP straightaway."*(CCGP1)

### 26 27 28 29 30 ***Perceptions of the EMOS as requiring technical competence***

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33 The EMOS was conceptualised as a "clever" system that could conduct complex searches, but would  
34 require technical knowledge on the part of users in order to do so. This allowed for this GP's limited use  
35 of the system when combined with an understanding of his own abilities to use the system;

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40 *"That's how I become accustomed to doing things, which is perhaps why I then don't use Eclipse,*  
41 *because I do think I might not have the ability and the power of making the use of a more*  
42 *powerful tool. But, perhaps I have also then learned useful habits with the old fashioned way."*  
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46  
47 (GP4)

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49 Non-use of the system was associated with the cognitive and physical demands associated with using  
50 the EMOS and finding time to learn how to get the best out of it. This further conceptualised the system  
51 as complex requiring time, training and *"proper teaching"* (GPM2) to gain the expertise required to  
52 utilise it.  
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3 *"And if you had the time to log into it and go oh, what does this do? What does that do? [...] You*  
4 *train your audit clerk who runs all sorts of searches and does all sorts of audit work, you could*  
5 *have the time to show her and teach her, [...] I'd love to have the time to tinker with, (the*  
6 *system). [...] You'd need time to play with it and time to...proper teaching, proper (training)*  
7 *showing us what it does" (GPM2)*  
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14 The conceptualisation of the EMOS as requiring technical competence was related to structures  
15 embedded within the technology that allowed for or constrained its use. This could either empower users  
16 and thus facilitate further use or could undermine that agency.  
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21 *"And also I'm computer literate and I can work out, I can problem solve because I'm reasonably*  
22 *well educated, if you were talking about average population here, they would either give up, they*  
23 *would probably have given up when they couldn't log in" (Pt2)*  
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28 This service user conceptualises the system as difficult and one that required her abilities as a "*computer*  
29 *literate*" to use it. This required an interaction of her capabilities and the structures within the system to  
30 engage with it and difficulties with logging in was perceived to be a potential constraint for other users.  
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### 34 35 ***Interactions and relationships: Individual, shared and collective use of the technology*** 36

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38 There were variations in the ways the technology was used within collaborative networks of social  
39 relations. Different general practice staff took responsibility for using the technology; use depended  
40 upon shared or collective roles, or upon a hierarchical allocation of access.  
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45 For service users, using the technology was determined by networks of social relations. This was  
46 expressed as having support from medical professionals to understand the system.  
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50 *"But I think the important thing is before you sort of almost start using it, you do need that kind*  
51 *of intervention from a medical practitioner in some way to actually help you with the things you*  
52 *need to know" (Pt1)*  
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3 Within general practices there was variation in who took responsibility for the EMOS. On receiving an  
4 alert through the system one practice manager would then “*pass it on to the GP and get them to respond*  
5 *to me*” (GPM 2) and that “*the doctors don’t access it at all.[...] I’m the only one that, yeah, has*  
6 *anything to do with it.*” (GPM 2) Another remarked:

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12 “*I get the alert the same way through the email, I identify the patient [...] then mine goes to the*  
13 *GP. But the GP actions it, I don’t have any more responsibility for it after that [...] They go into*  
14 *Eclipse, they do it, [...] my job is just to literally give them the information and they do the rest.*”  
15  
16 (GPM1)  
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21 Such variation was driven by the conventions and norms associated with work practices. In different  
22 general practices individuals were assigned to different roles and responsibilities often based on what  
23 worked best for the practice.  
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28 “*one of the GPs has been nominated within our practice to take that lead in the same way that*  
29 *we break our workload down in other areas; you be the lead for this and tell us if there’s anything*  
30 *we all need to know and share the workload.*” (GPM4)  
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35 The allocation of access to the EMOS limited its use. Community pharmacists did not have access to the  
36 system. Perceived social norms were seen as “*historically a barrier*” (CP2) that perpetuated that lack of  
37 access. Community pharmacists attributed this barrier to GPs seeing themselves as “*as the custodians of*  
38 *the patient record*” (CP2).  
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44 “*I think there always has been a conflict because GPs often see themselves as the custodians of*  
45 *the patient record and even though the information in that patient record, even abbreviated*  
46 *information is incredibly useful for community pharmacists, they’ve never successfully managed*  
47 *to allow us access and this is going back to EPS [Electronic Prescription Service], this is what*  
48 *EPS promised and it’s never happened.*” (CP2)  
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3 There was a perception that the system was a tool for the CCG. This differential access meant that the  
4  
5 system had not been used in some general practices. There were however perceptions that the system  
6  
7 had “evolved”.

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9  
10 *"I think that's what it was [...] originally purchased...or the agreement with Eclipse was*  
11  
12 *originally for the meds management team to use it as a tool for them [...] And I think Eclipse has*  
13  
14 *evolved since that happened [...] And I don't think any of us have kept up with how Eclipse has*  
15  
16 *evolved and what else it can now do."(GPM3)*  
17

18  
19 Such changes were related to social norms around ownership and conventions concerning how the  
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21 system would be used; centrally by the CCG to look at prescribing patterns across practices, and by  
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23 individual practices of their own prescribing audits. As the system evolved there were perceptions that it  
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25 could do more. In this way, perceptions of the technological structures and material properties of the  
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27 technology drove the ambitions of some users to learn more about the potential uses of the system which  
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29 opened up access to different users.  
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## 31 32 **DISCUSSION**

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35 Much of the previous literature on interventions to improve medication safety has focused upon  
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37 secondary healthcare settings and electronic audit and feedback systems of the kind examined in this  
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39 study are under-researched in primary care. A particular strength of this study is the use of strong  
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41 structuration theory which was found to be a useful theoretical approach to studying the implementation  
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43 and adoption of the EMOS. In applying this theoretical approach we were able to see the differences in  
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45 motivations, ambitions, aims and attitudes of different actors from different stakeholder groups towards  
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47 the IT intervention. Strong structuration theory could also reveal the complex contextual background in  
48  
49 which the EMOS was implemented and revealed how the implementation was informed by wider  
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51 contexts. Hence we were able to understand that the successful adoption of the EMOS was not merely  
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53 dependent upon agents but upon the complex terrain in which it was implemented. Previous studies  
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55 using this approach have focused upon large national IT projects where institutional contexts might be  
56  
57 considered to have more impact [26, 32 ]. We found however that in a smaller scale project, wider  
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3 policy institutional contexts did impact upon the implementation and adoption of the IT for example  
4 through the CCG's response to the requirements of national policies. In this way the use of the system  
5 depended on other factors alongside the dispositions of the users.  
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10 There are several limitations to this work which present further opportunities future research examining  
11 the adoption and implementation of electronic audit and feedback systems to improve medication safety  
12 in primary care settings. In understanding the contexts in which the EMOS was adopted it would have  
13 been useful to have looked at policy documentation. It has been suggested that studies such as these  
14 explore wider social contexts through analysis of background data and through ethnographic observation  
15 [29, 33 ]. Though we conducted one observation with a CCG pharmacist this was only as an extension  
16 of the interview with that participant to elicit some further understanding of how they used the EMOS.  
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18 A number of naturalistic observations would have been useful in unpicking contexts and agents' choices  
19 and actions in using the system.  
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### 28 29 **Relationship with previous literature**

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32 Primary care settings are governed by institutional norms, measures, rules and traditions, habits and  
33 behaviours [24, 34]. Some of these are embedded in local rules and conventions associated with the  
34 different working dynamics of individual practices and others are found in regulations and governance  
35 associated with wider economic and institutional contexts [24, 35 ]. In the present study we found that  
36 norms and social conventions could limit the use of the EMOS. Previous literature has established the  
37 role of social, organisational and work practices in the adoption of IT, [11, 12] others have focused upon  
38 functionality of design and tailoring to users [13, 36 ] or upon top-down implementation [36 , 37].  
39  
40 Previous research has indicated that emphasis upon training might also construct end-users as the  
41 problem [38]. Sociotechnical approaches to the implementation of IT have offered insight to the  
42 importance of the organisational and social contexts in which technology is delivered [16]. A focus upon  
43 interoperability, work practices and system usability suggests that poor adoption of IT is related to users  
44 or the system [14, 36 ]. This misses how interactions and relationships between contexts, users and the  
45 technology might work and how the implementation of IT is a social practice [39 ]. In this study, the  
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3 networks of social relations impacted upon the use of the system. Much of the previous sociotechnical  
4 literature does not seek to explain how a dynamic blend of wider political contexts, local priorities, the  
5 dispositions of users and the available properties of the technology work together. For instance whilst  
6 highlighting the importance of work practices and how technology needs to be embedded into pre-  
7 existing routines, previous literature, with notable exceptions, [24, 28, 29] has not seen these  
8 dynamically linked to wider contexts particularly in the context of medication safety in primary care. In  
9 our study whilst national guidelines might necessitate the monitoring of prescribing, the EMOS would  
10 not have been used to undertake this without the material properties within it and the ambitions of  
11 individuals at the CCG.  
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### 22 **Implications of the findings**

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25 Strong structuration theory would argue that individual agency is dependent upon knowledge of rules  
26 and conventions. As IT is implemented, new rules and conventions are established, adapted or rejected.  
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28 In our study it was seen that communication and feedback through the EMOS provided the CCG with  
29 the ability to monitor practices and to gain knowledge of which practices were engaged in using the  
30 system to improve medication safety. In this way the use of the system created new internal structures  
31 concerning such social rules and conventions. Similarly, in previous literature, information systems have  
32 been associated with enabling managers to capture information, place local clinicians under surveillance  
33 and make their actions calculable [39]. Furthermore an effect of such surveillance is for individuals to  
34 adapt their own behaviour to ensure they act legitimately [40].  
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47 This study highlights how healthcare IT interventions are implemented and adopted in a complex  
48 social and organisational context. Interventions that are top down and perceived as tools of managerial  
49 control are less likely to be effective than those that take into consideration existing local practices  
50 and the ambitions and attitudes of those who will use the technology.  
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### 55 **CONCLUSION**

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2  
3 Our study examines the implementation and adoption of an IT system for medicines optimisation in  
4 primary care. It was found that the dynamic combination of external, internal and technological  
5 structures impacted upon the adoption and implementation of the system. Information technology  
6 interventions for medicines optimisation should consider how utilisation may depend on a  
7 combination of the infrastructure within primary care, social structures embedded in the technology  
8 and the conventions, norms and dispositions of those utilising it.  
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## 15 16 **Figures**

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18  
19 *Figure 1.* Strong structuration theory and the use of the EMOS

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21  
22 *Figure legend:* Interaction between internal, external and technological structures that determined the  
23 use of the EMOS  
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## 27 **Abbreviations**

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30 IT: Information technology; GP: General practitioner; EMOS: Electronic medicines optimisation  
31 system; CCG: Clinical commissioning group.  
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## 35 **Acknowledgments**

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38 We are grateful to all participants who kindly gave their time.  
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## 42 **Contributors**

43  
44  
45 All authors were involved in the design of this study. MJ led on recruitment of participants, data  
46 collection, analysis of the data and drafting of the article. RLH helped co-facilitated focus groups.  
47 DLP, RLH, SR, AJA and DMA also made contributions to analysis and interpretation. All authors  
48 revised the article critically and approved the final version to be published.  
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9

### 10 **Disclaimer**

11  
12 The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the  
13 Department of Health.  
14  
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### 17 **Competing interests**

18  
19 The authors declare they have no competing interests.  
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### 24 **Ethical approval and consent to participate**

25  
26 All participants gave informed written consent to take part in the study, and for the interviews and  
27 focus groups to be audio recorded and transcribed verbatim . Ethical approval for the study was  
28 granted by the NHS National Research Ethics Service (reference 14/NW/0113)  
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### 34 **Availability of data**

35  
36 Data cannot be shared because participants did not consent to this. In addition since this is a small  
37 case study, involving small numbers of participants, there is a possibility that material in the  
38 transcripts could identify participants.  
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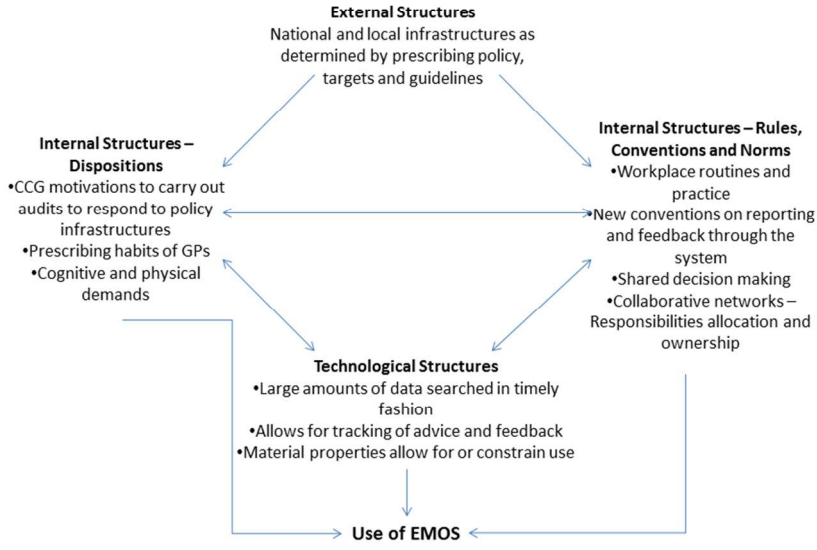
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For peer review only

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Strong structuration theory and the use of the EMOS: Interaction between internal, external and technological structures that determined use of the EMOS

275x190mm (96 x 96 DPI)

Review only

**Understanding the implementation and adoption of an information technology intervention to support medicines optimisation in primary care: qualitative study using strong structuration theory**

**COREQ checklist**

Note: in order to minimize the length of the manuscript, some of the details on the checklist (marked ‘\*’) are not included in the manuscript.

