

Participatory Design for Behaviour Change: An Integrative Approach to Healthcare Quality Improvement

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Abstract

Behaviour insights have been extensively applied to public policy and service design. The potential for an expanded use of behaviour change to healthcare quality improvement has been underlined in the England's National Health Service Five-Year Forward View report, in which staff behaviour is connected to the quality of care delivered to patients and better clinical practice (NHS, 2014). Improving the quality of healthcare service delivery involves adopting improvement cycles that are conducted by multiple agents through systematic processes of change and evaluation (Scoville et al., 2016). Despite the recognition that some of the recurring challenges to improve healthcare services are behavioural in essence, there is insufficient evidence about how behavioural insights can be successfully applied to quality improvement in healthcare. Simultaneously, the discussion on how to better engage participants in intervention design, and how to better enable participation are not seen as fundamental components of behaviour change frameworks. This paper presents an integrative approach, stemming from comprehensive literature review and an ongoing case study, in which participatory design is used as the conduit to activate stakeholder engagement in the application of a behaviour change framework, aiming to improve the processes of diagnosing and managing urinary tract infection in the emergency department of a hospital in England. Preliminary findings show positive results regarding the combined use of participatory design and behaviour change tools in the development of a shared-vision of the challenges in question, and the collaborative establishment of priorities of action, potential solution routes and evaluation strategies.

Keywords: Participatory Design, Behaviour Change, Behaviour Change Wheel, Quality Improvement, Healthcare, National Health Service

Traditionally, quality improvement approaches utilised in healthcare have been adapted from fields such as industrial management and organisational management which focus on process issues, such as production quality control (Boaden et al., 2008). More recently, human factors and ergonomics, which focuses on understanding interactions among humans and other elements of a system and optimising human well-being and overall system performance, has also been proposed to be integrated to quality improvement approaches (Hignett et al., 2015).

In order to improve quality in healthcare, process issues, interaction issues and system issues need to be appropriately addressed, but there is a growing recognition that some of the recurring challenges to improve healthcare services are behavioural in essence. There is also insufficient evidence about how behavioural insights can be successfully applied to quality improvement in healthcare. This paper aims to investigate how a behavioural approach can be employed to healthcare quality improvement in a participatory way. The first section of the paper will introduce background information in three areas: quality improvement, behaviour change, and participatory design – in order to build a participatory framework for behaviour change for healthcare quality improvement. The applicability of this framework will be tested in a clinical practice improvement project (diagnosis and management of urinary tract infection at an emergency department). Using the framework, the behavioural nature of this issue will be explored and interventions for behaviour change will be developed in a participatory way.

Literature Review

Quality Improvement in Healthcare

Quality improvement in healthcare encompasses the combined and continuous efforts of patients, professionals, researchers, organisations, and society in the change processes that result in better patient outcomes, better system performance, and better professional development (Batalden and Davidoff, 2007). In essence, quality improvement articulates a “combination of a ‘change’ (improvement) and a ‘method’ (an approach with appropriate tools), while paying attention to the context, in order to achieve better outcomes” (The Health Foundation, 2013), as represented in Figure 1.

