

# PHOENIX: A new framework for applying psychological theories to the adoption of innovations by healthcare professionals

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## Research

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# Abstract

Background: Although implementation science has borrowed concepts from psychology to explain how individuals think and act in relation to innovation adoption, the use of psychology has been limited and not well adapted to the aims and obligations of professionals. We aimed to enrich implementation science with a broader set of psychological theories relevant for professional behaviour, drawing particularly on the diffusion of innovations and stages of change models.

Methods : The study had two parallel components. The first was a hermeneutic review of how psychological theory has and could be used to understand innovation adoption by health professionals. The second component was an empirical case study of the implementation of guidance on routine HIV screening in three sites across two London hospitals. Primary data sources were synthesised and combined with emerging secondary research findings, each feeding into the other. Analysis focused empirically on how the stages of the diffusion of innovations adoption model (prior conditions, knowledge, persuasion, decision, implementation, confirmation) could be enriched by psychological theories.

Results: The hermeneutic review identified at least 20 relevant psychological theories from social, organisational, developmental and sports psychology; many of these were not single theories but contributions from domains of evolving research, making this an underestimate of potentially relevant theory. We developed a model (PHOENIX) to encapsulate how psychological theory can help illuminate each stage of adoption from diffusion of innovations theory:

- *Person and History* (prior conditions stage) – individuals' characteristics and past experiences;
- *Overload avoidance* (knowledge stage) – filtering strategies when faced with overwhelming amounts of new knowledge;
- *Evolving attitudes* (persuasion stage) – a social process of collectively emerging views within a team;
- *Networked decisions* (decision stage) – decisions at two levels of the department combined with individual judgements;
- *Implementation support* (implementation stage) to turn an intention to act into actual action, with external supports valuable to reduce the cognitive effort required;
- *uneXceptional* (confirmation stage) – sustained effort to turn the new behaviour from a conscious innovation to a habit.

Conclusions: The PHOENIX model, if affirmed in further studies, has potential to enrich the study of innovation adoption by healthcare staff in organisational and professional contexts.

# Contributions To The Literature

- Implementation science has borrowed concepts from psychology but these concepts could be more richly theorised and more closely aligned with the stages of implementation;
- This is the first study to enrich the individual adoption component of diffusion of innovation theory with robust psychological theories for each stage.
- We offer a new model, PHOENIX, which covers prior conditions, overload avoidance, evolving attitudes, networked decisions, implementation support and confirmation.
- Our model draws on the full breadth of psychological theory to improve implementation.

## Background

Research findings, and evidence-based guidelines based on them, can be thought of as innovations, defined by Everett Rogers as "*an idea, practice or object that is perceived as new*" (1, 2). Rogers' diffusion of innovations framework, first developed in the 1950s to explain uptake of new farming practices in Iowa, USA, has proved enduring for understanding the transfer and uptake of knowledge more generally (2), and in particular for seeing this as a staged process that takes place within a social system (as opposed to a one-off, isolated decision by an individual).

Rogers' empirical focus was on independent agents – farmers – who were not members of an organisation and whose social interactions were limited to encounters with other farmers, salespeople and university knowledge brokers; change came slowly in mid-20<sup>th</sup> century rural Iowa. Healthcare staff, in contrast, operate in a highly complex and rapidly evolving social and organisational system, with multiple layers and actors many of whom are actively seeking to bring about different types of change within the system (3).

In 2004, Greenhalgh and colleagues published a narrative systematic review which extended Rogers' diffusion of innovations model to include the complex organisational and regulatory context within which individual actors contemplated the adoption of any innovation (4). This review, which has been widely cited, drew on a wide range of academic disciplines, including organisational and management studies as well as interdisciplinary fields such as development studies and health promotion. Their framework was subsequently incorporated into an overview by Damschroder et al, who combined it with 18 other frameworks in a 'Consolidated Framework for Advancing Implementation Science' (5).

One research tradition that Greenhalgh et al identified as critically important to the study of the adoption of innovations but beyond the scope of their 2004 review was psychology (4). Rogers (whose undergraduate degree was in agriculture and PhD was in sociology) included what he called 'psychological antecedents of innovation' in his original diffusion of innovations model, but these were covered somewhat cursorily and were not theorised in psychological terms. None of the 19 frameworks and models incorporated into Damschroder's Consolidated Framework (5) included a central focus on the

psychology of professional behaviour change, though some did include relevant psychological theories (in particular a paper exploring the role of different theoretical perspectives by Grol et al (6)).

In principle, the health psychology is the area of psychology that should include the psychological dimension of health systems (7). However, the extensive work on developing theories and evidence regarding people's behaviour in relation to their own health has not been complemented with a similar focus on health professional behaviour. This is problematic, as the psychological underpinnings of how we behave in our personal lives and as professionals are fundamentally different (8). Professional objectives are defined in relation to our employer or our client; professional actions take into account external requirements such as standards; we judge ourselves and are judged by outcomes for others rather than solely for ourselves.