	<i>Guide question</i>	<i>Response</i>	<i>Page number in manuscript</i>
1	Interviewer/facilitator	MJ conducted the interviews. MJ and RLH facilitated the focus groups	7
2	Credentials	MJ holds an MSc in Health Psychology RLH holds a PhD in Medicines safety in Primary care	7
3	Occupation	MJ : Research Associate in medication safety; RLH: freelance research pharmacist	7
4	Gender	MJ male; RLH female	7
5	Experience and training	Both researchers have previous experience of undertaking qualitative research in healthcare at PhD and postdoctoral level	7
6	Relationship established	The researchers were not known to the participants prior to the study	7
7	Participant knowledge of the researcher	Participants were made aware of the reasons for doing the research via the information which was sent to the participant prior to the interview	*
8	Researcher characteristics	The researchers had identified the study topic as part of larger programmes of work in their research groups, medication safety in primary care.	7
9	Methodological orientation and theory	Strong structuration theory. The analysis was thematic using template analysis.	4-5, 7-8
10	Sampling	Individual participants were recruited on a purposive basis via the study CCG or through community pharmacy networks. All participants were chosen to fit the sampling frame (people within the CCG's geographical area who represented the stakeholder groups: pharmacists, doctors, general practice managers and patients)	6
11	Method of approach	Participants were approached by telephone or email	7
12	Sample size	19 participants	6-7
13	Non-participation	A number of possible participants were approached but declined to participate. Predominantly this was for reasons of time, workload or lack of use of the system. These included 2 pharmacist technicians, 2 GPs, 2 community pharmacists and 8 general practice managers.	7
14	Setting of data collection	Four interviews were conducted by telephone and one at the CCG offices, the focus groups were conducted at the CCG offices or at a local hotel.	7
15	Presence of non-participants	No non-participants were present	7

16	Description of sample	See Table 1 of the main manuscript	6-7
17	Interview guide	In the interviews and focus groups we explored experiences of working with the EMOS, perceptions of the system, benefits and drawbacks, the organisational structures and roles required for its use and the circumstances under which it was considered most effective. No pilot testing was undertaken due to the small scale nature of the study, the timescale of the study and the difficulties of recruitment.	7
18	Repeat interviews	None	7
19	Audio/visual recording	Audio recording only, with consent from the participant	7
20	Field notes	None	*
21	Duration	The interviews lasted between 20 and 50 mins. The focus groups lasted between 57-112 mins.	7
22	Data saturation	Data collection continued until saturation was reached and no new themes emerged from the interviews and focus groups.	7
23	Transcripts returned	No transcripts were returned to participants	*
24	Number of data coders	MJ coded the data but regular discussions codes were held with all authors	18
25	Description of the coding tree	A coding tree description is not given but details on a priori codes is included	8
26	Derivation of themes	A priori thematic codes were applied to the data and new themes emerged from the data. This is described in the analysis section	8
27	Software	QSRNvivo 10 software was utilised to manage the data	8
28	Participant checking	No	*
29	Quotations presented	Please see the results section of the manuscript	8-14
30	Data and findings consistent		8-14
31	Clarity of major themes		8-14
32	Clarity of minor themes		8-14

# BMJ Open

## Understanding the implementation and adoption of an information technology intervention to support medicines optimisation in primary care: qualitative study using strong structuration theory



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Secondary Subject Heading:	Qualitative research, Sociology, Health services research
Keywords:	Prescribing, Information technology < BIOTECHNOLOGY & BIOINFORMATICS, PRIMARY CARE, Strong Structuration Theory, Medicines optimisation

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Manuscripts

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3 1 **Understanding the implementation and adoption of an information technology intervention to**  
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5 2 **support medicines optimisation in primary care: qualitative study using strong structuration**  
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7 3 **theory.**  
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3 **1 ABSTRACT**  
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6 **2 Objectives**  
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9 Using strong structuration theory, we aimed to understand the adoption and implementation of an  
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11 electronic clinical audit and feedback tool to support medicines optimisation for patients in primary  
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13 care.  
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16 **6 Design**  
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19 Qualitative study. Transcripts were analysed using template analysis.  
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22 **8 Setting**  
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25 Clinical commissioning group in the South of England.  
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28 **10 Participants**  
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31 Four focus groups and five semi-structured interviews were conducted with eighteen participants  
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33 purposively sampled from a range of stakeholder groups (general practitioners, pharmacists, patients  
34  
35 and commissioners).  
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38 **14 Results**  
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41 Using the system could lead to improved medication safety but use was determined by broad  
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43 institutional contexts, by the perceptions, dispositions and skills of users and by the structures  
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45 embedded within the technology. These included: perceptions of the system as new and requiring  
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47 technical competence and skill; the adoption of the system for information gathering; and interactions  
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49 and relationships that involved individual, shared or collective use. The dynamics between these  
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51 external, internal and technological structures affected the adoption and implementation of the system.  
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54 **21 Conclusions**  
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3 1 Successful implementation of information technology interventions for medicines optimisation will  
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5 2 depend on a combination of the infrastructure within primary care, social structures embedded in the  
6  
7 3 technology and the conventions, norms and dispositions of those utilising it. Future interventions,  
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9 4 using electronic audit and feedback tools to improve medication safety, should consider the  
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11 5 complexity of the social and organisational contexts and how internal and external structures can  
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13 6 impact upon the use of the technology in order to support effective implementation.

### 7 **Strengths and limitations of this study**

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- This is the first study to explore the implementation of electronic audit and feedback systems to improve medication safety in primary care using strong structuration theory.
  - Strong structuration theory was found to be particularly valuable for unpicking why the system was used and the different motivations, ambitions, aims and attitudes of a range of stakeholders.
  - This was an exploratory study that relied mainly upon interview and focus group data from a number of key stakeholders located in one clinical commissioning group in England.
  - Additional insights may have been gained by undertaking ethnographic observation to discover exactly the ways people utilised the Electronic Medicines Optimisation System (EMOS).

### 18 **INTRODUCTION**

19 Prescribing of medicines to patients is the most common clinical intervention in primary care.  
20 However, with high volumes of medicines prescribed in primary care [1], the prevalence of repeat  
21 prescribing and the increased burden and complexity of multimorbidity and related polypharmacy  
22 [2,3], there is an increased likelihood that prescribing or monitoring errors can occur [4,5]. Recent  
23 studies using prescribing safety indicators to investigate the prevalence of hazardous prescribing in  
24 primary care found 5.2 to 5.5% of patients to be at risk of potentially hazardous prescribing and 7.6



1 to 11.8% of patients not receiving recommended monitoring tests [6,7]. Some medication errors may  
2 not lead to harm; however, approximately 13% of patients have experienced an adverse drug event  
3 after receiving prescription medication in primary care, and many of those have been serious enough  
4 for patients to seek medical assistance at hospital [8, 9]. The monitoring of patients in receipt of  
5 prescription medication is therefore considered important in order to avoid potentially serious adverse  
6 drug events.

7 In the UK, national and local policies have set out recommendations for medication safety  
8 improvement [10-12]. "An Organisation with a Memory" [13] set out the necessity for the  
9 establishment of a patient safety culture within healthcare organisations. This emphasised the  
10 importance of organisational practices. Policy has also set out how the utilisation of information  
11 technology presents opportunities to fulfil medication safety requirements and that the contribution of  
12 information systems should be maximised [11]. This was further enhanced by Department of Health  
13 recommendations in the report "Building a Safer NHS for patients: Improving Medication Safety"  
14 [10], which recommended that steps to safer prescribing may include the implementation of effective  
15 IT systems particularly those systems that might highlight and give warnings to medical staff of  
16 prescription errors. Similar recommendations have suggested there is a need to develop systems that  
17 optimise the use of medicines and that this might include improved electronic decision support for  
18 clinicians [12]. Locally, the Clinical Commissioning Group (CCG) that formed the setting for this  
19 study operated a prescribing incentive scheme designed to improve the quality of prescribing, respond  
20 to the requirements of national guidelines, and reduce excessive prescribing and costs, which was  
21 incentivised by small financial rewards for general practices [14].

22 Healthcare information technology (IT) systems may be useful for monitoring medication usage.  
23 However, the implementation of such IT has not always been successful, with technology being  
24 resisted, not used effectively or used differently than was planned. Previous research has suggested  
25 that reasons for this might reside in the design and functionality of the technology. Poorly designed or  
26 implemented IT systems have been seen to create cognitive overload [15], and disrupt workflow [16].  
27 Furthermore, IT systems may be utilised in ways unintended by developers, either to overcome

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2  
3 1 problems with design or as new uses for the technology become apparent [17-19]. However, such  
4  
5 2 tailoring of systems suggests a dynamic where implementation actually involves interpretation and  
6  
7 3 adaptation of systems to fit existing work practices, or changes to work practices in order to adapt to  
8  
9 4 the new system [20-25]. In other words, the success or failure of an IT implementation could be seen  
10  
11 5 as being shaped by interactions between the technology, the users and social and organisational  
12  
13 6 processes [26-28]. This sociotechnical view, rather than focusing only upon the functionality of  
14  
15 7 systems, takes into account the complex nature of healthcare and the cultural, social and  
16  
17 8 organisational aspects of the workplaces [22-29].

19  
20 9 Strong structuration theory (SST) has been proposed as a way of examining these sociotechnical  
21  
22 10 aspects of healthcare IT implementation [30]. It is based on Giddens' structuration theory, which  
23  
24 11 proposed a relationship between structures (such as social norms, political and economic institutions)  
25  
26 12 and agency (people's actions and choices) [31]. According to Stones [30], SST extends this structure -  
27  
28 13 agency relationship to include the following elements (see figure 1):

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31 14 • *External structures*, which are the physical social or economic context in which action is  
32  
33 15 contemplated. External structures are built through social positions, practices and networks of  
34  
35 16 social relationships [29, 32]. These could include hierarchical relationships between employers  
36  
37 17 and employees, professional roles, local and national guidelines, governance measures,  
38  
39 18 regulations, professional codes of practice, as well as local work practices and interactions  
40  
41 19 among groups of stakeholders [30, 32].  
42  
43 20 • *Internal structures*, which are manifest in two ways. Firstly, as the skills, dispositions,  
44  
45 21 ambitions, attitudes, values, past experiences of actors and ways of viewing the world.  
46  
47 22 Secondly, as the actors' knowledge of rules, conventions, obligations and social norms, which  
48  
49 23 may involve partial understandings and past experiences. These inform how one is supposed  
50  
51 24 to act in specific situations in the here and now, based upon the agents understanding of  
52  
53 25 external structures [30, 32-33].  
54  
55 26 • *Agency*, which is how and why agents draw upon internal structures to act in particular ways  
56  
57 27 in specific situations [32]

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- 1 • *Outcome*, which is the way agency impacts on external or internal structures and how they are
  - 2 maintained or changed [32].

3 Stones and Greenhalgh [32] further explained the role of technology in SST: rather than there being

4 symmetry between technology and human actors, they are instead separate and may act in different

5 ways [32]. Technology incorporates procedures, codes, material properties and standards that can

6 enable or constrain use [19, 32-34]; it is therefore seen as shaping human actions by making certain

7 actions possible [35]. Previous studies [29, 34] suggest that SST can illuminate the implementation

8 and adoption of information technology by understanding how people "*take action with respect to*

9 *technologies*"; in other words, what people actually do with the systems and to what effect [32].

10 Strong structuration theory has been previously used to understand the ways a large scale healthcare

11 IT intervention, designed to assist patients and General Practitioners (GPs) to book hospital outpatient

12 appointments, was resisted or adopted [34].

13 INSERT FIGURE 1

14 This study uses SST to examine a new electronic medicines optimisation system (EMOS) [36] that

15 was implemented in a primary care locality. The EMOS allows different stakeholders - general

16 practitioners, Clinical Commissioning Group (CCG) managers, pharmacists, general practice

17 managers, and patients - access to real time anonymized patient data including medical diagnoses,

18 prescribed medications and laboratory test results. It comprises a secure patient database and a web-

19 based user interface that extracts patient specific data from the general practice clinical record system.

20 The interface provides a number of user functions; these include reviewing a specific patient health

21 record, identifying patients who are at risk of a medication-related adverse event, such as those who

22 are on inappropriate combinations of drugs or who have not received appropriate monitoring and

23 carrying out clinical audits on a subset of patients [36]. The EMOS also allowed clinicians and

24 managers in the health locality to audit prescribing practices across general practices and make

25 comparisons against national guidelines. Patients have access to the system through a patient passport

26 which allows them to view their medications and test results. In this context it was felt that SST would

1 unpick the ways in which users of the system drew upon their dispositions, attitudes skills and  
2 ambitions and upon their knowledge of and understanding of external structures to engage with the  
3 technology. Therefore, we aimed to examine the specific question: “in what ways did external,  
4 internal and technological structures impact upon the implementation and adoption of the EMOS?”