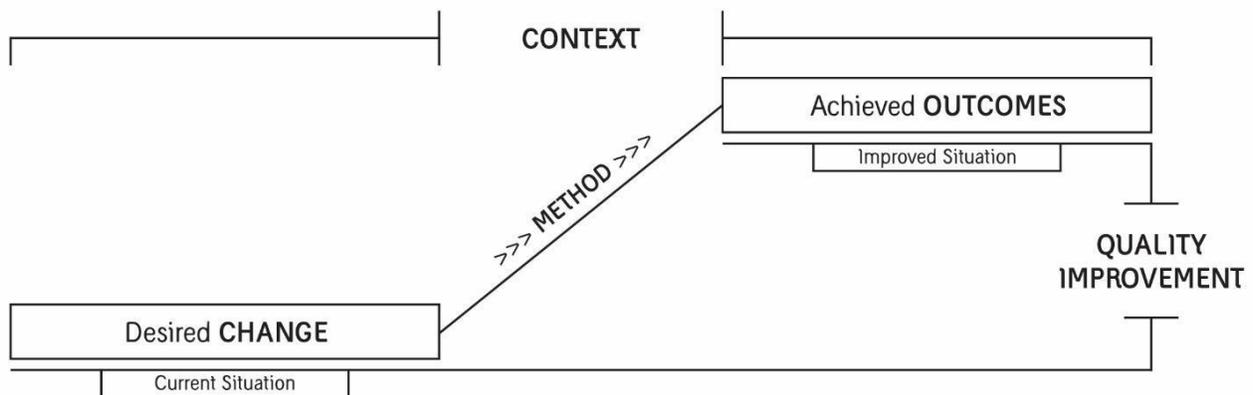


Figure 1: How Quality Improvement is Achieved.

In a review of methods to improve the quality of healthcare (including Lean, Six Sigma, Statistical Process Control, Plan-Do-Study-Act), Boaden et al. concluded that “from a research evidence viewpoint, none of the approaches stands out as being more successful in healthcare than any of the others.” (2008). The publication asserts that “the process of improvement is more important than the specific approach or method” and “the main issue is the way in which the improvement is implemented, rather than the nature of the improvement itself” (Ibid). This emphasis on process over method is supported by the Health Foundation (2013), and Frankel

et al. (2017); they both add that QI projects need to involve a variety of stakeholders to be effective and sustainable.

Dixon-Woods et al. (2012) have identified ten major challenges to healthcare quality improvement projects which can be clustered into three groups: (1) design and planning; (2) organisational and institutional contexts, professions and leadership; and (3) sustainability, spread and unintended consequences. Among the ten challenges described by these authors, many (*i.e. convincing people that there is a problem; convincing people that the solution chosen is the right one; the organisational context, culture and capacities; and tribalism and lack of staff engagement*) could be directly affected by a change in methodology – e.g. by emphasising behaviour change, stakeholder engagement, and the participatory aspects of how quality improvement approaches are employed.

A participatory behaviour change approach appears especially appealing when we recognise how challenging it is for healthcare organisations to provide services that are safe, reliable and effective at the system-level – i.e., as a continuous ‘culture’ that permeates several departments and engage multiple people within the organisations (Frankel et al., 2017). Behaviour change approaches to QI seem thus very fit, since “quality will only improve where the behaviour of individuals within the system changes and this has to date often been ignored or underplayed in quality improvement efforts.” (Boaden et al., 2008).

Behaviour Change

The field of behaviour change is concerned with describing and understanding the causes and consequences of behaviour as to enable changes for the better. A definition that accounts for both individual and contextual factors influencing behaviour states that ‘human behaviour is defined as the product of individual or collective human actions, seen within and influenced by their structural, social and economic context’ (NICE, 2007).

The practical processes of implementing change usually involve some type of planned intervention which frequently relies on the use of behaviour change frameworks. A framework for changing behaviour is fundamentally a game-plan that follows a logic sequence of interconnected stages. Thus, a behaviour change intervention is an activity (or a series of activities) which principal intention is ‘to get an individual or a population to behave differently from how s/he or they would have acted without such an action’ (Michie et al., 2014). Interventions attempt to influence behaviour by applying the appropriate theoretical knowledge and practical expertise, mostly drawn from the many behavioural sciences and related disciplines (House of Lords, 2011).

Using behaviour change interventions as a method for improving quality in healthcare service delivery is a promising strategy that has already shown significant results in areas such as antibiotics prescription, reducing missed appointments, increasing medicine adherence (Hallsworth et al., 2016), optimising referrals, and improving hand hygiene (Perry et al., 2015).

Behaviour Change Wheel Framework

The Behaviour Change Wheel (BCW) is a framework targeted at healthcare practice and public health that was developed from a systematic analysis of other nineteen selected frameworks, built intentionally to overcome their flaws and limitations (Michie et al., 2011). The framework is recognised as being comprehensive and conceptually coherent (Perry et al., 2015); and also as an approach that proposes to “mediate the middle ground between the individual agency and contextual approaches” to behaviour change (Niedderer et al., 2014). At the core of this strategy to bridge individual and contextual factors is a dedicated model of behaviour, the COM-B model, which articulates *capability* (physical and psychological variables), *opportunity* (social and physical components of the context and environment), and *motivation* (reactions and plans). The main purpose of this embedded model of behaviour is to simplify the understanding of the determinants that could account for explaining and predicting changes in behavioural patterns, without incurring in oversimplification (Atkins and Michie, 2015).