Despite this, the main psychological theories used to look at the behaviour of health professionals have been those used to look at people's behaviour in relation to their own health, in particular the theory of planned behaviour and the related theory of reasoned action (9) (10). The PRIME project aimed to investigate how effective the principal theories are empirically through a series of studies evaluating how well different theories explained and predicted health professional behaviour (11, 12). These studies found that four of the theories were moderately effective in predicting intentions: the theory of planned behaviour, social cognitive theory, implementation intentions and operant conditioning predicted 25% to 42.6% of variation ( $R^2$ ) in intention. However, the performance of the theories declined strikingly when considering actual behaviour (measured through administrative data), where even these four best-performing theories only explained 2.4% to 6.3% of the variation in behaviour. This difference is not that surprising; Eccles, Hrisos (13) had already reported on a systematic review showing that the correlation between intention and behaviour varied widely, from -0.42 to 0.52, with results varying substantially according to study methodology. This provides empirical support to the argument that those psychological theories which are currently mainly used in implementation science are not providing a useful basis for understanding and predicting professional behaviour.

Michie et al aimed to simplify the complexity of the wide range of psychological theories that might be relevant to implementation science by identifying a core set of psychological constructs that would be usable by interdisciplinary implementation researchers. To achieve this, they conducted a consensus exercise with experts in health services research and health psychology. This process identified 128 constructs drawing on 33 different psychological theories. The resulting Theoretical Domains Framework (TDF) has proved helpful in a wide range of studies (14).

However, this approach suffers from two weaknesses. The first is that it loses the explanatory power of theory. By separating out constructs from their originating theories, the Theoretical Domains Framework provides a useful checklist, but does not retain the explanatory power of the theories they stem from.

The second weakness is that the Theoretical Domains Framework focuses on the individual adopter, and does not take sufficient account of the wider organisational and system context that is vital to

considering the real-world adoption of innovation by health professionals. Though some researchers have sought to address this perceived weakness by combining the Theoretical Domains Framework with Damschroder et al's Consolidated Framework in empirical studies of innovation (15), this emerging research strategy itself illustrates a persisting lack of consensus about how to link multi-level, interdisciplinary models of how innovation happens in healthcare organisations with psychological theories of innovation adoption by healthcare staff. There remains a gap in research focusing on the distinctive character of the psychology of health professional behaviour in a way that is also linked to their wider social and professional context.

The aim of this study was to address this gap by extending the diffusion of innovations model by integrating psychological theories that are relevant to professional behaviour change, thereby strengthening both fields of research and informing more effective implementation efforts.

Our research question was: "Can the process of individual adoption described in Rogers' diffusion of innovation model provide a structuring device for integrating psychological theory into a multi-level theoretical framework for implementing innovation in healthcare? If so, which psychological theories are most relevant for innovation adoption by health professionals?".

## **Study Design And Methods**

The study had two components which were undertaken in parallel, each informing the other: a hermeneutic review of how psychological theory has and could be used to understand the implementation of research findings in healthcare, and an empirical case study of the implementation of guidance on routine HIV screening in two London hospitals (Figure 1).

## **Secondary research to identify relevant psychological theories**

We aimed to identify how psychology has been used to understand the adoption of innovations by professionals in healthcare organisations, and to identify additional relevant psychological theories that could extend existing theoretical approaches. We began this systematic review with a protocol-based literature search of four databases (PubMed, PubMed Central, PsycINFO and Web of Science Social Science Citation Index). However, this proved neither sensitive nor specific, identifying only three relevant papers from over 3500 hits (16). This was due partly to the diffuse and heterogeneous nature of the dataset and partly to the fact that many psychological terms (such as beliefs, attitudes or self-esteem) were used with a vernacular meaning rather than linked to specific psychological theories or definitions.

Noting our previous finding that informal and unstructured search strategies are significantly more efficient and effective than protocol-based ones when dealing with diffuse bodies of literature and terms that have multiple meanings (17), we sought suggestions from experts in the field and used citation tracking ('snowballing'). In addition, following our previous methodology for ascertaining the 'normal

science' of research traditions beyond our immediate expertise (18), we identified classic descriptions of theories related to implementation and change from psychology textbooks.

Our goal was to identify as wide a range as possible of potentially relevant psychological theories, going beyond those currently used in the health psychology literature. To achieve this, we broke down the review according to each of the stages of individual adoption as described by Rogers, and sought to identify relevant psychological theories for each of these stages. For example, the 'knowledge' stage can be understood as a process of information acquisition and processing, and so we sought to identify potentially relevant psychological theories about these processes. In particular, we sought theories from areas such as social and organisational psychology, reflecting the professional and organisational contexts in which health professionals work, as well as theories related to the psychology of expertise and expert performance.

## Empirical research: multi-site case study

We undertook an empirical case study the focus of which was on individual health professional behaviour in order to explore and refine our emerging theoretical framework. Ethics approval for this study was granted by the Queen Mary University of London Research Ethics Committee in June 2014 (QMREC1362c); NHS approval was granted for each research site.

The case study selected was implementation of UK National Guidance on universal offering of HIV testing in hospitals whose catchment populations met the threshold for high HIV prevalence (>2 per 1000)(19). This includes all of London, for example (20). Studies of implementing this guidance show that there is much variability in testing rates among clinicians (21). This case was chosen because, unlike many clinical practice guidelines where clinician behaviour is heavily protocol-driven or the intervention of interest is included in a wider protocol or care pathway, offering an HIV test to a patient attending for a different complaint is largely a point-of-care decision by the individual clinician, albeit one that takes place within a wider context. Thus this case enabled us, to some extent at least, to focus on this individual adoption of innovations.

We collected data at three sites in London, which were parts of two large teaching hospital trusts, both of which had made an organisational commitment to deliver routine HIV testing as set out in the guidance. The core dataset consisted of semi-structured interviews with health professionals and others involved in offering HIV testing, supplemented with field notes and related hospital documents; it is summarised in Table 1.