## 5 **METHODS**

### 6 **Study design and setting**

7 Our study used a qualitative design. The study setting was a CCG in the South of England, which was  
8 chosen because it was an early adopter of the EMOS and had all general practices signed up to the  
9 system. The CCG was relatively small in size (17 separate general practices, and approximately  
10 140,000 patients). Medicines management activities at the CCG were undertaken by three clinical  
11 pharmacists (including participants CCGP1 and CCGP2) and two pharmacy technicians. Additionally  
12 one GP (participant GP1) operated as prescribing lead for the CCG. In the English National Health  
13 Service (NHS), a CCG is a clinically-led statutory NHS body responsible for the planning and  
14 commissioning of health care services for their local area, and cover groups of general practices  
15 within a local area. The sampling frame was people within the CCG’s geographical area who  
16 represented the stakeholder groups. This included doctors, pharmacists, general practice managers and  
17 patients.

### 18 **Understanding the background**

19 Prior to data collection we undertook actions to build a picture of the system and the context in which  
20 it was to be used. Authors MJ and RLH were given an overview of the system in a preliminary  
21 meeting with the study CCG prior to data collection. In addition MJ visited a separate CCG in the  
22 North of England that was utilising the EMOS. Web-based materials relating to the system were read  
23 prior to data collection [36].

### 24 **Recruitment and data collection**

- 1 Individual participants were recruited on a purposive basis via the CCG or through community  
 2 pharmacy networks, to represent the different stakeholder groups (see Table 1).  
 3 Table 1 –Study participants

Participants	Role	How they used the EMOS
<b>Interviews</b>		
GP1-INT	General Practitioner	In general practice and prescribing lead for the Clinical Commissioning Group (CCG) .Worked with the medicines management team in supporting the adoption of the EMOS by the CCG. Used the EMOS to send alerts to GPs.
GP2	General Practitioner	In general practice and respiratory lead for the CCG. Utilised the EMOS to undertake audits of prescribing relating to respiratory conditions.
GP3	General Practitioner	In general practice
CCGP1 (additional observation as part of interview)	CCG Pharmacist	Utilised the EMOs to undertake medication reviews with care home patients
CCGP2	CCG Pharmacist	CCG medicines management team. Used the EMOS to run audits centrally at the CCG and then alert clinicians locally
<b>Focus group A - General Practitioners</b>		
GP4	General Practitioner	In general practice
GP1-FG	General Practitioner	In practice and as prescribing lead for the CCG
<b>Focus group B – Community Pharmacists</b>		
CP1	Community Pharmacist	Aware of, but no access
CP2	Community Pharmacist	Aware of, but no access
CP3	Community Pharmacist	Aware of, but no access
CP4	Community Pharmacist	Aware of, but no access
<b>Focus Group C – Patients</b>		
Pt1	Patient	Access through patient passport
Pt2	Patient	Access through patient passport
Pt3	Patient	Access through patient passport
Pt4	Patient	Access through patient passport
<b>Focus Group D - General practice managers</b>		
GPM1	General Practice Manager	In general practice
GPM2	General Practice Manager	In general practice
GPM3	General Practice Manager	In general practice
GPM4	General Practice Manager	In general practice

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3 1 Potential participants were contacted by telephone or email. Five semi-structured interviews (lasting  
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5 2 between 20-50 minutes) were conducted with three GPs and two CCG pharmacists, who were known  
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7 3 to be using the system, and had specific roles that required the use of the EMOS between August and  
8  
9 4 December 2014. Four homogeneous focus groups (lasting between 57-112 minutes) were also  
10  
11 5 conducted between September and December 2014, each with a specific group of stakeholders: GPs  
12  
13 6 (2); community pharmacists (4); patients (4); and general practice managers (4). No repeat interviews  
14  
15 7 were conducted, although one GP was interviewed and also participated in a focus group. Each focus  
16  
17 8 group was conducted with different a specific type of stakeholder, as this was felt to facilitate free and  
18  
19 9 open discussion.

20  
21  
22 10 Topic guides for the interviews and focus groups were developed by reading relevant literature  
23  
24 11 examining the implementation of information technology in healthcare settings [16, 17, 20, 23, 24.]  
25  
26 12 Both interviews and focus groups were conducted to illicit individual thoughts and opinions and to  
27  
28 13 promote discussion amongst specific homogenous groups of stakeholders. In the interviews and focus  
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30 14 groups, we explored experiences of working with the EMOS, perceptions of the system, benefits and  
31  
32 15 drawbacks, the organisational structures and roles required for its use and the circumstances under  
33  
34 16 which it was considered most effective. Data collection continued until saturation was reached and no  
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36 17 new themes emerged from the interviews and focus groups. The interviews and focus groups were  
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38 18 carried out by a male research associate in medication safety trained and experienced in qualitative  
39  
40 19 health research who holds an MSc in Health Psychology (MJ). The focus groups were co-facilitated  
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42 20 by a female freelance research pharmacist experienced in qualitative methodology and with a PhD in  
43  
44 21 Medicines Safety in Primary Care (RLH). The researchers were not known to the participants prior to  
45  
46 22 the study. Four interviews were conducted by telephone and one at the CCG offices. The focus  
47  
48 23 groups were conducted at the CCG offices or at a local hotel solely with the participants, RLH and MJ  
49  
50 24 present. All participants gave written informed consent to take part in the study, and for the interviews  
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52 25 and focus groups to be audio recorded and transcribed verbatim. Ethical approval for the study was  
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54 26 granted by the Preston NHS Research Ethics Committee (reference 14/NW/0113).

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## 1 Analysis

2 The analysis was thematic, using a template approach [37]. Template analysis involves the  
3 summarising of themes through a coding template. Often, template analysis begins with an *a priori* set  
4 of themes. New themes are then added, or existing themes revised, as data is iteratively analysed in a  
5 process of developing a template [37]. An *a priori* set of thematic codes based upon strong  
6 structuration theory was developed from the literature [30, 32, 34, 38.] These included: external  
7 structures such as national or local policies, guidelines and governance; interactions, including  
8 relationships, conflicts and communication; the internal structures of agents including dispositions,  
9 skills, attitudes and cognitive demands; rules and contextuality including routines, social norms and  
10 regulations and technological structures including the social structures built into the technology. This  
11 set of codes was applied to the transcripts by MJ and documented using the QSR NVivo 10  
12 application. The coding template was then modified through successive readings and of the data and  
13 discussions with other authors. The template was then internally reviewed for completeness by MJ  
14 and DLP (who had independently reviewed all transcripts).

## 15 RESULTS

16 The ways in which the EMOS was implemented and adopted were conceptualised in four broad  
17 thematic categories: adoption of the system for information gathering; perceptions of the system as  
18 new; perceptions of the EMOS as requiring technical competence; and the interactions and  
19 relationships that involved individual or collective use of the technology.

### 20 *Adoption of the system for information gathering*

21 The EMOS facilitated the efficient acquisition of information relating to the appropriateness of  
22 prescribing for individual patients. External structures provided the conditions for the use of the  
23 technology; specifically through the requirements of national policies relating to safe medicines use as  
24 set down by national governance and guidelines and the CCG's responses to those requirements. The  
25 CCG was motivated to carry out audits of prescribing, and much of the data extracted through such

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3 1 audits were used to benchmark the CCG against these national policies and targets. This auditing was in  
4  
5 2 turn determined by the policy and institutional climate that required the reporting of such auditing, the  
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7 3 setting of certain guidelines and targets, and the adherence to those. This further led to the CCG utilising  
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9 4 the technology in a local context to monitor prescribing behaviour in practices in response to local  
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11 5 initiatives. External structures such as national or local “initiatives” worked with the internal structures  
12  
13 6 (in this specific instance the motivations of the CCG to report in response to these “initiatives”) and the  
14  
15 7 material properties of the technology, to more swiftly identify patients registered with general practices  
16  
17 8 that met the relevant prescribing safety audit. The material properties of the system shaped the ability  
18  
19 9 to conduct extensive searches of electronic health records across multiple general practices in a  
20  
21 10 relatively short space of time. According to the following extract from an interview with a CCG  
22  
23 11 pharmacist the technological structures enabled the collection of data in a more efficient and timely  
24  
25 12 fashion.

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28 13 *“[...]it’s a way of being able to gather pseudo-anonymised individual patient data and relate it to*  
29  
30 14 *ideas and thoughts around initiatives that CCG or the medicines management team are looking at*  
31  
32 15 *that perhaps has been identified or highlighted nationally, or locally and it can all be done*  
33  
34 16 *relatively quickly within a few seconds if necessary. So you don’t have to trawl round 17 different*  
35  
36 17 *practices” (CCGP2)*

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39 18 Centrally, in a form of pay for performance initiative, the CCG made the EMOS part of a “GP  
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41 19 *incentive scheme to engage with alerts in a meaningful way*” (GP1-INT) and this was conceptualised  
42  
43 20 as *“trying to sort of get some more traction”* (GP1-INT). Guidelines and documents concerning  
44  
45 21 strategies for prescribing framed the possibilities for use *“to actually monitor the progress against a*  
46  
47 22 *sort of target outcome”* (GP1-INT). The functionality within the EMOS allowed for benchmarking  
48  
49 23 across the CCG. This in turn provided for structures that could be utilised by the CCG to encourage  
50  
51 24 practices to use the system, and an infrastructure that supported their own activities in monitoring  
52  
53 25 prescribing behaviour and to *“reward good prescribing”* (GP1-INT).  
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3 1 *"if there are some practices that are demonstrating very good prescribing, then we've picked*  
4  
5 2 *those out as well and highlighted those to act as a kind of beacon of hope for everybody else".*  
6  
7 3 *(CCGP2)*  
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10 4 The system also allowed for communication channels and feedback, where contact with practices was  
11  
12 5 made through the system or as a result of alerts being sent out by email. Such communication, between  
13  
14 6 the clinicians placed centrally at the CCG and the individual GP practices, enabled the CCG to  
15  
16 7 monitor prescribing as *"a way of looking at the map"* (GP2) as well as the use of the system by  
17  
18 8 *"tracking our advice in those practices"* (GP1-INT). The codes and material properties of the system  
19  
20 9 facilitated monitoring in that logging on to the system indicated engagement with it. This in turn  
21  
22 10 allowed the CCG to further monitor and audit prescribing patterns since they could swiftly see which  
23  
24 11 practices had responded to alerts and *"[could] have some kind of objective measure that [gave them]*  
25  
26 12 *some idea as to who's perhaps even more engaged than others"* (CCGP2). The ambitions and  
27  
28 13 motivations of the CCG to monitor prescribing acted as an internal structure to work *"very hard to get*  
29  
30 14 *the uptake of that better"* (CCGP2) and in *"trying to persuade our clinicians to use it so that we get a*  
31  
32 15 *much more real time feedback."* (CCGP2). Furthermore, this combination of technological  
33  
34 16 infrastructure and the ambitions of the CCG created a new internal structure in the form of a  
35  
36 17 convention for using the system.  
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39 18 *"(When) the GP logs onto the Eclipse system and there's a little tick box to say patient*  
40  
41 19 *reviewed [...]. Now some practices are doing that as a regular routine exercise, so that means*  
42  
43 20 *that tracking our advice in those practices is very easy and what it does allow you to do as*  
44  
45 21 *well is not to send the same alert out to the same practice again"* (GP1-INT).  
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48  
49 22 In this way there were patterns of agent-technology relationships that reinforced a hierarchical agent -  
50  
51 23 agent relationship within the network. The CCG managers were interacting with the technology to  
52  
53 24 monitor prescribing since engagement at local clinician level with the system was encouraged by the  
54  
55 25 CCG, because it provided further feedback to them, agent-technology relationships could build  
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3 1 through the system use as new agent -agent relationships between managers centrally at the CCG and  
4  
5 2 local GPs.

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8 3 ***Perceptions of the system as new***

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10 4 Using the EMOS was characterised as a new practice that would require new approaches. Resistance  
11  
12 5 towards the system was thus justified by characterising existing behaviours as ingrained. Here, habits  
13  
14 6 and ways of doing things that were presented by one GP as "*the old fashioned way*" (CCGP2)  
15  
16 7 provided for a limited use of the system. One such disposition was around their prescribing habits,  
17  
18 8 which they described as "*conservative*" (CCGP2). This allowed for a limited use of the EMOS, in  
19  
20 9 which most alerts would not require action because prescribing behaviour was already "*protective of*  
21  
22 10 *patients*"(CCGP2). Similarly, as the following extract illustrates, non-use of the system resulted from  
23  
24 11 habitual accustomed practice of using other systems, pre-existing routines and repetitive ways of  
25  
26 12 doing things.

27  
28  
29  
30 13 *"I think the trouble is Eclipse is another thing you have to log into along with the other 20*  
31  
32 14 *things you log into every day, and you're so used to using your other clinical system all the*  
33  
34 15 *time."*(GPM3)

35  
36  
37 16 In a further example of agent-agent relationships associated with the use of the system, the CCG  
38  
39 17 pharmacists were concerned that GPs would otherwise avoid using the system. It was assumed that GPs,  
40  
41 18 in addition to training on the system, needed persuasion in order to "*just [get] them to use it as habit*"  
42  
43 19 (CCGP1).

44  
45  
46 20 *"but we have had a situation where the GP said, oh, I'm not sure if I'll have time to look on*  
47  
48 21 *Eclipse, but you can't spoon feed them everything"*(CCGP1)

49  
50  
51 22 Social structures could shape the ways things were done. Workplace routines and practices, such as  
52  
53 23 the prioritisation of work schedules, acted as constraints or enablers to the use of the new system.