Another aspect of the BCW that also attempts to address the theory-practice gap by providing mechanisms to connect the two worlds, is the inclusion of seven *intervention functions* and nine *policy categories* in its very structure. According to the authors, these are non-overlapping components that build from the analysis of previous works and relevant literature, and they should assist designers and practitioners in envisioning and planning effective interventions (Michie et al., 2011).

The application of the BCW framework starts from an analysis of the sources of behaviour, using the COM-B model to identify which determinants are causing the occurrence of the behaviour(s) to be changed. Once the behaviour is understood in context, since “behaviours are a part of a system, they do not occur in isolation” (Michie et al., 2014), one or more of the nine intervention functions can be chosen along with the policy category(ies) suitable to deliver the intervention (Figure 2).

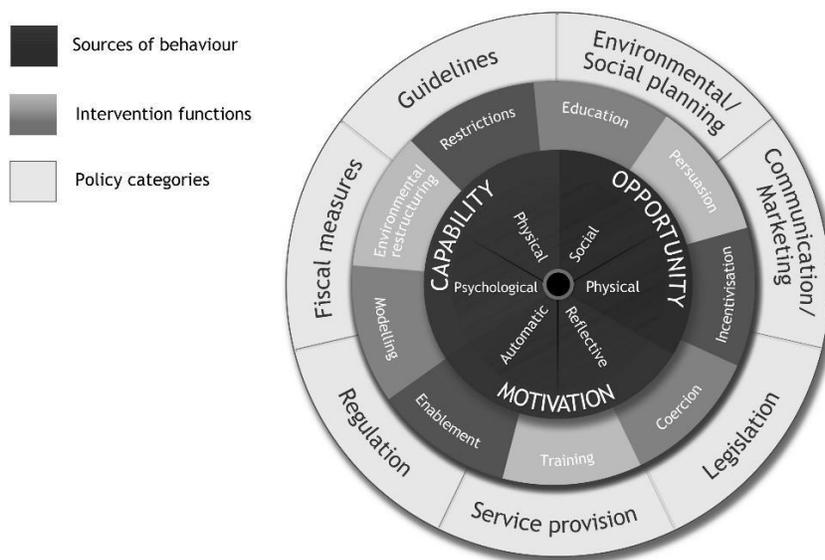


Figure 2: The Behaviour Change Wheel (Michie et al., 2011).

The correct use of the framework is supported by eight worksheets that help practitioners to follow the logic steps of the intervention process, considering the necessary variables, and employing the appropriate tools. Amongst these tools is the Theoretical Domains Framework (TDF) – which is “a synthesis of constructs from behaviour change theories, developed in a consensus process to make theories more accessible for implementation” (Michie et al., 2014). The TDF establishes categories of determinants (such as knowledge, social influences, intentions) that can be used to determine which behaviour change techniques are more appropriate to enable the desired changes in the target population. Behaviour change techniques (BCTs) are also key to the application of the Behaviour Change Wheel. BCTs are the smallest components of an intervention that still retain the ‘active ingredients’ that are necessary to enable changes to specific determinants, considering a particular target population and context (Michie and Johnston, 2012). To be effective, change techniques need to: (1) target a specific determinant that predicts the behaviour in question, (2) be able to change that determinant, and (3) be translated into a practical application that works for the target population, within the social and physical environment they interact (Kok et al., 2015).

From a behavioural perspective, the Behaviour Change Wheel is robust and encompassing: it establishes clear relationships between the determinants of behaviour (both individual and environmental/contextual), potential strategies (intervention functions and policy categories), and techniques for change in a stepwise implementation programme. However, like most frameworks, it fails to explicitly incorporate participatory strategies to engage the relevant users and implementers in a coordinated effort for enacting collaborative change.