Access to sites came through links with researchers and clinicians interested in this topic and connected at national level. Through this network, we were able to contact the lead consultant responsible for HIV testing at both sites. These lead consultants were then crucial in providing contacts for potential participants and sustaining support for the research within each site, which was challenging in both cases. While the lead consultant responsible for this guidance in each case was an HIV consultant, the

action required mostly took place in other departments (in particular the accident and emergency departments, acute admissions units, and some specialised departments). This guidance was not such a priority for those departments and getting their agreement to participate and agreeing practical opportunities to interview staff required sustained engagement, in the case of one department for well over six months. Interviews were typically 30-40 minutes long, at a time and place convenient to the participants (either at their workplace or in one instance remotely). The interview structure is provided at appendix one.

Interviews were transcribed and coded, and combined with field notes and documents for analysis. Field notes for each site visit were used to record the organisational setting for interviews; example documents were sought where these were related to discussions in the interview, such as how HIV testing had been incorporated into processes such as booklets and checklists.

## Synthesis and development of a theoretical model

Literature review findings and empirical data were synthesised using an adaptation of the hermeneutic process described by Boell and Cecez-Kecmanovic (22), as illustrated in Figure 1. Starting from the wide range of potentially psychological theories that we identified from the literature review, we used Rogers' individual adoption model as a means of focusing on relevant psychological questions for each stage, as described above. So for the initial stage of knowledge we identified relevant theories of how information is acquired and shared; for the stage of persuasion how attitudes are formed, and so on, in an iterative process. We continued this iterative process as we integrated analysis of the empirical data. The empirical analysis of the initial interviews suggested further avenues of inquiry for the secondary research. For example, the initial literature review focused primarily on decision-making at individual level, but empirical data suggested that group decision-making was also relevant. This prompted additional review of the psychological literature on that topic, and the theories identified through that in turn provided sensitising concepts which then helped to refine future interviews and the empirical analysis, as shown in Figure 1. We have also presented emerging findings to clinicians and researchers and incorporated feedback. This article follows the SRQR standards for reporting qualitative research (23).

## Results

In this section, we first offer brief descriptive findings from our literature review and empirical case study. We then describe our theoretical synthesis in the form of a new model of individual adoption of innovations (PHOENIX) which refines and extends Rogers' original model of individual adoption by integrating relevant psychological theory for each stage.

## Descriptive findings

The structured search phase of our hermeneutic literature review identified 3528 titles, but as described above, after screening these we found that only three met the inclusion criterion (a specific psychological theory relevant to the adoption of innovations by professionals). Using snowball searching, asking experts and consulting textbooks identified an additional 72 sources; after excluding duplicates our final dataset consisted of 75 papers and book chapters. From these, we identified a total of 20 potentially relevant candidate theories or theoretical domains from cognitive, social, organisational, developmental and sports psychology.

Implementation rates for routine HIV screening were low at both sites (10-40% across the A&E and AAU departments), but varied widely between individual clinicians and between departments, and contrasted with some other departments achieving 90% coverage of HIV screening. The overall picture was of clinicians who were faced with an overwhelming volume of information, which they were coping with through strategies for heavily filtering and prioritising information. This guidance on routine HIV screening was by and large viewed positively but was also being evaluated in the wider context of other priorities (including those set by the wider organisation and system), and their role in comparison to other potential providers such as general practitioners. While in principle offering the test was an individual decision for each clinician interacting with a particular patient, the context for those decisions was strongly shaped at the group level, though collective discussion and norms within particular teams. Many departments were using classical environmental cues such as prompts at the bedside to remind clinicians about the test and reassure patients about its acceptability, but these were not sufficient to ensure implementation. For example, one unit had widespread wearing of 'we test for HIV' badges and had integrated prominent prompts for the test in the booklets used to record the processing of each patient, and yet still had a testing rate of only 10%.

We found that the stages of adoption from Rogers' diffusion of innovations model did provide a useful structuring device for disentangling different psychological processes during adoption, for analysing those in relation to psychological theories from the literature and for organising and analysing our empirical data, as we describe below. Each of these stages of adoption appeared to be analytically distinct from a psychological perspective, in that each of the stages involved distinctive psychological processes which related to different wider psychological theories, and there did not appear to be any additional stages required to explain our data. This does not mean that these stages described a universal or linear process; rather, it means that the stages were conceptually and analytically distinct (though we discuss below some concepts that varied from those described by Rogers for each of the adoption stages). Moreover, using these stages of adoption as a structuring device opened up a broader and more useful range of psychological theory.

## Theoretical synthesis: the PHOENIX model

We propose the mnemonic PHOENIX to depict the five stages of the refined model of individual adoption of innovations, preceded by prior conditions. Each stage is underpinned by a number of specific

psychological theories. The PHOENIX stages are summarised in Table 2 and described in more detail below. Examples of empirical data are provided in an additional file.

## Person and History (prior conditions)

Rogers described prior conditions such as age, gender, cultural background, motivation, values, goals and relevant (general or specific) knowledge, all of which set the context for the stages of an individual's decision to adopt an innovation or not (1).

In psychological terms, these antecedent characteristics can be understood principally in terms of personality traits. Costa and McCrea's five factor model (24) is the principal psychological model used for describing personality characteristics, and sees personality in five basic dimensions of neuroticism, extraversion, openness, agreeableness and conscientiousness. Several of these may have links to early adoption, such as openness and conscientiousness, but it is unlikely to be either practical or ethical to discriminate between health professionals on the basis of their personality profiles. Accordingly, we did not seek to assess personality profiles as part of our empirical data collection, though the relationship of personality type to innovation adoption is an area of potential future research.