54  
55 24 Here this GP highlighted contingencies within the structures associated with the "*special*  
56  
57 25 *circumstances of my workplace*" (GP4) which allowed for a range of actions from side-lining the alert  
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1 through to reviewing the patient. In this way the duality of structure - the specific demands of his  
2 work - and his agency - his interaction with the alerts in the EMOS - both governed his act of utilising  
3 the system and the extent and character of that utilisation.

4 *"[...] it can depend on the nature of the alerts, how urgent it seems, and the special circumstances*  
5 *of my workplace [...] some things might actually get side-lined for a few weeks if they're not*  
6 *clinically urgent, but [...] the next time I catch up with my paperwork then I'll dig up that*  
7 *alert[...]and review the situation"* (GP4)

8 For the CCG pharmacist, undertaking medication reviews in care homes the system changed the way  
9 they worked because *"if necessary if there's something that comes up on Eclipse whilst we're there we*  
10 *can, rather than having to go back to the surgery first, check it and then make a decision"* (CCGP1). In  
11 this way the technology shaped their actions. Furthermore the technological structures in the EMOS and  
12 the internal structures led to new shared decision making, use and outcome.

13 *"We can look on Eclipse and most of the time it's on Eclipse and we can answer the question*  
14 *there and then. For example, we had a patient who was on Memantine, who was a really not very*  
15 *well gentleman, [...] so we phoned the GP straightaway."*(CCGP1)

### 16 ***Perceptions of the EMOS as requiring technical competence***

17 The EMOS was conceptualised as a "clever" system that could conduct complex searches, but would  
18 require technical knowledge on the part of users in order to do so. This allowed for this GP's limited use  
19 of the system when combined with an understanding of his own abilities to use the system;

20 *"That's how I become accustomed to doing things, which is perhaps why I then don't use Eclipse,*  
21 *because I do think I might not have the ability and the power of making the use of a more*  
22 *powerful tool. But, perhaps I have also then learned useful habits with the old fashioned way."*  
23 (GP4)

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3 1 Non-use of the system was associated with the cognitive and physical demands associated with using  
4  
5 2 the EMOS and finding time to learn how to get the best out of it. This further conceptualised the system  
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7 3 as complex requiring time, training and "proper teaching" (GPM2) to gain the expertise required to  
8  
9 4 utilise it.

10  
11  
12 5 *"And if you had the time to log into it and go oh, what does this do? What does that do? [...] You*  
13  
14 6 *train your audit clerk who runs all sorts of searches and does all sorts of audit work, you could*  
15  
16 7 *have the time to show her and teach her, [...] I'd love to have the time to tinker with, (the*  
17  
18 8 *system). [...] You'd need time to play with it and time to...proper teaching, proper (training)*  
19  
20 9 *showing us what it does" (GPM2)*

21  
22  
23 10 The conceptualisation of the EMOS as requiring technical competence was related to structures  
24  
25 11 embedded within the technology that allowed for or constrained its use. This could either empower users  
26  
27 12 and thus facilitate further use or could undermine that agency.

28  
29  
30 13 *"And also I'm computer literate and I can work out, I can problem solve because I'm reasonably*  
31  
32 14 *well educated, if you were talking about average population here, they would either give up, they*  
33  
34 15 *would probably have given up when they couldn't log in" (Pt2)*

35  
36  
37 16 This service user conceptualises the system as difficult and one that required her abilities as a "computer  
38  
39 17 literate" to use it. This required an interaction of her capabilities and the structures within the system to  
40  
41 18 engage with it and difficulties with logging in was perceived to be a potential constraint for other users.

42  
43  
44 19 ***Interactions and relationships: Individual, shared and collective use of the technology***

45  
46  
47 20 There were variations in the ways the technology was used within collaborative networks of social  
48  
49 21 relations. Different general practice staff took responsibility for using the technology; use depended  
50  
51 22 upon shared or collective roles, or upon a hierarchical allocation of access.

52  
53  
54 23 For service users, using the technology was determined by networks of social relations. This was  
55  
56 24 expressed as having support from medical professionals to understand the system.

1  
2  
3 1 *“But I think the important thing is before you sort of almost start using it, you do need that kind*  
4  
5 2 *of intervention from a medical practitioner in some way to actually help you with the things you*  
6  
7 3 *need to know” (Pt1)*  
8  
9

10 4 Within general practices, there was variation in who took responsibility for the EMOS. On receiving an  
11  
12 5 alert through the system one practice manager would then *“pass it on to the GP and get them to respond*  
13  
14 6 *to me” (GPM 2)* and that *“the doctors don’t access it at all. [...] I’m the only one that, yeah, has*  
15  
16 7 *anything to do with it.”(GPM 2)* Another remarked:

17  
18  
19 8 *“I get the alert the same way through the email, I identify the patient [...] then mine goes to the*  
20  
21 9 *GP. But the GP actions it, I don't have any more responsibility for it after that [...] They go into*  
22  
23 10 *Eclipse, they do it, [...] my job is just to literally give them the information and they do the rest.”*  
24  
25 11 *(GPM1)*  
26  
27

28 12 Such variation was driven by the conventions and norms associated with work practices. In different  
29  
30 13 general practices individuals were assigned to different roles and responsibilities often based on what  
31  
32 14 worked best for the practice.  
33  
34

35 15 *“one of the GPs has been nominated within our practice to take that lead in the same way that*  
36  
37 16 *we break our workload down in other areas; you be the lead for this and tell us if there's anything*  
38  
39 17 *we all need to know and share the workload.” (GPM4)*  
40  
41

42 18 The allocation of access to the EMOS limited its use. Community pharmacists did not have access to the  
43  
44 19 system. Perceived social norms were seen as *“historically a barrier” (CP2)* that perpetuated that lack of  
45  
46 20 access. Community pharmacists attributed this barrier to GPs seeing themselves as *“as the custodians of*  
47  
48 21 *the patient record” (CP2).*  
49  
50

51 22 *“I think there always has been a conflict because GPs often see themselves as the custodians of*  
52  
53 23 *the patient record and even though the information in that patient record, even abbreviated*  
54  
55 24 *information is incredibly useful for community pharmacists, they’ve never successfully managed*  
56  
57  
58  
59  
60

1  
2  
3 1 *to allow us access and this is going back to EPS [Electronic Prescription Service], this is what*  
4  
5 2 *EPS promised and it's never happened." (CP2)*  
6  
7

8 3 There was a perception that the system was a tool for the CCG. This differential access meant that the  
9  
10 4 system had not been used in some general practices. There were however perceptions that the system  
11  
12 5 had "evolved".  
13

14  
15 6 *"I think that's what it was [...] originally purchased...or the agreement with Eclipse was*  
16  
17 7 *originally for the meds management team to use it as a tool for them [...] And I think Eclipse has*  
18  
19 8 *evolved since that happened [...] And I don't think any of us have kept up with how Eclipse has*  
20  
21 9 *evolved and what else it can now do."(GPM3)*  
22  
23

24 10 Such changes were related to social norms around ownership and conventions concerning how the  
25  
26 11 system would be used; centrally by the CCG to look at prescribing patterns across practices, and by  
27  
28 12 individual practices of their own prescribing audits. As the system evolved there were perceptions that it  
29  
30 13 could do more. In this way, perceptions of the technological structures and material properties of the  
31  
32 14 technology drove the ambitions of some users to learn more about the potential uses of the system which  
33  
34 15 opened up access to different users.  
35  
36

## 37 **DISCUSSION**

38  
39

40 17 The adoption and implementation of the EMOS was dependent upon a dynamic mix of external  
41  
42 18 structures, internal structures and the material properties embedded in the technology. External  
43  
44 19 infrastructures, the motivations of users and the material properties of the EMOS facilitated information  
45  
46 20 gathering. Perceiving the system as new could lead to resistance and the maintenance of habitual  
47  
48 21 behaviours. Use was dependent upon interactions and relationships between users. Use could be further  
49  
50 22 constrained by conceptualising the system as requiring technical competence.  
51  
52

53 23 SST proposes that in order to act, agents draw upon internal structures. These internal structures include  
54  
55 24 dispositions and knowledge of the "strategic terrain" of external structures [29]. It has been suggested  
56  
57 25 that to understand the implementation and adoption of IT from a SST standpoint it is important to  
58  
59  
60

1 understand the context in which the IT is being introduced, the networks of people and technologies, the  
2 dispositions of actors in those networks, the material properties of the technology and how those shape  
3 human action [29, 32]. In the present study, the contextual background was shaped by policy relating to  
4 medication safety and the requirement to benchmark against national prescribing and safety targets.  
5 CCG managers' knowledge of the external structures relating to that policy background, and their own  
6 skills and ambitions, led to actions around the monitoring of prescribing behaviours across the CCG  
7 area. This was facilitated by material properties in the system. The outcomes of the monitoring  
8 actions were not just that prescribing data was gathered and reported to other institutions but that the  
9 external structures, the dispositions of the CCG managers and the material properties of the system  
10 allowed for governance and monitoring of clinicians behaviours through tracking engagement with the  
11 system and processes of persuasion and reward. This could therefore have been said to reinforce  
12 hierarchical relationships between the CCG and local GPs. Hence, the use of the system created new  
13 internal structures concerning such social rules and conventions. Similarly, in previous literature,  
14 information systems have been associated with enabling managers to capture information, place local  
15 clinicians under surveillance and make their actions calculable [39]. Furthermore, an effect of such  
16 surveillance is for individuals to adapt their own behaviour to ensure they act legitimately [40].

17 Previous literature has established the role of social, organisational and work practices in the adoption of  
18 IT, [16,1] others have focused upon functionality of design and tailoring to users [18, 41] or upon top-  
19 down implementation [41, 42]. Other research has indicated that emphasis upon training might also  
20 construct end-users as the problem [43]. With notable exceptions [29, 33, 34], much of this earlier  
21 literature has highlighted the importance of work practices and how technology needs to be embedded  
22 into pre-existing routines, but has not seen these dynamically linked to wider contexts particularly in the  
23 context of medication safety in primary care. In this study we found that key agents in the network either  
24 resisted or sustained use of the system. GPs saw the system as new and unnecessary and not compatible  
25 with existing workplace routines. There were also differences in agents responses to the material  
26 properties in the system where these were seen as facilitating use by some agents and by others as a  
27 barrier to use because the material properties of the system were perceived as to make it difficult to

1 use. SST enabled us to understand these dispositional behaviours in relation to social structures  
2 particularly pre-existing routines, work practices and social norms. In previous research there has been a  
3 focus upon interoperability, work practices and system usability suggesting that poor adoption of IT is  
4 related to users or the system [19, 41]. This misses how interactions and relationships between contexts,  
5 users and the technology might work and how the implementation of IT is a social practice [39]. In this  
6 study, these networks of social relations impacted upon the use of the system.

### 7 **Implications of the findings**

8 SST would argue that individual agency is dependent upon knowledge of rules and conventions.  
9 Primary care settings are governed by institutional norms, measures, rules and traditions, habits and  
10 behaviours [29, 44]. Some of these are embedded in local rules and conventions associated with the  
11 different working dynamics of individual practices, while others are found in regulations and  
12 governance associated with wider economic and institutional contexts [29, 45]. Using SST in this way  
13 may be particularly valuable in primary care research, as general practices operate with their own  
14 organizational culture and dynamic which may well lead to marked differences in working practices and  
15 structure [46].

16 This study highlights how healthcare IT interventions are implemented and adopted in a complex  
17 social and organisational context. Interventions that are top down and perceived as tools of managerial  
18 control are less likely to be effective than those that take into consideration existing local practices  
19 and the ambitions and attitudes of those who will use the technology.

### 20 **Strengths and limitations**

21 Much of the previous literature on interventions to improve medication safety has focused upon  
22 secondary healthcare settings, and electronic audit and feedback systems of the kind examined in this  
23 study are under-researched in primary care. A particular strength of this study is the use of strong  
24 structuration theory which was found to be a useful theoretical approach to studying the implementation  
25 and adoption of the EMOS in a primary care setting. In applying this theoretical approach we were able  
26 to see the differences in motivations, ambitions, aims and attitudes of different actors from different



1 stakeholder groups towards the IT intervention. Strong structuration theory could also reveal the  
2 complex contextual background in which the EMOS was implemented and revealed how the  
3 implementation was informed by wider contexts. Hence we were able to understand that the successful  
4 adoption of the EMOS was not merely dependent upon agents but upon the complex terrain in which it  
5 was implemented. Previous studies using this approach have focused upon large national IT projects  
6 where institutional contexts might be considered to have more impact [32, 47]. We found however that  
7 in a smaller scale project, wider policy institutional contexts did impact upon the implementation and  
8 adoption of the IT for example through the CCG's response to the requirements of national policies. In  
9 this way the use of the system depended on other factors alongside the dispositions of the users.

10 There are several limitations to this work which present further opportunities for future research  
11 examining the adoption and implementation of electronic audit and feedback systems to improve  
12 medication safety in primary care settings. It has been suggested that studies such as these explore wider  
13 social contexts through analysis of background data and through ethnographic observation [35,  
14 48]. Though we conducted one observation with a CCG pharmacist this was only as an extension of the  
15 interview with that participant to elicit some further understanding of how they used the EMOS. A  
16 number of naturalistic observations would have been useful in unpicking contexts and agents' choices  
17 and actions in using the system.