Problems with Current Behaviour Change Approaches

If we are to look prospectively to employing behaviour change in healthcare quality improvement, we ought to pay attention to some problematic issues about how current frameworks and approaches operate. In the concluding remarks of a recent publication, three main challenges for the future of behaviour change are outlined: (1) the relative disregard for social and cultural factors that influence human behaviour; (2) the need for a transdisciplinary perspective to understand behaviour and change processes; and (3) the ‘evidence conundrum’, embodied in the supremacy of quantitative evidence from randomised controlled trials, which undermine the important scientific contribution of alternative approaches (Spotswood and Marsh, 2016). Concurrently, various problems in applying behaviour change theories to behaviour change practice have been identified in recent years: inappropriate use of theoretical grounding in practical applications (Davies et al., 2010; Michie et al., 2015); insufficient representation of behaviour change expertise (NHS, 2014); and the need for a more multidisciplinary, collaborative approach (Solomon, 2005).

The ‘evidence conundrum’ is an unintended consequence of a growing concern to try and ensure that behaviour change interventions are ‘evidence-based’ and ‘theory-based’. Such an approach overemphasises a ‘hard science’, expert-focused view, dominated by strict rules

ascertained, for example, by the rising adoption of templates for reporting interventions – an excessively rigid perspective that has encountered little open criticism to date (Ogden, 2016).

In this quest to strengthen the body of theory supporting behaviour change, research designs that favour quantitative evidence with much less emphasis on the processual aspects of intervention development have flourished, dwarfing qualitative research approaches that can offer important complementary perspectives. One of the aspects that suffered from this dominating research ethos is the core importance of stakeholder participation, and how the views and voices of those impacted by the interventions should be integrated into the design and implementation of such interventions.

An emphasis on participatory design as a strategy for engagement in behaviour change interventions can address two of the challenges identified by Spotswood and Marsh (year): the ‘evidence conundrum’ (the overstated impact of quantitative evidence and research methods in behaviour change study and practice); and a more transdisciplinary approach to behaviour change (by providing a different philosophical perspective, as well as specific methods and tools). Therefore, we believe participatory design has a major potential to unite with behaviour change, presenting efficient and inclusive methods for quality improvement in healthcare service delivery, as represented in Figure 3.

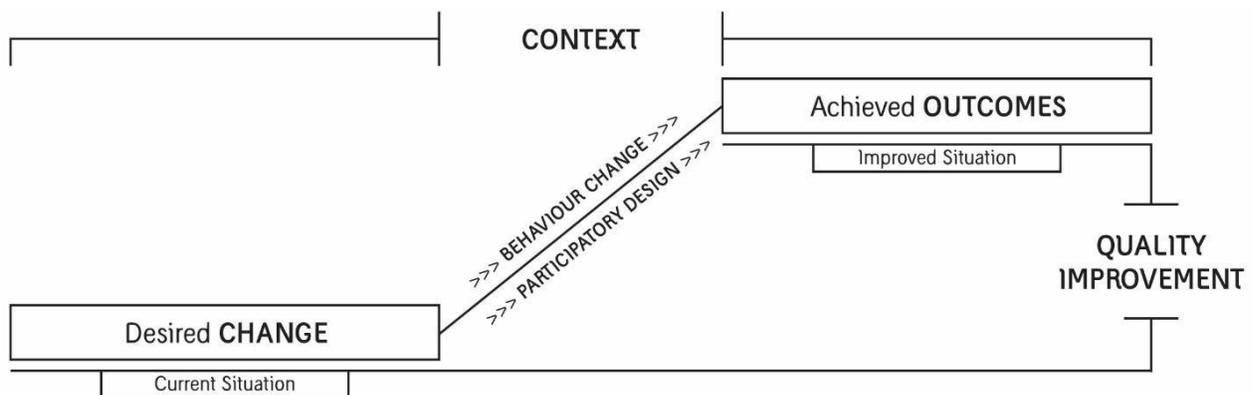


Figure 3: Behaviour Change and Participatory Design as the Combined Methods to Achieve Quality Improvement.

Participatory Design

The core aspiration of participatory design is to enable the involvement of relevant stakeholder groups in all stages of the design process, including the co-definition of problems, co-development of alternatives, and co-implementation of solutions (Robertson and Simonsen, 2012, 2013). That encompasses the engagement of people in determining technical and social objectives for the design effort, analysing the current situation and problems in question, developing solution and implementation strategies, considering evaluation criteria (Gregory, 2003), and collectively reflecting on the processes of change (Ostergaard et al., 2016).