More relevant was the history of each person before this specific situation of potential adoption. Some participants already had experience of the utility of testing for HIV as part of their clinical care, or had come from departments where this was already well-established practice, and they referred to this as a reference point shaping their adoption in this situation. Conversely, some participants had experience of previous innovations that they had not perceived positively, and that also appeared to affect their openness to this proposed change. In almost all cases, the individual profile and history of each individual was clearly relevant in shaping their view of this innovation.

## Overload avoidance (knowledge stage)

In Rogers' model, the first stage in the individual adoption process was 'knowledge' – whether and when the potential adopter learnt about the innovation. For health professionals today, this is not a matter of having too little information, but rather facing volumes of information that are beyond the capacity of individual professionals to absorb (25, 26). Reflecting this, we found that the information strategies being employed by health professionals were less concerned with seeking out information than filtering it.

In our case study, we identified four specific filtering mechanisms used by health professionals to avoid information overload:

- getting most of their information through *peer networks* (different networks offered different kinds of information – and of different quality and detail);
- being *selective* about additional sources of potentially useful information such as email alerts;

- prioritising certain kinds of information (notably, safety-related messages) from more general NHS information channels; and
- seeking out additional information on the basis of what was of personal interest to them.

These strategies can be understood through a combination of two psychological theories: bounded rationality and selective exposure to information.

*Bounded rationality* was first introduced as a concept by Simon in 1955 (27) as a way of describing the practical strategies of thinking that people use to make choices, rather than the impractical and in many instances impossible attempt to analyse all possible options. In the situation of cognitive overload facing today's healthcare professionals, finding such 'satisficing' strategies for reduced processing of information is arguably essential. This need not mean worse outcomes; as Marewski and Gigerenzer argue, simplified approaches (using heuristics, for example, rather than working exhaustively through each choice) can be "ecologically rational" (28, p80). The heuristic to attend preferentially to information offered by peers, for example, usually means that a similarly qualified professional has already processed this information and considered it relevant.

*Selective exposure* is a psychological mechanism through which people avoid information likely to challenge their attitudes, beliefs or behaviours (29). The model for selective exposure contrasts two conflicting motivations: a 'defence motivation' (avoiding information creating a cognitive dissonance) and an 'accuracy motivation' (seeking out the most relevant information whether it is comfortable or not). Information about new practices and techniques can be expected to create some cognitive dissonance (by definition, it is likely to challenge the professional's current practice). Nevertheless, the accuracy motivation could sometimes overcome this discomfort – as illustrated by the fact that clinicians in our sample were distinctively open to safety-related information.

## Evolving attitudes to the innovation (persuasion stage)

The second stage in Rogers' innovation adoption model was persuasion. In psychological terms, persuasion can be seen as the formation of positive attitudes towards the innovation. Rogers strongly emphasised the social nature of persuasion, especially by others whom the intended adopter considered similar to themselves (peer opinion leaders) or more knowledgeable (expert opinion leaders). In his model of innovation, Rogers emphasised a construct he called "felt need" – that is, a perceived problem for which the intended adopter views the innovation as the solution (1).

While Rogers described felt need as a prior condition for the individual adoption process, our data suggest that the mechanism of attitude formation towards an innovation in a healthcare context is somewhat different. Rather than an individual felt need, there appeared to be a greater or lesser degree of shared acknowledgement among a particular group of clinicians (consultants in a particular department, for example) that untreated HIV was a problem to be addressed. One example of this was the creation of shared awareness of the problem of untreated HIV through a process of audit and feedback.

The theory of *socially shared cognition*, summarised by Tindale et al (who drew on earlier work by others in social and organisational psychology) (30), holds that attitudes in social groups are not simply the aggregation of individual attitudes, but are also a collective process. The group forms shared representations, understandings and meanings, which shape the attitudes and behaviours of individuals who identify with, and operate within, the group. Shared cognition emerges through a combination of common experience, learning, social interaction, and social comparison (30). Similar processes of social cognition have been described through Gabbay and Le May's concept of 'mindlines'(31).

## Networked decisions (decision stage)

Psychological theories such as the theory of planned behaviour typically represent decision-making as essentially individual. However, our data painted a picture of a networked decision processes that operated at two levels: collective decision-making combined with individual judgements about its application to particular patients.

Individual participants described being well aware of the collective view of their department, even when they did not necessarily or always agree with it. This collective decision emerged and evolved over time from interactions within the group. This was partly formal, with departments having processes for creating their own guidelines which acted as a mechanism for deciding whether and how to incorporate external guidance. It was also informal, with participants describing collective departmental views on particular practices which might or might not be formally constituted in departmental guidance. This collective departmental decision could be seen as a collectively constructed and maintained social norm (32). Alongside this, though, the individual level of decision-making remained as well. There was a clear sense of clinical autonomy, with individuals making their own decisions about the care required by individual patients, informed by but not wholly determined by the wider expectations of the department.