## 18 **CONCLUSION**

19 Our study examines the implementation and adoption of an IT system for medicines optimisation in  
20 primary care. It was found that the dynamic combination of external, internal and technological  
21 structures impacted upon the adoption and implementation of the system. Information technology  
22 interventions for medicines optimisation should consider how utilisation may depend on a  
23 combination of the infrastructure within primary care, social structures embedded in the technology  
24 and the conventions, norms and dispositions of those utilising it.

## 25 **Figures**

1  
2  
3 1 *Figure 1. Strong structuration theory incorporating a technology dimension (adapted from Stones,*  
4  
5 2 *2005).*

6  
7  
8 3 *Figure legend: Strong structuration theory incorporating a technology dimension (adapted from*  
9  
10 4 *Stones, 2005). Trisha Greenhalgh, Rob Stones **Theorising big IT programmes in healthcare: Strong***  
11  
12 5 ***structuration theory meets actor-network theory** Social Science & Medicine, Volume 70, Issue 9,*  
13  
14 6 *2010, 1285–1294*

## 17 **Abbreviations**

18  
19  
20 8 EMOS: Electronic medicines optimisation system; CCG: Clinical commissioning group. IT:  
21  
22 9 Information technology; SST: Strong Structuration Theory; GP: General practitioner; NHS: National  
23  
24 10 Health Service.

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28  
29  
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31  
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## 36 **Contributors**

37  
38  
39 16 All authors were involved in the design of this study. MJ led on recruitment of participants, data  
40  
41 17 collection, analysis of the data and drafting of the article. RLH helped co-facilitated focus groups.  
42  
43 18 DLP, RLH, SR, AJA and DMA also made contributions to analysis and interpretation. All authors  
44  
45 19 revised the article critically and approved the final version to be published.

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1  
2  
3 **1 Disclaimer**

4  
5 2 The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the  
6  
7 3 Department of Health.

8  
9  
10  
11 **5 Competing interests**

12  
13 6 The authors declare they have no competing interests.  
14  
15  
16

17  
18 **8 Ethical approval and consent to participate**

19 9 All participants gave informed written consent to take part in the study, and for the interviews and  
20  
21 10 focus groups to be audio recorded and transcribed verbatim . Ethical approval for the study was  
22  
23 11 granted by the NHS National Research Ethics Service (reference 14/NW/0113)  
24  
25  
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27  
28 **13 Availability of data**

29 14 Data cannot be shared because participants did not consent to this. In addition since this is a small  
30  
31 15 case study, involving small numbers of participants, there is a possibility that material in the  
32  
33 16 transcripts could identify participants.  
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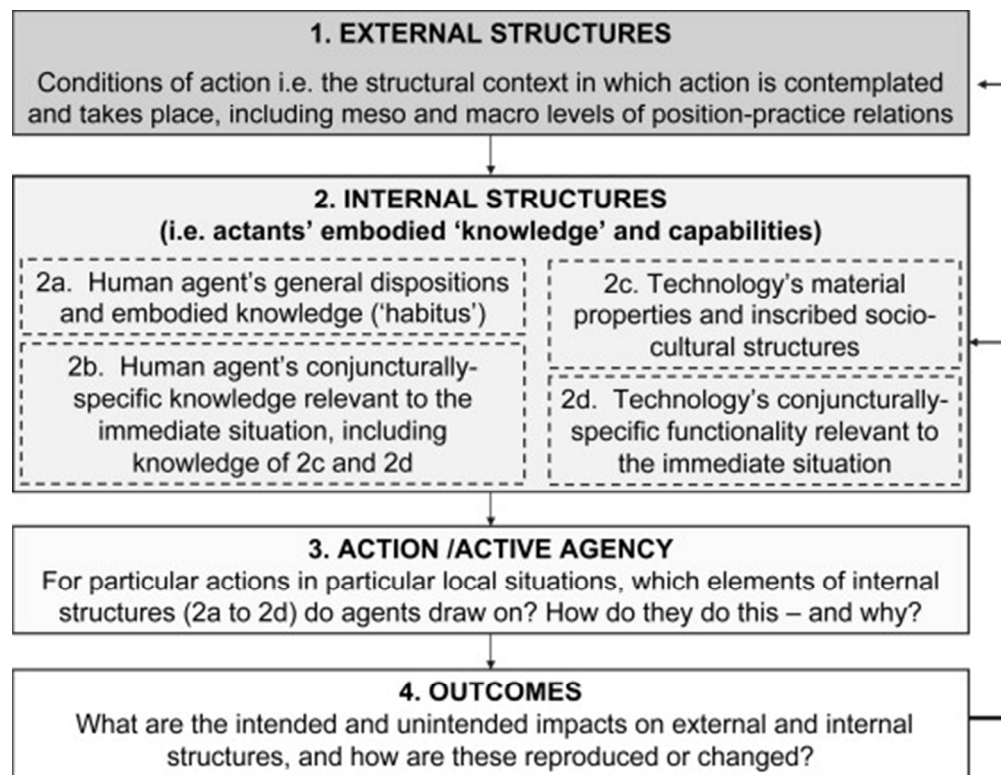
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120x92mm (113 x 113 DPI)

**Understanding the implementation and adoption of an information technology intervention to support medicines optimisation in primary care: qualitative study using strong structuration theory**

**COREQ checklist**

Note: in order to minimize the length of the manuscript, some of the details on the checklist (marked ‘\*’) are not included in the manuscript.

	<i>Guide question</i>	<i>Response</i>	<i>Page number in manuscript</i>
1	Interviewer/facilitator	MJ conducted the interviews. MJ and RLH facilitated the focus groups	9
2	Credentials	MJ holds an MSc in Health Psychology RLH holds a PhD in Medicines safety in Primary care	9
3	Occupation	MJ : Research Associate in medication safety; RLH: freelance research pharmacist	9
4	Gender	MJ male; RLH female	9
5	Experience and training	Both researchers have previous experience of undertaking qualitative research in healthcare at PhD and postdoctoral level	9
6	Relationship established	The researchers were not known to the participants prior to the study	9
7	Participant knowledge of the researcher	Participants were made aware of the reasons for doing the research via the information which was sent to the participant prior to the interview	*
8	Researcher characteristics	The researchers had identified the study topic as part of larger programmes of work in their research groups, medication safety in primary care.	9
9	Methodological orientation and theory	Strong structuration theory. The analysis was thematic using template analysis.	5-6, 10
10	Sampling	Individual participants were recruited on a purposive basis via the study CCG or through community pharmacy networks. All participants were chosen to fit the sampling frame (people within the CCG's geographical area who represented the stakeholder groups: pharmacists, doctors, general practice managers and patients)	8-9
11	Method of approach	Participants were approached by telephone or email	9
12	Sample size	19 participants	8-9
13	Non-participation	A number of possible participants were approached but declined to participate. Predominantly this was for reasons of time, workload or lack of use of the system. These included 2 pharmacist technicians, 2 GPs, 2 community pharmacists and 8 general practice managers.	*
14	Setting of data collection	Four interviews were conducted by telephone and one at the CCG offices, the focus groups were conducted at the CCG offices or at a local hotel.	9
15	Presence of non-participants	No non-participants were present	9

16	Description of sample	See Table 1 of the main manuscript	8
17	Interview guide	In the interviews and focus groups we explored experiences of working with the EMOS, perceptions of the system, benefits and drawbacks, the organisational structures and roles required for its use and the circumstances under which it was considered most effective. No pilot testing was undertaken due to the small scale nature of the study, the timescale of the study and the difficulties of recruitment.	9
18	Repeat interviews	None -One GP was interviewed and participated in a focus group	9
19	Audio/visual recording	Audio recording only, with consent from the participant	9
20	Field notes	None	*
21	Duration	The interviews lasted between 20 and 50 mins. The focus groups lasted between 57-112 mins.	9
22	Data saturation	Data collection continued until saturation was reached and no new themes emerged from the interviews and focus groups.	9
23	Transcripts returned	No transcripts were returned to participants	*
24	Number of data coders	MJ coded the data but regular discussions codes were held with all authors. Coding template reviewed by MJ and DLP	10
25	Description of the coding tree	A coding tree description is not given but details on a priori codes is included	10
26	Derivation of themes	A priori thematic codes were applied to the data and new themes emerged from the data. This is described in the analysis section	10
27	Software	QSRNvivo 10 software was utilised to manage the data	10
28	Participant checking	No	*
29	Quotations presented	Please see the results section of the manuscript	10-17
30	Data and findings consistent		10-17
31	Clarity of major themes		10-17
32	Clarity of minor themes		10-17

# BMJ Open

## Understanding the implementation and adoption of an information technology intervention to support medicines optimisation in primary care: qualitative study using strong structuration theory



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3 1 **Understanding the implementation and adoption of an information technology intervention to**  
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5 2 **support medicines optimisation in primary care: qualitative study using strong structuration**  
6  
7 3 **theory**  
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2  
3 1 **ABSTRACT**  
4

5  
6 2 **Objectives**  
7

8  
9 3 Using strong structuration theory, we aimed to understand the adoption and implementation of an  
10  
11 4 electronic clinical audit and feedback tool to support medicines optimisation for patients in primary  
12  
13 5 care.  
14

15  
16 6 **Design**  
17

18  
19 7 A qualitative study informed by strong structuration theory. The analysis was thematic, using a  
20  
21 8 template approach. An *a priori* set of thematic codes, based upon strong structuration theory, was  
22  
23 9 developed from the literature and applied to the transcripts. The coding template was then modified  
24  
25 10 through successive readings of the data.  
26  
27

28  
29 11 **Setting**  
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32 12 Clinical commissioning group in the South of England.  
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35 13 **Participants**  
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37  
38 14 Four focus groups and five semi-structured interviews were conducted with eighteen participants  
39  
40 15 purposively sampled from a range of stakeholder groups (general practitioners, pharmacists, patients  
41  
42 16 and commissioners).  
43

44  
45 17 **Results**  
46

47  
48 18 Using the system could lead to improved medication safety but use was determined by broad  
49  
50 19 institutional contexts, by the perceptions, dispositions and skills of users and by the structures  
51  
52 20 embedded within the technology. These included: perceptions of the system as new and requiring  
53  
54 21 technical competence and skill; the adoption of the system for information gathering; and interactions  
55  
56 22 and relationships that involved individual, shared or collective use. The dynamics between these  
57  
58 23 external, internal and technological structures affected the adoption and implementation of the system.  
59  
60

## 1 **Conclusions**

2 Successful implementation of information technology interventions for medicines optimisation will  
3 depend on a combination of the infrastructure within primary care, social structures embedded in the  
4 technology and the conventions, norms and dispositions of those utilising it. Future interventions,  
5 using electronic audit and feedback tools to improve medication safety, should consider the  
6 complexity of the social and organisational contexts and how internal and external structures can  
7 impact upon the use of the technology in order to support effective implementation.

## 8 **Strengths and limitations of this study**

- 9 • This is the first study to explore the implementation of electronic audit and feedback systems  
10 to improve medication safety in primary care using strong structuration theory.
- 11 • Strong structuration theory was found to be particularly valuable for unpicking why the  
12 system was used and the different motivations, ambitions, aims and attitudes of a range of  
13 stakeholders.
- 14 • This was an exploratory study that relied mainly upon interview and focus group data from a  
15 number of key stakeholders located in one clinical commissioning group in England.
- 16 • Additional insights may have been gained by undertaking ethnographic observation to  
17 discover exactly the ways people utilised the Electronic Medicines Optimisation System  
18 (EMOS)

## 19 **INTRODUCTION**

20 Prescribing of medicines to patients is the most common clinical intervention in primary care.  
21 However, with high volumes of medicines prescribed in primary care [1], the prevalence of repeat  
22 prescribing and the increased burden and complexity of multimorbidity and related polypharmacy  
23 [2,3], there is an increased likelihood that prescribing or monitoring errors can occur [4,5]. Recent  
24 studies using prescribing safety indicators to investigate the prevalence of hazardous prescribing in

1 primary care found 5.2 to 5.5% of patients to be at risk of potentially hazardous prescribing and 7.6  
2 to 11.8% of patients not receiving recommended monitoring tests [6,7]. Some medication errors may  
3 not lead to harm; however, approximately 13% of patients have experienced an adverse drug event  
4 after receiving prescription medication in primary care, and many of those have been serious enough  
5 for patients to seek medical assistance at hospital [8, 9]. The monitoring of patients in receipt of  
6 prescription medication is therefore considered important in order to avoid potentially serious adverse  
7 drug events.

8 In the UK, national and local policies have set out recommendations for medication safety  
9 improvement [10-12]. "An Organisation with a Memory" [13] set out the necessity for the  
10 establishment of a patient safety culture within healthcare organisations. This emphasised the  
11 importance of organisational practices. Policy has also set out how the utilisation of information  
12 technology presents opportunities to fulfil medication safety requirements and that the contribution of  
13 information systems should be maximised [11]. This was further enhanced by Department of Health  
14 recommendations in the report "Building a Safer NHS for patients: Improving Medication Safety"  
15 [10], which recommended that steps to safer prescribing may include the implementation of effective  
16 IT systems particularly those systems that might highlight and give warnings to medical staff of  
17 prescription errors. Similar recommendations have suggested there is a need to develop systems that  
18 optimise the use of medicines and that this might include improved electronic decision support for  
19 clinicians [12]. Locally, the Clinical Commissioning Group (CCG) that formed the setting for this  
20 study operated a prescribing incentive scheme designed to improve the quality of prescribing, respond  
21 to the requirements of national guidelines, and reduce excessive prescribing and costs, which was  
22 incentivised by small financial rewards for general practices [14].