This overarching aspiration for active involvement is driven by three defining values: *having a*

say; *mutual learning*; and *co-realisation*. As established by Bratteteig et al. (2013), and Robertson and Simonsen (2013), *having a say* refers to the ability of people to impact decision-making processes with regards to their perspectives of the issues and their vision for the future; *mutual learning* enables a deep experience of exchange between participants, recognising that all involved have things to contribute with and to get from the collaborative effort; and *co-realisation* relates to the dynamic of making the changes together, building on complementary strengths and different types of expertise.

To activate these values and put its aspirations to practice, participatory design has combined and perfected a set of methods and tools which assist in the realisation of participatory projects.

These methods can be organised into three encompassing categories: methods for *telling stories*; methods for *making things*; and methods for *enacting possible futures* (Brandt et al., 2013). This categorisation expands on a previous work that clustered co-design tools and techniques into three groups: *talking, telling and explaining*; *making tangible things*; and *acting, enacting and playing* (Sanders et al., 2010).

The fundamental point enlightened by these ways of looking at methods and tools is to foster a mindset in which participation permeates the intervention process as a whole: at first, by contributing to better define the problem-space, via enabling the description and visualization of multiple perspectives and contributing factors; secondly, by giving support to activities that explore the solution-space through an experimental process of modelling and prototyping in two- and three-dimensional forms, and in conceptual and concrete ways; and finally, the combination of these two efforts make it possible for future visions to develop as the result of the collective and collaborative engagement of all involved – these visions simultaneously articulate the technological and social requirements needed to put solutions to practice in real-life.

Framework Development: Integrating participatory design with behaviour change

The tendency to overlook the participatory dimensions of behaviour change interventions confronts the fundamental, moral and practical importance of improving the participatory aspects of healthcare service in general (Cahill, 1998; NHS, 1998; Crawford et al., 2002; Ridley and Jones, 2002; Gutmacher et al., 2010; Israel et al., 2013; NHS, 2013; Richards et al., 2013), and of behaviour change interventions in particular (Darnton, 2008; Craig et al., 2014). That becomes clear on the lack of explicit reference to participation in most existing behaviour change frameworks. This issue is aggravated by the lack of awareness of many behaviour science researchers about the potential contributions that participatory design could offer: aside from a handful of exceptions (such as Yardley et al., 2015; and Collins, 2016), most published works consulted through our study make no mention to participatory design or co-design approaches and methods to enable stakeholder involvement in behaviour change intervention projects¹.

¹ To determine the underlining structure of Behaviour Change Frameworks, we have carried out an initial analysis of ten different frameworks proposed by authors from various backgrounds, across the domain areas of public policy, health, and sustainability. The selected frameworks cover a period from the late 1990's, when frameworks

One of our primary aims with the present study is to investigate issues related to stakeholder involvement in behaviour change interventions; consequently, a ‘participatory agenda’ guides the work, permeating all stages of the pilot intervention being developed along with the BCW framework. A vital step to accomplishing that aim was to outline a comparison between the stages of the behaviour change wheel framework and the overarching phases of a participatory design process (Table 1).

| | | | |
|--|--------------------------|-------------------------------|---|
| PHASES OF THE PARTICIPATORY DESIGN PROCESS | CO-DEFINITION | CO-DEVELOPMENT | CO-IMPLEMENTATION |
| STAGES OF THE BEHAVIOUR CHANGE WHEEL FRAMEWORK | UNDERSTAND THE BEHAVIOUR | IDENTIFY INTERVENTION OPTIONS | IDENTIFY CONTENT AND IMPLEMENTATION OPTIONS |

Table 1: A Comparison Between the Phases of Participatory Design and the Stages of the Behaviour Change Wheel.