The context for innovation adoption is conventionally described in terms of two levels beyond the individual: the organisation within which they work, and the wider system and context (4). However, the term that we have used above is the department, and this is because our findings strongly suggested that it was this smaller grouping that was the principal influence on behaviour, and thus that it should be considered separately from the hospital as a whole. We suggest that this is because of the relative size and shared ties of the smaller departmental group. The *theory of personal social networks* proposed by Sutcliffe, Dunbar (33) depicts the individual at the centre of a series of concentric circles of relationships, with smaller numbers of closer ties in the centre (in single or double figures) up to a larger active network but with weaker ties of tens or hundreds of people. Given the social and collective processes of forming attitudes and decisions that we describe above, hospitals are simply too large for these collective processes to function throughout them. This is not to say that they do not matter, but rather than they matter in particular ways; in our study, control of overall resources and organisational priorities were two key hospital-level influences. Nevertheless, the primary unit shaping these networked decisions was not the hospital, but the individual departments within it.

We have used the term 'department' throughout this paper in this sense, as meaning the functional team within the hospital. What are formally defined as departments vary widely in size, with some also being much larger than the group functioning collectively through the processes defined above. We have opted to use the term department as the generic term for functional units within a hospital.

## **Implementation support (implementation stage)**

This implementation phase was the stage that our participants identified as the key challenge with HIV screening; not a lack of commitment in principle, but difficulties with doing it in practice. The central psychological issue is our limited capacity to think about and act on many things at once (34). We found that implementation was affected by three key strategies for overcoming limited cognitive capacity: prioritisation, routinisation and using external cues.

The extent to which implementation was seen as a priority varied by department as well as by individual, reflecting the networked decisions described above. Some departments had successfully formed a collective view that HIV testing was a core part of their activities. In others it was considered to be a relatively low priority; this was particularly the case in the urgent care departments, where HIV testing was perceived to be a low priority in comparison to more immediate care requirements.

The second theme was routinisation; 'automation' of the desired action into a new, regular habit so that less cognitive effort is required (e.g. integration of the new behaviour into an established routine). This requires the effort of rethinking an existing routine (taking bloods, in this instance); in psychological terms, consciously focusing on and adapting a previous pattern of behaviour until the new routine itself becomes habitual (25). How far individual participants undertook that effort itself depended on the priority they perceived to be given to that by the department overall. It also depended on their personal situation – people who had recently joined the department had had to adapt many of their routines and incorporating this HIV testing had been included part of that adaptation.

The third strategy of using external prompts (e.g. reminders, checklists) at the point of implementation aims to reduce the need for conscious effort through the environment providing a cue instead (35). This strategy had been widely used at both sites in this study. For instance, in site 2 a booklet was completed for each patient in AAU (the 'clerking booklet') with two specific prompts for HIV screening; prompts being included in the IT systems in both AAU and A&E across both sites; and reminders for HIV testing in trays containing vials for blood tests. Such environmental cues have proved widely successful in other contexts (36). However, given the low implementation rates described above they had clearly not been successful in the sites studied (although other uses of external supports to implementation had been more successful, such as pre-set standard blood tests incorporating HIV).

## **UneXceptional (confirmation stage)**

The final stage in Rogers' innovation adoption model is called 'confirmation'. In psychological terms, the confirmation phase is the process of making something part of unexceptional, routine practice. In psychological terms, this can be understood in terms of dual process theory; the transition from the reflective, effortful and consciously controlled new behaviour initially necessary for implementation to an established habit (25, 37).

This process of becoming automatic requires sustained effort over a period of time, though. Other than for particularly motivated individuals, sustaining this effort requires the organisation to support this process of confirmation. Brewster and colleagues describe different ways in which organisations acted to support the confirmation process, with a small number of staff within a team providing sustained support to confirmation for up to a year (38). Our sites took similar approaches, with HIV departments and particularly engaged colleagues in some other departments actively supporting this confirmation process for months or even years. This was needed due to the time needed for individuals to form habits (typically weeks or months, reflecting wider research(39)) together with staff turnover, in particular for junior doctors. One additional method that emerged from our sites was using local evidence; that is evidence that the action was valuable in their local context, rather than general evidence from elsewhere.

## Discussion

### Summary of key findings

This study, which included both empirical and secondary research components, has explored the process of individual adoption of innovations in a healthcare context. While there has been previous interest in using psychological theory for implementation science, the focus of previous attempts has been on doing so through simplification, either by simplifying the theories and their links to other aspects of implementation, or by relying on single psychological theories such as the theory of planned behaviour.

Our aim was to see whether we could better reconcile the breadth of relevant psychological theories with broader implementation science by using the framework of the individual adoption process from diffusion of innovation theory. Our study shows that this is a viable approach, with each stage of adoption proving to be a useful lens for identifying distinctive relevant psychological theories. Our findings go some way towards addressing the anomaly in the literature identified by Birken et al that there is currently both overlap and ambiguity between highly-cited multi-level models of diffusion of innovation in healthcare (4, 5) and theories of individual innovation adoption (15).

Our key findings can be summarised as follows. The previous experience of clinicians affected their attitude towards innovations in general and this innovation in particular; this can be both an obstacle and an opportunity for change. Clinicians' awareness of innovations such as guidelines was strongly influenced by information overload; they employed strategies to manage and direct their exposure to new information. Attitudes towards innovations did not merely reflect the views of the individual views; rather, they were powerfully shaped by collective social cognition. Decisions about adoption took place at two

main levels: collective decision-making by the department and individual decisions by clinicians. We found that the department (in the sense of the functional team within the hospital, not necessarily the formally defined entity) was distinct from the wider organisation. Ensuring the conscious effort required for implementation could be helped by strategies including making this a particular priority; adapting existing routines to include it; and using external cues. External support to these efforts was pivotal, and required sustained commitment for months or years.