23 Healthcare information technology (IT) systems may be useful for monitoring medication usage.  
24 However, the implementation of such IT has not always been successful, with technology being  
25 resisted, not used effectively or used differently than was planned. Previous research has suggested  
26 that reasons for this might reside in the design and functionality of the technology. Poorly designed or  
27 implemented IT systems have been seen to create cognitive overload [15], and disrupt workflow [16].



1  
2  
3 1 Furthermore, IT systems may be utilised in ways unintended by developers, either to overcome  
4  
5 2 problems with design or as new uses for the technology become apparent [17-19]. However, such  
6  
7 3 tailoring of systems suggests a dynamic where implementation actually involves interpretation and  
8  
9 4 adaptation of systems to fit existing work practices, or changes to work practices in order to adapt to  
10  
11 5 the new system [20-25]. In other words, the success or failure of an IT implementation could be seen  
12  
13 6 as being shaped by interactions between the technology, the users and social and organisational  
14  
15 7 processes [26-28]. This sociotechnical view, rather than focusing only upon the functionality of  
16  
17 8 systems, takes into account the complex nature of healthcare and the cultural, social and  
18  
19 9 organisational aspects of the workplaces [22-29].

20  
21  
22 10 Strong structuration theory (SST) has been proposed as a way of examining these sociotechnical  
23  
24 11 aspects of healthcare IT implementation [30]. It is based on Giddens' structuration theory, which  
25  
26 12 proposed a relationship between structures (such as social norms, political and economic institutions)  
27  
28 13 and agency (people's actions and choices) [31]. According to Stones [30], SST extends this structure -  
29  
30 14 agency relationship to include the following elements (see figure 1):

- 31  
32  
33 15 • *External structures*, which are the physical social or economic context in which action is  
34  
35 16 contemplated. External structures are built through social positions, practices and networks of  
36  
37 17 social relationships [29, 32]. These could include hierarchical relationships between employers  
38  
39 18 and employees, professional roles, local and national guidelines, governance measures,  
40  
41 19 regulations, professional codes of practice, as well as local work practices and interactions  
42  
43 20 among groups of stakeholders [30, 32].
- 44  
45 21 • *Internal structures*, which are manifest in two ways. Firstly, as the skills, dispositions,  
46  
47 22 ambitions, attitudes, values, past experiences of actors and ways of viewing the world;  
48  
49 23 Secondly as the actors' knowledge of rules, conventions, obligations and social norms, which  
50  
51 24 may involve partial understandings and past experiences. These inform how one is supposed  
52  
53 25 to act in specific situations in the here and now, based upon the agents understanding of  
54  
55 26 external structures [30, 32-33].

- 1 • *Agency*, which is how and why agents draw upon internal structures to act in particular ways  
2 in specific situations [32]
- 3 • *Outcome*, which is the way agency impacts on external or internal structures and how they are  
4 maintained or changed [32].

5 Stones and Greenhalgh [32] further explained the role of technology in SST: rather than there being  
6 symmetry between technology and human actors, they are instead separate and may act in different  
7 ways [32]. Technology incorporates procedures, codes, material properties and standards that can  
8 enable or constrain use [19, 32-34]; it is therefore seen as shaping human actions by making certain  
9 actions possible [35]. Previous studies [29, 34] suggest that SST can illuminate the implementation  
10 and adoption of information technology by understanding how people "*take action with respect to*  
11 *technologies*"; in other words, what people actually do with the systems and to what effect [32].

12 Strong structuration theory has been previously used to understand the ways a large scale healthcare  
13 IT intervention, designed to assist patients and General Practitioners (GPs) to book hospital outpatient  
14 appointments, was resisted or adopted [34].

15 INSERT FIGURE 1

16 This study uses SST to examine a new electronic medicines optimisation system (EMOS) [36] that  
17 was implemented in a primary care locality. The EMOS allows different stakeholders - general  
18 practitioners, Clinical Commissioning Group (CCG) managers, pharmacists, general practice  
19 managers, and patients - access to real time anonymized patient data including medical diagnoses,  
20 prescribed medications and laboratory test results. It comprises a secure patient database and a web-  
21 based user interface that extracts patient specific data from the general practice clinical record system.  
22 The interface provides a number of user functions; these include reviewing a specific patient health  
23 record, identifying patients who are at risk of a medication-related adverse event, such as those who  
24 are on inappropriate combinations of drugs or who have not received appropriate monitoring and  
25 carrying out clinical audits on a subset of patients [36]. The EMOS also allowed clinicians and  
26 managers in the health locality to audit prescribing practices across general practices and make

1  
2  
3 1 comparisons against national guidelines. Patients have access to the system through a patient passport  
4  
5 2 which allows them to view their medications and test results. In this context it was felt that SST would  
6  
7 3 unpick the ways in which users of the system drew upon their dispositions, attitudes skills and  
8  
9 4 ambitions and upon their knowledge of and understanding of external structures to engage with the  
10  
11 5 technology. Therefore, we aimed to examine the specific question: “in what ways did external,  
12  
13 6 internal and technological structures impact upon the implementation and adoption of the EMOS?”

## 16 7 **METHODS**

### 19 8 **Study design and setting**

22 9 Our study used a qualitative design. The study setting was a CCG in the South of England, which was  
23  
24 10 chosen because it was an early adopter of the EMOS and had all general practices signed up to the  
25  
26 11 system. The CCG was relatively small in size (17 separate general practices, and approximately  
27  
28 12 140,000 patients). Medicines management activities at the CCG were undertaken by three clinical  
29  
30 13 pharmacists (including participants CCGP1 and CCGP2) and two pharmacy technicians. Additionally  
31  
32 14 one GP (participant GP1) operated as prescribing lead for the CCG. In the English National Health  
33  
34 15 Service (NHS), a CCG is a clinically-led statutory NHS body responsible for the planning and  
35  
36 16 commissioning of health care services for their local area, and cover groups of general practices  
37  
38 17 within a local area. The sampling frame was people within the CCG’s geographical area who  
39  
40 18 represented the stakeholder groups. This included doctors, pharmacists, general practice managers and  
41  
42 19 patients.

### 46 20 **Understanding the background**

49 21 Prior to data collection we undertook actions to build a picture of the system and the context in which  
50  
51 22 it was to be used. Authors MJ and RLH were given an overview of the system in a preliminary  
52  
53 23 meeting with the study CCG prior to data collection. In addition MJ visited a separate CCG in the  
54  
55 24 North of England that was utilising the EMOS. Web-based materials relating to the system were read  
56  
57 25 prior to data collection [36].

1 **Recruitment and data collection**

2 Individual participants were recruited on a purposive basis via the CCG or through community  
3 pharmacy networks, to represent the different stakeholder groups (see Table 1).

4 Table 1 – Case study participants

Participants	Role	How they used the EMOS
<b>Interviews</b>		
GP1-INT	General Practitioner	In general practice and prescribing lead for the Clinical Commissioning Group (CCG) . Worked with the medicines management team in supporting the adoption of the EMOS by the CCG. Used the EMOS to send alerts to GPs.
GP2	General Practitioner	In general practice and respiratory lead for the CCG. Utilised the EMOS to undertake audits of prescribing relating to respiratory conditions.
GP3	General Practitioner	In general practice
CCGP1 (additional observation as part of interview)	CCG Pharmacist	Utilised the EMOS to undertake medication reviews with care home patients
CCGP2	CCG Pharmacist	CCG medicines management team. Used the EMOS to run audits centrally at the CCG and then alert clinicians locally
<b>Focus group A - General Practitioners</b>		
GP4	General Practitioner	In general practice
GP1-FG	General Practitioner	In practice and as prescribing lead for the CCG
<b>Focus group B – Community Pharmacists</b>		
CP1	Community Pharmacist	Aware of, but no access
CP2	Community Pharmacist	Aware of, but no access
CP3	Community Pharmacist	Aware of, but no access
CP4	Community Pharmacist	Aware of, but no access
<b>Focus Group C – Patients</b>		
Pt1	Patient	Access through patient passport
Pt2	Patient	Access through patient passport
Pt3	Patient	Access through patient passport
Pt4	Patient	Access through patient passport
<b>Focus Group D - General practice managers</b>		
GPM1	General Practice Manager	In general practice
GPM2	General Practice Manager	In general practice
GPM3	General Practice Manager	In general practice
GPM4	General Practice Manager	In general practice

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3 1  
4  
5 2 Potential participants were contacted by telephone or email. Five semi-structured interviews (lasting  
6  
7 3 between 20-50 minutes) were conducted with three GPs and two CCG pharmacists, who were known  
8  
9 4 to be using the system, and had specific roles that required the use of the EMOS between August and  
10  
11 5 December 2014. Four homogeneous focus groups (lasting between 57-112 minutes) were also  
12  
13 6 conducted between September and December 2014, each with a specific group of stakeholders: GPs  
14  
15 7 (2); community pharmacists (4); patients (4); and general practice managers (4). No repeat interviews  
16  
17 8 were conducted, although one GP was interviewed and also participated in a focus group. Each focus  
18  
19 9 group was conducted with different a specific type of stakeholder, as this was felt to facilitate free and  
20  
21 10 open discussion.

22  
23  
24 11 Topic guides for the interviews and focus groups were developed by reading relevant literature  
25  
26 12 examining the implementation of information technology in healthcare settings. [16, 17, 20, 23, 24].  
27  
28 13 Both interviews and focus groups were conducted to illicit individual thoughts and opinions and to  
29  
30 14 promote discussion amongst specific homogenous groups of stakeholders. In the interviews and focus  
31  
32 15 groups, we explored experiences of working with the EMOS, perceptions of the system, benefits and  
33  
34 16 drawbacks, the organisational structures and roles required for its use and the circumstances under  
35  
36 17 which it was considered most effective. Data collection continued until saturation was reached and no  
37  
38 18 new themes emerged from the interviews and focus groups. The interviews and focus groups were  
39  
40 19 carried out by a male research associate in medication safety trained and experienced in qualitative  
41  
42 20 health research who holds an MSc in Health Psychology (MJ). The focus groups were co-facilitated  
43  
44 21 by a female freelance research pharmacist experienced in qualitative methodology and with a PhD in  
45  
46 22 Medicines Safety in Primary Care (RLH). The researchers were not known to the participants prior to  
47  
48 23 the study. Four interviews were conducted by telephone and one at the CCG offices. The focus  
49  
50 24 groups were conducted at the CCG offices or at a local hotel solely with the participants, RLH and MJ  
51  
52 25 present. All participants gave written informed consent to take part in the study, and for the interviews  
53  
54 26 and focus groups to be audio recorded and transcribed verbatim. Ethical approval for the study was  
55  
56 27 granted by the Preston NHS Research Ethics Committee (reference 14/NW/0113).

1

## 2 **Analysis**

3 The analysis was thematic, using a template approach [37]. Template analysis involves the  
4 summarising of themes through a coding template. Often, template analysis begins with an *a priori* set  
5 of themes . New themes are then added, or existing themes revised, as data is iteratively analysed in a  
6 process of developing a template [37]. An *a priori* set of thematic codes based upon strong  
7 structuration theory was developed from the literature [30, 32, 34, 38 ]. These included: external  
8 structures such as national or local policies, guidelines and governance; interactions, including  
9 relationships, conflicts and communication; the internal structures of agents including dispositions,  
10 skills, attitudes and cognitive demands; rules and contextuality including routines, social norms and  
11 regulations and technological structures including the social structures built into the technology. This  
12 set of codes was applied to the transcripts by MJ and documented using the QSR NVivo 10  
13 application. The coding template was then modified through successive readings of the data and  
14 discussions with other authors. The template was then internally reviewed for completeness by MJ  
15 and DLP (who had independently reviewed all transcripts).

## 16 **RESULTS**

17 The ways in which the EMOS was implemented and adopted were conceptualised in four broad  
18 thematic categories: adoption of the system for information gathering; perceptions of the system as  
19 new; perceptions of the EMOS as requiring technical competence; and the interactions and  
20 relationships that involved individual or collective use of the technology.

### 21 ***Adoption of the system for information gathering***

22 The EMOS facilitated the efficient acquisition of information relating to the appropriateness of  
23 prescribing for individual patients. External structures provided the conditions for the use of the  
24 technology; specifically through the requirements of national policies relating to safe medicines use as  
25 set down by national governance and guidelines and the CCG's responses to those requirements. The

1 CCG was motivated to carry out audits of prescribing, and much of the data extracted through such  
2 audits were used to benchmark the CCG against these national policies and targets. This auditing was in  
3 turn determined by the policy and institutional climate that required the reporting of such auditing, the  
4 setting of certain guidelines and targets, and the adherence to those. This further led to the CCG utilising  
5 the technology in a local context to monitor prescribing behaviour in practices in response to local  
6 initiatives. External structures such as national or local "initiatives" worked with the internal structures  
7 (in this specific instance the motivations of the CCG to report in response to these "initiatives") and the  
8 material properties of the technology, to more swiftly identify patients registered with general practices  
9 that met the relevant prescribing safety audit. The material properties of the system shaped the ability  
10 to conduct extensive searches of electronic health records across multiple general practices in a  
11 relatively short space of time. According to the following extract from an interview with a CCG  
12 pharmacist the technological structures enabled the collection of data in a more efficient and timely  
13 fashion.