Subsequently, a list of participatory and behaviour change methods and tools could be identified and then paired up with the appropriate stages of the intervention plan. That process allowed for the basis of our participatory approach to behaviour change interventions to emerge, as it is presented below (Table 2):

| | | | |
|--|---|--|--|
| PHASES OF THE PARTICIPATORY DESIGN PROCESS | CO-DEFINITION | CO-DEVELOPMENT | CO-IMPLEMENTATION |
| SELECTED PARTICIPATORY DESIGN METHODS and TOOLS | >User Interviews; >Focus Groups; >User Forum; >Card Sorting; | >User/Care Journey; >Story-Telling; >2D Mapping; >Thematic Networks Map. | >Co-Design Workshops; >Brainstorming; >2D and 3D Prototyping; >Insight Cards/Ideas Cards; |
| STAGES OF THE BEHAVIOUR CHANGE WHEEL FRAMEWORK | UNDERSTAND THE BEHAVIOUR | IDENTIFY INTERVENTION OPTIONS | IDENTIFY CONTENT AND IMPLEMENTATION OPTIONS |
| SELECTED BEHAVIOUR CHANGE METHODS and TOOLS | >COM-B Model; >Worksheets 1-4. | >COM-B Model; >Intervention Functions Matrix; >Policy Categories Matrix; >Worksheets 5-6. | >Heuristic Evaluation; >Usability Testing/Eval; >Role Playing; >User Experience Audit; >Piloting/Trialing. |
| PARTICIPATORY DESIGN METHODS: Kensing et al., 1996; Aldersey-Williams et al., 1999; Attridge-Stirling, 2001; Maguire, 2001; Vredenburg et al., 2002; Sanders et al., 2010; Martin and Hanington, 2012. BEHAVIOUR CHANGE METHODS: Michie et al., 2014; Michie et al., 2015; Kok et al., 2015. | | | |

Table 2: A Participatory Approach for Stakeholder Engagement in Behaviour Change

began to appear in a more structured fashion, to present time. The criteria for choosing this group of frameworks was through cross-reference in the consulted literature of the field, complemented by a search on digital databases (PubMed, the Cochrane Platform, Google Scholar, and Web of Science). The analysis was focused on understanding how the frameworks outline the stages that comprise the intervention plan, what the objectives of each stage are, and (if reported) the methods employed to achieve the particular goals of each stage and the overall goals of the intervention.

Pilot Study: Testing the Framework

Context

Urinary Tract Infection (UTI) diagnose, especially in older patients that present asymptomatic bacteriuria and confounding symptoms, is less precise and this population is frequently mistreated with antibiotics (NICE, 2015). The situation gets more aggravated since older patients frequently are not correctly assessed due to lack of specific knowledge about this cohort among physicians without specific geriatric training (Gladman et al., 2016). Antimicrobial Resistance (AMR) is a global public health concern caused mainly by “the systematic misuse and overuse of drugs in human medicine and food production” (WHO, 2015), and it has been observed in all regions of the world. Studies carried out in five different countries in Europe and the UK (Tonkin-Crine et al., 2011) and in Ireland (Cullinan et al., 2014) show a broad range of reasons to explain why over-prescription is a recurrent behaviour, even when clinical judgement and scientific evidence suggest alternative approaches.

In the Emergency Department of the NHS hospital where our pilot study is taking place, the diagnostic and management processes of urinary tract infection (UTI) are characterised by several challenging factors, as reported by some staff and observed by the researchers. These involve two major areas of concern which are often in conflict: (1) the current, culturally established practices carried out by ED staff – which, for many reasons, are not always in line with the national ‘guidelines’ or standardised recommendations for ‘best practice’; and (2) the external factors (resources) and pressures (from the organisation and the system, and from users

– patients, carers, family) – that make up for the social and professional environment in which decisions are made, and the healthcare services are delivered. Regarding quality improvement interventions, the healthcare context is regarded as distinct and more complex (Boaden et al., 2008), and changing clinical practice is considered particularly difficult to achieve (Dixon, IN: Nesta, 2016).

Participants

The pilot study involves two complementary groups of stakeholders (Table 3) that were purposefully sampled considering their professional expertise; participation in the activities of relevant hospital wards; and their previous knowledge about the importance of addressing UTI in secondary care.