## Strengths and limitations

To our knowledge, this is the first study to address the individual adoption component of diffusion of innovation theory and enrich it with robust psychological theories. The use of an empirical case study in parallel with the extensive literature search and hermeneutic cycle (Figure 1) allowed some testing of key theoretical concepts and relationships. As with all small-scale case study research, there is a trade-off between depth and breadth, and our qualitative design precluded formal hypothesis-testing of the predictive power of particular theories. The case was selected to foreground the individual adoption decision while backgrounding wider organisational and policy enablers and constraints; the findings may or may not be transferable to other guideline implementation challenges. HIV is widely still widely perceived to be particularly sensitive, and this may have affected implementation, but in practice the data did not suggest divergent implementation challenges for HIV in comparison to other issues, beyond the particular importance of informed consent for HIV testing. This guidance was professionally led and was not a high priority for the health service as a whole. A different innovation with greater formal support (eg: a political priority such as the four-hour limit on A&E waiting times), or linked to specific official guidance (eg: from NICE) might have illustrated different interactions, in particular more exploring tensions between system, organisational and local decision-making.

## Conclusions

To make progress with the complex challenge of implementation requires a multi-disciplinary perspective across the social sciences. Our starting point for this study was our belief that there has been a relative lack of dialogue between psychology and implementation science, and that the repertoire of psychological theories used was somewhat narrow and took too little account of the context within which health professionals work. We have identified a broader range of relevant psychological theory for each of the stages of individual adoption. Our findings require replication and refinement in other studies, but they have revealed potential for the design of new interventions designed to improve evidence-based clinical practice by busy front-line clinicians. Further research should draw on a wider range of empirical data in order to refine this model and begin to develop and trial such interventions.

## Declarations

## Ethics approval and consent to participate

Ethics approval for this study was granted by the Queen Mary University of London Research Ethics Committee in June 2014 (QMREC1362c); NHS approval was granted for each research site, and individual consent was given by each participant.

## Consent for publication

Not applicable.

## Availability of data and materials

The anonymised datasets analysed during this study are available from the corresponding author on reasonable request.

## Competing interests

The authors declare that they have no competing interests.

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## Authors' contributions

The authors developed the study design jointly. NF carried out the data collection and initial analysis, with review and supervision from TG and SS. All authors read and approved the final manuscript.

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Not applicable.

## References

1. Rogers EM. Diffusion of Innovations. 5th ed. New York, USA: Free Press; 2003.
2. Estabrooks C, Derksen L, Winther C, Lavis J, Scott S, Wallin L, et al. The intellectual structure and substance of the knowledge utilization field: A longitudinal author co-citation analysis, 1945 to 2004. Implementation Science. 2008;3.
3. Greenhalgh T, Papoutsis C. Studying complexity in health services research: desperately seeking an overdue paradigm shift. BMC Medicine. 2018;16:95-.

4. Greenhalgh T, Robert G, Bate P, Macfarlane F, Kyriakidou O. Diffusion of innovations in health service organisations : a systematic literature review. illustrated ed. Massachusetts, USA/Oxford, UK: Blackwell Publishing; 2005. 316 p.
5. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implement Sci.* 2009;4:50-.
6. Grol R, Bosch MC, Hulscher ME, Eccles MP, Wensing M. Planning and studying improvement in patient care: the use of theoretical perspectives. *Milbank Quarterly.* 2007;85(1):93-138.
7. Ogden J. Health psychology: a textbook. 4th, illustrated ed. Maidenhead: Open University Press; 2007. 528 p.
8. Grol R, Wensing M, Bosch M, Hulscher M, Eccles M. Theories of implementation of change in healthcare. In: Grol R, Wensing M, Eccles M, Davis D, editors. *Improving Patient Care: The Implementation of Change in Health Care.* Second ed. Chichester, UK: Wiley-Blackwell; 2013. p. 18-39.
9. Davies P, Walker AE, Grimshaw JM. A systematic review of the use of theory in the design of guideline dissemination and implementation strategies and interpretation of the results of rigorous evaluations. *Implement Sci.* 2010;5:14.
10. Godin G, Bélanger-Gravel A, Eccles MP, Grimshaw J. Healthcare professionals' intentions and behaviours: A systematic review of studies based on social cognitive theories. *Implement Sci.* 2008;3(36):1-12.
11. Eccles MP, Grimshaw JM, MacLennan G, Bonetti D, Glidewell L, Pitts NB, et al. Explaining clinical behaviors using multiple theoretical models. *Implement Sci.* 2012;7:99.
12. Walker AE, Grimshaw J, Johnston M, Pitts N, Steen N, Eccles MP. PRIME-PRocess modelling in ImpleMEntation research: selecting a theoretical basis for interventions to change clinical practice. *BMC Health Serv Res.* 2003;3(1):22.
13. Eccles MP, Hrisos S, Francis J, Kaner EF, Dickinson HO, Beyer F, et al. Do self-reported intentions predict clinicians' behaviour: a systematic review. *Implement Sci.* 2006;1(1):28.
14. Francis JJ, O'Connor D, Curran J. Theories of behaviour change synthesised into a set of theoretical groupings: introducing a thematic series on the theoretical domains framework. *Implementation Science.* 2012;7:35.
15. Birken SA, Powell BJ, Presseau J, Kirk MA, Lorencatto F, Gould NJ, et al. Combined use of the Consolidated Framework for Implementation Research (CFIR) and the Theoretical Domains Framework (TDF): a systematic review. *Implementation Science.* 2017;12(1):2-.
16. Boell SK, Cecez-Kecmanovic D. On being 'systematic' in literature reviews in IS. *J Inf Technol.* 2014;30(2):161-73.
17. Greenhalgh T, Peacock R. Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. *BMJ.* 2005;331(7524):1064-5.
18. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O, Peacock R. Storylines of research in diffusion of innovation: a meta-narrative approach to systematic review. *Social Science & Medicine.*