14 *"[...]it's a way of being able to gather pseudo-anonymised individual patient data and relate it to*  
15 *ideas and thoughts around initiatives that CCG or the medicines management team are looking at*  
16 *that perhaps has been identified or highlighted nationally, or locally and it can all be done*  
17 *relatively quickly within a few seconds if necessary. So you don't have to trawl round 17 different*  
18 *practices"(CCGP2)*

19 Centrally, in a form of pay for performance initiative, the CCG made the EMOS part of a "GP  
20 incentive scheme to engage with alerts in a meaningful way" (GP1-INT) and this was conceptualised  
21 as "trying to sort of get some more traction" (GP1-INT). Guidelines and documents concerning  
22 strategies for prescribing framed the possibilities for use "to actually monitor the progress against a  
23 sort of target outcome" (GP1-INT). The functionality within the EMOS allowed for benchmarking  
24 across the CCG. This in turn provided for structures that could be utilised by the CCG to encourage  
25 practices to use the system, and an infrastructure that supported their own activities in monitoring  
26 prescribing behaviour and to "reward good prescribing" (GP1-INT).

1  
2  
3 1 *"if there are some practices that are demonstrating very good prescribing, then we've picked*  
4  
5 2 *those out as well and highlighted those to act as a kind of beacon of hope for everybody else".*  
6  
7 3 *(CCGP2)*  
8  
9

10 4 The system also allowed for communication channels and feedback, where contact with practices was  
11  
12 5 through the system or as a result of alerts being sent out by email. Such communication, between the  
13  
14 6 clinicians placed centrally at the CCG and the individual GP practices, enabled the CCG to monitor  
15  
16 7 prescribing as *"a way of looking at the map"* (GP2) as well as the use of the system by *"tracking our*  
17  
18 8 *advice in those practices"* (GP1-INT). The codes and material properties of the system facilitated  
19  
20 9 monitoring in that logging on to the system indicated engagement with it. This in turn allowed the  
21  
22 10 CCG to further monitor and audit prescribing patterns since they could swiftly see which practices  
23  
24 11 had responded to alerts and *"[could] have some kind of objective measure that [gave them] some idea*  
25  
26 12 *as to who's perhaps even more engaged than others"* (CCGP2). The ambitions and motivations of the  
27  
28 13 CCG to monitor prescribing acted as an internal structure to work *"very hard to get the uptake of that*  
29  
30 14 *better"* (CCGP2) and in *"trying to persuade our clinicians to use it so that we get a much more real*  
31  
32 15 *time feedback."* (CCGP2). Furthermore, this combination of technological infrastructure and the  
33  
34 16 ambitions of the CCG created a new internal structure in the form of a convention for using the  
35  
36 17 system.  
37  
38

39 18 *"(When) the GP logs onto the Eclipse system and there's a little tick box to say patient*  
40  
41 19 *reviewed [...]. Now some practices are doing that as a regular routine exercise, so that means*  
42  
43 20 *that tracking our advice in those practices is very easy and what it does allow you to do as*  
44  
45 21 *well is not to send the same alert out to the same practice again"* (GP1-INT).  
46  
47

48  
49 22 In this way there were patterns of agent-technology relationships that reinforced a hierarchical agent -  
50  
51 23 agent relationship within the network. The CCG managers were interacting with the technology to  
52  
53 24 monitor prescribing since engagement at local clinician level with the system was encouraged by the  
54  
55 25 CCG, because it provided further feedback to them, agent-technology relationships could build  
56  
57  
58  
59  
60



1 through the system use as new agent-agent relationships between managers centrally at the CCG and  
2 local GPs.

### 3 *Perceptions of the system as new*

4 Using the EMOS was characterised as a new practice that would require new approaches. Resistance  
5 towards the system was thus justified by characterising existing behaviours as ingrained. Here, habits  
6 and ways of doing things that were presented by one GP as "*the old fashioned way*" (CCGP2),  
7 provided for a limited use of the system. One such disposition was around their prescribing habits,  
8 which they described as "*conservative*" (CCGP2). This allowed for a limited use of the EMOS, in  
9 which most alerts would not require action because prescribing behaviour was already "*protective of*  
10 *patients*"(CCGP2). Similarly, as the following extract illustrates, non-use of the system resulted from  
11 habitual accustomed practice of using other systems, pre-existing routines and repetitive ways of  
12 doing things.

13 *"I think the trouble is Eclipse is another thing you have to log into along with the other 20*  
14 *things you log into every day, and you're so used to using your other clinical system all the*  
15 *time."*(GPM3)

16 In a further example of agent-agent relationships associated with the use of the system, the CCG  
17 pharmacists were concerned that GPs would otherwise avoid using the system. It was assumed that GPs,  
18 in addition to training on the system, needed persuasion in order to "*just [get] them to use it as habit*"  
19 (CCGP1).

20 *"but we have had a situation where the GP said, oh, I'm not sure if I'll have time to look on*  
21 *Eclipse, but you can't spoon feed them everything"*(CCGP1)

22 Social structures could shape the ways things were done. Workplace routines and practices, such as  
23 the prioritisation of work schedules, acted as constraints or enablers to the use of the new system.

24 Here this GP highlighted contingencies within the structures associated with the "*special*  
25 *circumstances of my workplace*" (GP4) which allowed for a range of actions from side-lining the alert

1 through to reviewing the patient. In this way the duality of structure - the specific demands of his  
2 work - and his agency - his interaction with the alerts in the EMOS - both governed his act of utilising  
3 the system and the extent and character of that utilisation.

4 *"[...] it can depend on the nature of the alerts, how urgent it seems, and the special circumstances*  
5 *of my workplace [...] some things might actually get side-lined for a few weeks if they're not*  
6 *clinically urgent, but [...]the next time I catch up with my paperwork then I'll dig up that*  
7 *alert[...]and review the situation"* (GP4)

8 For the CCG pharmacist, undertaking medication reviews in care homes the system changed the way  
9 they worked because *"if necessary if there's something that comes up on Eclipse whilst we're there we*  
10 *can, rather than having to go back to the surgery first, check it and then make a decision"* (CCGP1). In  
11 this way the technology shaped their actions. Furthermore the technological structures in the EMOS and  
12 the internal structures led to new shared decision making, use and outcome.

13 *"We can look on Eclipse and most of the time it's on Eclipse and we can answer the question*  
14 *there and then. For example, we had a patient who was on Memantine, who was a really not very*  
15 *well gentleman, [...] so we phoned the GP straightaway."*(CCGP1)

### 16 ***Perceptions of the EMOS as requiring technical competence***

17 The EMOS was conceptualised as a "clever" system that could conduct complex searches, but would  
18 require technical knowledge on the part of users in order to do so. This allowed for this GP's limited use  
19 of the system when combined with an understanding of his own abilities to use the system;

20 *"That's how I become accustomed to doing things, which is perhaps why I then don't use Eclipse,*  
21 *because I do think I might not have the ability and the power of making the use of a more*  
22 *powerful tool. But, perhaps I have also then learned useful habits with the old fashioned way."*  
23 (GP4)

1  
2  
3 1 Non-use of the system was associated with the cognitive and physical demands associated with using  
4  
5 2 the EMOS and finding time to learn how to get the best out of it. This further conceptualised the system  
6  
7 3 as complex requiring time, training and "*proper teaching*" (GPM2) to gain the expertise required to  
8  
9 4 utilise it.

10  
11  
12 5 *"And if you had the time to log into it and go oh, what does this do? What does that do? [...] You*  
13  
14 6 *train your audit clerk who runs all sorts of searches and does all sorts of audit work, you could*  
15  
16 7 *have the time to show her and teach her, [...] I'd love to have the time to tinker with, (the*  
17  
18 8 *system). [...] You'd need time to play with it and time to...proper teaching, proper (training)*  
19  
20 9 *showing us what it does" (GPM2)*

21  
22  
23 10 The conceptualisation of the EMOS as requiring technical competence was related to structures  
24  
25 11 embedded within the technology that allowed for or constrained its use. This could either empower users  
26  
27 12 and thus facilitate further use or could undermine that agency.

28  
29  
30 13 *"And also I'm computer literate and I can work out, I can problem solve because I'm reasonably*  
31  
32 14 *well educated, if you were talking about average population here, they would either give up, they*  
33  
34 15 *would probably have given up when they couldn't log in" (Pt2)*

35  
36  
37 16 This service user conceptualises the system as difficult and one that required her abilities as a "*computer*  
38  
39 17 *literate*" to use it. This required an interaction of her capabilities and the structures within the system to  
40  
41 18 engage with it and difficulties with logging in was perceived to be a potential constraint for other users.

42  
43  
44 19 ***Interactions and relationships: Individual, shared and collective use of the technology***

45  
46  
47 20 There were variations in the ways the technology was used within collaborative networks of social  
48  
49 21 relations. Different general practice staff took responsibility for using the technology; use depended  
50  
51 22 upon shared or collective roles, or upon a hierarchical allocation of access.

52  
53  
54 23 For service users, using the technology was determined by networks of social relations. This was  
55  
56 24 expressed as having support from medical professionals to understand the system.

1  
2  
3 1 *“But I think the important thing is before you sort of almost start using it, you do need that kind*  
4  
5 2 *of intervention from a medical practitioner in some way to actually help you with the things you*  
6  
7 3 *need to know” (Pt1)*  
8  
9

10 4 Within general practices, there was variation in who took responsibility for the EMOS. On receiving an  
11  
12 5 alert through the system one practice manager would then *“pass it on to the GP and get them to respond*  
13  
14 6 *to me” (GPM 2)* and that *“the doctors don’t access it at all. [...] I’m the only one that, yeah, has*  
15  
16 7 *anything to do with it.”(GPM 2)* Another remarked:

17  
18  
19 8 *“I get the alert the same way through the email, I identify the patient [...] then mine goes to the*  
20  
21 9 *GP. But the GP actions it, I don't have any more responsibility for it after that [...] They go into*  
22  
23 10 *Eclipse, they do it, [...] my job is just to literally give them the information and they do the rest.”*  
24  
25 11 *(GPM1)*  
26  
27

28 12 Such variation was driven by the conventions and norms associated with work practices. In different  
29  
30 13 general practices individuals were assigned to different roles and responsibilities often based on what  
31  
32 14 worked best for the practice.  
33  
34

35 15 *“one of the GPs has been nominated within our practice to take that lead in the same way that*  
36  
37 16 *we break our workload down in other areas; you be the lead for this and tell us if there's anything*  
38  
39 17 *we all need to know and share the workload.” (GPM4)*  
40  
41

42 18 The allocation of access to the EMOS limited its use. Community pharmacists did not have access to the  
43  
44 19 system. Perceived social norms were seen as *“historically a barrier” (CP2)* that perpetuated that lack of  
45  
46 20 access. Community pharmacists attributed this barrier to GPs seeing themselves as *“as the custodians of*  
47  
48 21 *the patient record” (CP2).*  
49  
50

51 22 *“I think there always has been a conflict because GPs often see themselves as the custodians of*  
52  
53 23 *the patient record and even though the information in that patient record, even abbreviated*  
54  
55 24 *information is incredibly useful for community pharmacists, they’ve never successfully managed*  
56  
57  
58  
59  
60

1  
2  
3 1 *to allow us access and this is going back to EPS [Electronic Prescription Service], this is what*  
4  
5 2 *EPS promised and it's never happened." (CP2)*  
6  
7

8 3 There was a perception that the system was a tool for the CCG. This differential access meant that the  
9  
10 4 system had not been used in some general practices. There were however perceptions that the system  
11  
12 5 had "evolved".  
13

14  
15 6 *"I think that's what it was [...] originally purchased...or the agreement with Eclipse was*  
16  
17 7 *originally for the meds management team to use it as a tool for them [...] And I think Eclipse has*  
18  
19 8 *evolved since that happened [...] And I don't think any of us have kept up with how Eclipse has*  
20  
21 9 *evolved and what else it can now do."(GPM3)*  
22  
23

24 10 Such changes were related to social norms around ownership and conventions concerning how the  
25  
26 11 system would be used; centrally by the CCG to look at prescribing patterns across practices, and by  
27  
28 12 individual practices of their own prescribing audits. As the system evolved there were perceptions that it  
29  
30 13 could do more. In this way, perceptions of the technological structures and material properties of the  
31  
32 14 technology drove the ambitions of some users to learn more about the potential uses of the system which  
33  
34 15 opened up access to different users.  
35  
36

## 37 **DISCUSSION**

38  
39

40 17 The adoption and implementation of the EMOS was dependent upon a dynamic mix of external  
41  
42 18 structures, internal structures and the material properties embedded in the technology. External  
43  
44 19 infrastructures, the motivations of users and the material properties of the EMOS facilitated information  
45  
46 20 gathering. Perceiving the system as new could lead to resistance and the maintenance of habitual  
47  
48 21 behaviours. Use was dependent upon interactions and relationships between users. Use could be further  
49  
50 22 constrained by conceptualising the system as requiring technical competence.  
51  
52

53 23 SST proposes that in order to act, agents draw upon internal structures. These internal structures include  
54  
55 24 dispositions and knowledge of the "strategic terrain" of external structures [29]. It has been suggested  
56  
57 25 that to understand the implementation and adoption of IT from a SST standpoint it is important to  
58  
59  
60

1 understand the context in which the IT is being introduced, the networks of people and technologies, the  
2 dispositions of actors in those networks , the material properties of the technology and how those shape  
3 human action [29, 32]. In the present study the contextual background was shaped by policy relating to  
4 medication safety and the requirement to benchmark against national prescribing and safety targets.  
5 CCG managers' knowledge of the external structures relating to that policy background and their own  
6 skills and ambitions led to actions around the monitoring of prescribing behaviours across the CCG area.  
7 This was facilitated by material properties in the system. The outcomes from of the monitoring actions  
8 were not just that prescribing data was gathered and reported to other institutions but that the external  
9 structures, the dispositions of the CCG managers and the material properties of the system allowed for  
10 governance and monitoring of clinicians behaviours through tracking engagement with the system and  
11 processes of persuasion and reward. This could therefore have been said to reinforce hierarchical  
12 relationships between the CCG and local GPs. Hence the use of the system created new internal  
13 structures concerning such social rules and conventions. Similarly, in previous literature, information  
14 systems have been associated with enabling managers to capture information, place local clinicians  
15 under surveillance and make their actions calculable [39]. Furthermore, an effect of such surveillance is  
16 for individuals to adapt their own behaviour to ensure they act legitimately [40].