- 2005;61(2):417-30.
19. British HIV Association (BHIVA), British Association of Sexual Health and HIV, British Infection Society. UK National Guidelines for HIV Testing 2008. London: British HIV Association (BHIVA); 2008.
20. Public Health England. HIV prevalence by Local Authority of residence to end December 2014. Tables No. 1:2015. London: Public Health England; 2015 [Available from: <https://www.gov.uk/government/statistics/hiv-data-tables>.
21. Health Protection Agency. Time to test for HIV: Expanding HIV testing in healthcare and community services in England [Electronic resource]. London: Health Protection Agency; 2011.
22. Boell SK, Cecez-Kecmanovic D. A hermeneutic approach for conducting literature reviews and literature searches. Communications of the Association for Information Systems. 2014;34(1):257-86.
23. O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for Reporting Qualitative Research: A Synthesis of Recommendations. Academic Medicine. 2014;89(9):1245-51.
24. Costa PT, McCrae RR. Four ways five factors are basic. Personality and individual differences. 1992;13(6):653-65.
25. Bate L, Hutchinson A, Underhill J, Maskrey N. How clinical decisions are made. Br J Clin Pharmacol. 2012;74(4):614-20.
26. Vincent C, Amalberti R. Safer Healthcare: strategies for the real world. Cham, Switzerland: Springer International Publishing; 2016 2016.
27. Simon HA. A Behavioral Model of Rational Choice. The Quarterly Journal of Economics. 1955;69(1):99.
28. Marewski JN, Gigerenzer G. Heuristic decision making in medicine. Dialogues Clin Neurosci. 2012;14(1):77-89.
29. Hart W, Albarracín D, Eagly AH, Brechan I, Lindberg MJ, Merrill L. Feeling validated versus being correct: A meta-analysis of selective exposure to information. Psychological Bulletin. 2009;135(4):555.
30. Tindale RS, Meisenhelder HM, Dykema-Engblade AA, Hogg MA. Shared cognition in small groups. 2002. In: Blackwell Handbook of Social Psychology: Group processes [Electronic book] [Internet]. Blackwell Publishing; [1-30].
31. Gabbay J, le May A. Evidence based guidelines or collectively constructed mindlines? Ethnographic study of knowledge management in primary care. BMJ. 2004;329(7473):1013-6.
32. Schultz PW, Nolan JM, Cialdini RB, Goldstein NJ, Griskevicius V. The constructive, destructive, and reconstructive power of social norms. Psychological Science. 2007;18(5):429-34.
33. Sutcliffe A, Dunbar R, Binder J, Arrow H. Relationships and the social brain: Integrating psychological and evolutionary perspectives. British Journal of Psychology. 2012;103(2):149-68.
34. Kahneman D. Thinking, Fast and Slow. London: Penguin; 2011 2011. 512 p.
35. Gollwitzer PM. Implementation intentions: strong effects of simple plans. American Psychologist. 1999;54(7):493.

36. Gollwitzer PM, Sheeran P. Implementation Intentions and Goal Achievement: A Meta-analysis of Effects and Processes. *Advances in Experimental Social Psychology*. 38: Elsevier; 2006. p. 69-119.
37. Potthoff S, Presseau J, Sniehotta FF, Johnston M, Elovainio M, Avery L. Planning to be routine: habit as a mediator of the planning-behaviour relationship in healthcare professionals. *Implementation Science*. 2017;12(1):24.
38. Brewster A, Curry L, Cherlin E, Talbert-Slagle K, Horwitz L, Bradley E. Integrating new practices: a qualitative study of how hospital innovations become routine. *Implementation Science*. 2015;10:168.
39. Lally P, Jaarsveld CHMv, Potts HW, Wardle J. How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology*. 2010;40(6):998-1009.

## Tables

*Table 1: Interviews by site, department and role*

Department	Site 1		Site 2	Total
	1	1b		
HIV	1 consultant 1 junior doctor		1 consultant	3
A&E	1 consultant 1 technician		3 junior doctors 8 nurses	13
Other specialist departments		1 oncology consultant	1 acute admissions unit consultant 1 colposcopy nurse 1 geriatrics consultant	4
Observational data and documents	3 visit field notes (8 pages) ED pathway checklists (4 pages)	Field notes (1 page)	3 visit field notes (12 pages) Patient HIV test information leaflets (4 pages) AAU clerking booklet, 24 pages Hospital guideline compliance review table (13 pages) Example fortnightly HIV testing feedback to clinicians, 2 pages	
Total	4	1	15	20

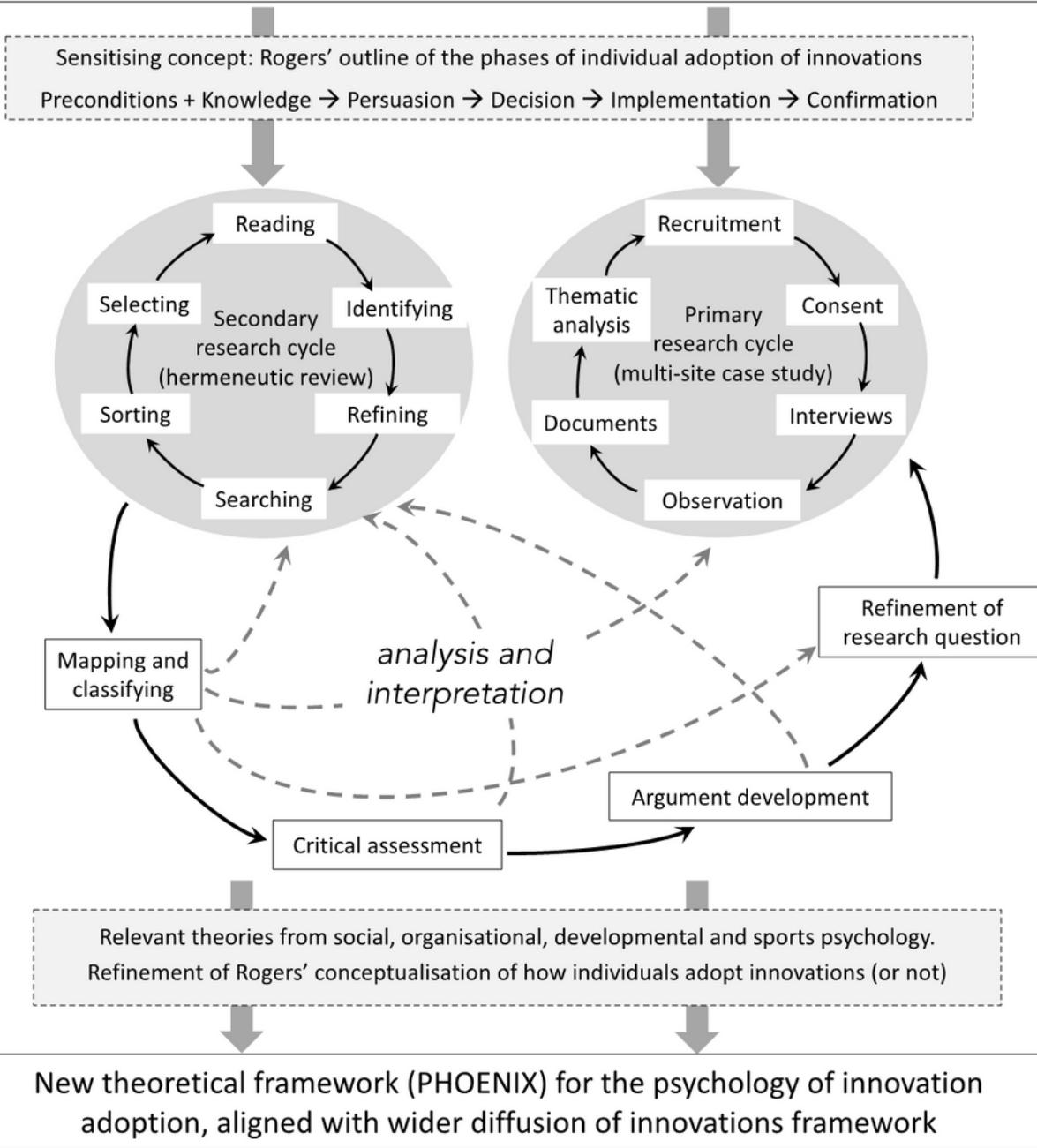
*Table 2: The PHOENIX model: stages in individual adoption of innovations in a healthcare context*

Stage no	Rogers' original model of adoption stages	PHOENIX model adapted for healthcare context	Relevant psychological theories and issues
-	Prior conditions, e.g. motivation, goals and values	<u>Person</u> and <u>History</u>	Personal traits and past experiences (both general and specific to this innovation).
1	Knowledge, which makes the individual aware of an innovation	<u>Overload avoidance</u>	In the face of overwhelming amounts of information, clinicians use filtering strategies ( <u>bounded rationality</u> and <u>selective exposure to information</u> ) to prioritise what is viewed and assimilated.
2	Persuasion, through which individuals and groups form attitudes towards an innovation	<u>Evolving attitudes</u>	Attitudes towards an innovation are formed both individually and collectively, through <u>socially shared cognition</u> within a functional work group. The perception that the innovation is needed (and will solve an important problem) is constructed and negotiated by the group rather than pre-existing in the individual.
3	Decision	<u>Networked decisions</u>	Decisions taken at two levels; collective decision-making combined with individual judgements. The <i>theory of personal social networks</i> puts the individual at a series of concentric circles of relationships, with functional teams ('departments') the primary unit for collective decision-making.
4	Implementation	<u>Implementation support</u>	Putting decisions into practice requires cognitive effort, and can be supported externally ( <u>theory of implementation intentions</u> ). These include prioritisation of the innovation, integrating it into routines, and using external cues and support.
5	Confirmation	<u>Unexceptional</u>	The key to sustainability of the new practice is ensuring that it becomes part of an 'automatic' personal routine; in <i>dual-process theory</i> , transferring from conscious to habitual

behaviour. This requires sustained effort and wider support.

## Figures

Objective: Develop a theoretical framework to explain the psychology of innovation adoption by individuals in a healthcare context



## **Figure 1**

Study flowchart

## **Supplementary Files**

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