17  
18 Previous literature has established the role of social, organisational and work practices in the adoption of  
19 IT, [16,17] others have focused upon functionality of design and tailoring to users [18, 41] or upon top-  
20 down implementation [41, 42]. Other research has indicated that emphasis upon training might also  
21 construct end-users as the problem [43]. With notable exceptions [29, 33, 34], much of this earlier  
22 literature has highlighted the importance of work practices and how technology needs to be embedded  
23 into pre-existing routines, but has not seen these dynamically linked to wider contexts particularly in the  
24 context of medication safety in primary care. In this study we found that key agents in the network either  
25 resisted or sustained use of the system. GPs saw the system as new and unnecessary and not compatible  
26 with existing workplace routines. There were also differences in agents responses to the material  
27 properties in the system where these were seen as facilitating use by some agents and by others as a

1  
2  
3 1 barrier to use because the material properties of the system were perceived as to make it difficult to  
4  
5 2 use. SST enabled us to understand these dispositional behaviours in relation to social structures  
6  
7 3 particularly pre-existing routines, work practices and social norms. In previous research there has been a  
8  
9 4 focus upon interoperability, work practices and system usability suggesting that poor adoption of IT is  
10  
11 5 related to users or the system [19, 41]. This misses how interactions and relationships between contexts,  
12  
13 6 users and the technology might work and how the implementation of IT is a social practice [39]. In this  
14  
15 7 study, these networks of social relations impacted upon the use of the system.  
16

### 17 18 **Implications of the findings**

19  
20 9 SST would argue that individual agency is dependent upon knowledge of rules and conventions.  
21  
22 10 Primary care settings are governed by institutional norms, measures, rules and traditions, habits and  
23  
24 11 behaviours [29, 44]. Some of these are embedded in local rules and conventions associated with the  
25  
26 12 different working dynamics of individual practices while others are found in regulations and governance  
27  
28 13 associated with wider economic and institutional contexts [29, 45]. Using SST in this way may be  
29  
30 14 particularly valuable in primary care research since general practices operate with their own  
31  
32 15 organizational culture and dynamic which may well lead to marked differences in working practices and  
33  
34 16 structure [46].  
35

36  
37  
38 17 This study highlights how healthcare IT interventions are implemented and adopted in a complex  
39  
40 18 social and organisational context. Interventions that are top down and perceived as tools of managerial  
41  
42 19 control are less likely to be effective than those that take into consideration existing local practices  
43  
44 20 and the ambitions and attitudes of those who will use the technology.  
45

### 46 47 **Strengths and limitations**

48  
49 22 Much of the previous literature on interventions to improve medication safety has focused upon  
50  
51 23 secondary healthcare settings, and electronic audit and feedback systems of the kind examined in this  
52  
53 24 study are under-researched in primary care. A particular strength of this study is the use of strong  
54  
55 25 structuration theory which was found to be a useful theoretical approach to studying the implementation  
56  
57 26 and adoption of the EMOS in a primary care setting. In applying this theoretical approach we were able  
58  
59  
60

1 to see the differences in motivations, ambitions, aims and attitudes of different actors from different  
2 stakeholder groups towards the IT intervention. Strong structuration theory could also reveal the  
3 complex contextual background in which the EMOS was implemented and revealed how the  
4 implementation was informed by wider contexts. Hence we were able to understand that the successful  
5 adoption of the EMOS was not merely dependent upon agents but upon the complex terrain in which it  
6 was implemented. Previous studies using this approach have focused upon large national IT projects  
7 where institutional contexts might be considered to have more impact [32, 47]. We found however that  
8 in a smaller scale project, wider policy institutional contexts did impact upon the implementation and  
9 adoption of the IT for example through the CCG's response to the requirements of national policies. In  
10 this way the use of the system depended on other factors alongside the dispositions of the users.

11 There are several limitations to this work which present further opportunities for future research  
12 examining the adoption and implementation of electronic audit and feedback systems to improve  
13 medication safety in primary care settings. It has been suggested that studies such as these explore wider  
14 social contexts through analysis of background data and through ethnographic observation [35, 48  
15 ]. Though we conducted one observation with a CCG pharmacist this was only as an extension of the  
16 interview with that participant to elicit some further understanding of how they used the EMOS. A  
17 number of naturalistic observations would have been useful in unpicking contexts and agents' choices  
18 and actions in using the system.

## 19 **CONCLUSION**

20 Our study examines the implementation and adoption of an IT system for medicines optimisation in  
21 primary care. It was found that the dynamic combination of external, internal and technological  
22 structures impacted upon the adoption and implementation of the system. Information technology  
23 interventions for medicines optimisation should consider how utilisation may depend on a  
24 combination of the infrastructure within primary care, social structures embedded in the technology  
25 and the conventions, norms and dispositions of those utilising it.

## 26 **Figures**



1  
2  
3 1 *Figure 1.* Strong structuration theory incorporating a technology dimension (adapted from Stones,  
4  
5 2 2005).

6  
7  
8 3 *Figure legend:* Strong structuration theory incorporating a technology dimension (adapted from  
9  
10 4 Stones, 2005). Trisha Greenhalgh, Rob Stones **Theorising big IT programmes in healthcare:**  
11  
12 5 **Strong structuration theory meets actor-network theory** Social Science & Medicine, Volume 70,  
13  
14 6 Issue 9, 2010, 1285–1294

### 17 **Abbreviations**

18  
19  
20 8 EMOS: Electronic medicines optimisation system; CCG: Clinical commissioning group. IT:  
21  
22 9 Information technology; SST: Strong Structuration Theory; GP: General practitioner; NHS: National  
23  
24 10 Health Service.

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28  
29  
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### 36 **Contributors**

37  
38  
39 16 All authors were involved in the design of this study. MJ led on recruitment of participants, data  
40  
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42  
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44  
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2  
3 **1 Disclaimer**

4  
5 2 The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the  
6  
7 3 Department of Health.

8  
9  
10  
11 **5 Competing interests**

12  
13 6 The authors declare they have no competing interests.  
14  
15  
16

17 **8 Ethical approval and consent to participate**

18  
19 9 All participants gave informed written consent to take part in the study, and for the interviews and  
20  
21 10 focus groups to be audio recorded and transcribed verbatim . Ethical approval for the study was  
22  
23 11 granted by the NHS National Research Ethics Service (reference 14/NW/0113)  
24  
25  
26

27 **13 Availability of data**

28  
29 14 Data cannot be shared because participants did not consent to this. In addition since this is a small  
30  
31 15 case study, involving small numbers of participants, there is a possibility that material in the  
32  
33 16 transcripts could identify participants.  
34  
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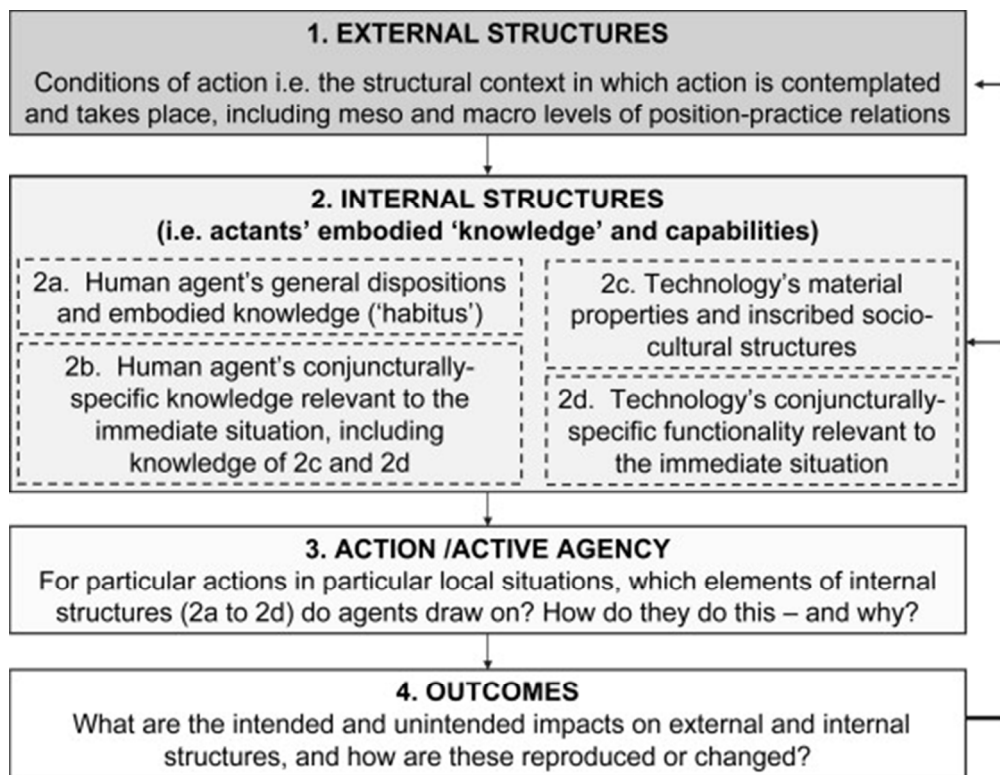
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**Understanding the implementation and adoption of an information technology intervention to support medicines optimisation in primary care: qualitative study using strong structuration theory**

**COREQ checklist**

Note: in order to minimize the length of the manuscript, some of the details on the checklist (marked ‘\*’) are not included in the manuscript.

	<i>Guide question</i>	<i>Response</i>	<i>Page number in manuscript</i>
1	Interviewer/facilitator	MJ conducted the interviews. MJ and RLH facilitated the focus groups	9
2	Credentials	MJ holds an MSc in Health Psychology RLH holds a PhD in Medicines safety in Primary care	9
3	Occupation	MJ : Research Associate in medication safety; RLH: freelance research pharmacist	9
4	Gender	MJ male; RLH female	9
5	Experience and training	Both researchers have previous experience of undertaking qualitative research in healthcare at PhD and postdoctoral level	9
6	Relationship established	The researchers were not known to the participants prior to the study	9
7	Participant knowledge of the researcher	Participants were made aware of the reasons for doing the research via the information which was sent to the participant prior to the interview	*
8	Researcher characteristics	The researchers had identified the study topic as part of larger programmes of work in their research groups, medication safety in primary care.	9
9	Methodological orientation and theory	Strong structuration theory. The analysis was thematic using template analysis.	5-6, 10
10	Sampling	Individual participants were recruited on a purposive basis via the study CCG or through community pharmacy networks. All participants were chosen to fit the sampling frame (people within the CCG's geographical area who represented the stakeholder groups: pharmacists, doctors, general practice managers and patients)	8-9
11	Method of approach	Participants were approached by telephone or email	9
12	Sample size	19 participants	8-9
13	Non-participation	A number of possible participants were approached but declined to participate. Predominantly this was for reasons of time, workload or lack of use of the system. These included 2 pharmacist technicians, 2 GPs, 2 community pharmacists and 8 general practice managers.	*
14	Setting of data collection	Four interviews were conducted by telephone and one at the CCG offices, the focus groups were conducted at the CCG offices or at a local hotel.	9
15	Presence of non-participants	No non-participants were present	9

16	Description of sample	See Table 1 of the main manuscript	8
17	Interview guide	In the interviews and focus groups we explored experiences of working with the EMOS, perceptions of the system, benefits and drawbacks, the organisational structures and roles required for its use and the circumstances under which it was considered most effective. No pilot testing was undertaken due to the small scale nature of the study, the timescale of the study and the difficulties of recruitment.	9
18	Repeat interviews	None -One GP was interviewed and participated in a focus group	9
19	Audio/visual recording	Audio recording only, with consent from the participant	9
20	Field notes	None	*
21	Duration	The interviews lasted between 20 and 50 mins. The focus groups lasted between 57-112 mins.	9
22	Data saturation	Data collection continued until saturation was reached and no new themes emerged from the interviews and focus groups.	9
23	Transcripts returned	No transcripts were returned to participants	*
24	Number of data coders	MJ coded the data but regular discussions codes were held with all authors. Coding template reviewed by MJ and DLP	10
25	Description of the coding tree	A coding tree description is not given but details on a priori codes is included	10
26	Derivation of themes	A priori thematic codes were applied to the data and new themes emerged from the data. This is described in the analysis section	10
27	Software	QSRNvivo 10 software was utilised to manage the data	10
28	Participant checking	No	*
29	Quotations presented	Please see the results section of the manuscript	10-17
30	Data and findings consistent		10-17
31	Clarity of major themes		10-17
32	Clarity of minor themes		10-17