The core group of stakeholders (*core group* from now on) includes doctors, pharmacists, microbiologists, healthcare researchers, and nurses, totalling nineteen people. The second group of stakeholders (*ED group* from now on) constitutes Emergency Department consultants working as doctors, nurses, and managers, totalling twenty-eight professionals. The ED group has supported and advised the core group, and acted as liaison agents within the Emergency Department extended work community. Participants’ engagement through the study has been characterised by a diverse (regarding professional profiles) and irregular (regarding number of participants) attendance to in-person activities, and by a continuous process of information exchange and update via digital media (email, text message, and WhatsApp).

| | | |
|---|---|------------------------------------|
| CORE GROUP n=19 M=09, F=10 | DOCTORS (7); NURSES (3); PHARMACISTS (4); MICROBIOLOGISTS (3); HEALTHCARE RESEARCHERS (2). | TOTAL n=47 M=21, F=26 |
| ED GROUP n=28 M=12, F=16 | DOCTORS (15); NURSES (9); MANAGERS (4). | |

Table 3: Pilot Study Participants by Sub-Group and Expertise (with number of male and female participants).

Methods

Our participatory approach includes focus group activities, involving representatives of both groups of stakeholders, as well as meetings, semi-structured interviews, and constant exchange of information via varied means of communication; a diagram of the completed, in-progress and planned activities is displayed in Figure 4 below.

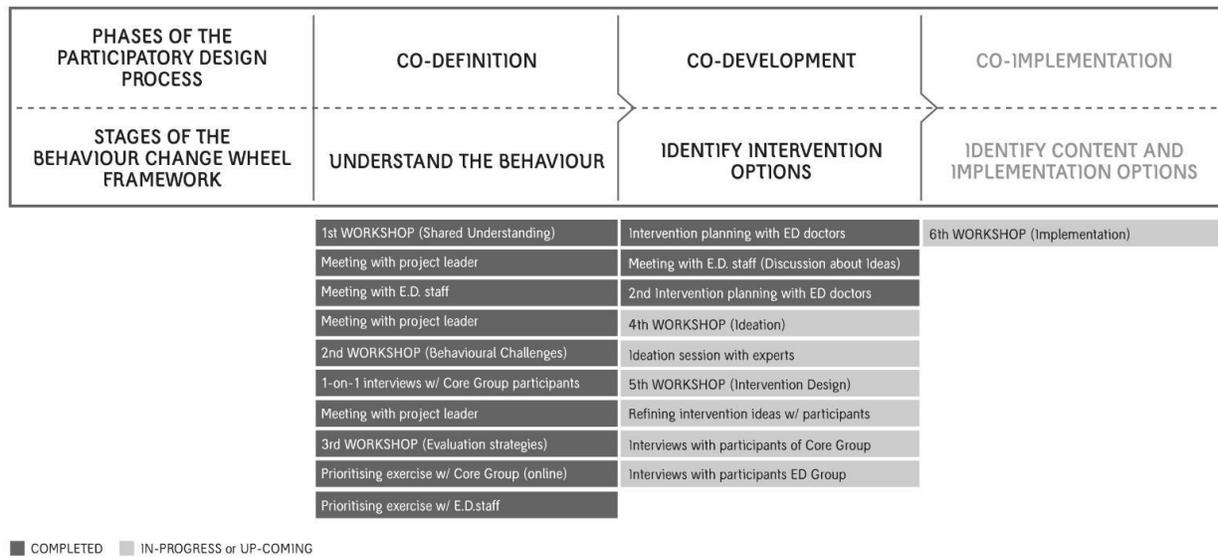


Figure 4: Activities per Stage of the Ongoing Pilot Study, Following the Participatory Design and the Behaviour Change Wheel Combined Approach.

The first activity involving the core group consisted of a workshop in which card-sorting (Kensing et al., 1996; Sanders et al., 2010), user-journeys (adapted as a ‘care journey’) (Hanington and Martin, 2012), and group discussion methods (Aldersey-Williams et al., 1999) were employed to make collective sense of a large volume of findings stemming from in-depth interviews with ED staff².

Our study combines behaviour change and design approaches via an integrative approach. As noted, both the behaviour change wheel framework and the participatory design approach can be described as three-staged processes with many overlapping connections regarding their aims and objectives. In the first stage, the central concern of the BCW is to determine what is the behaviour that needs to be changed – that is accomplished by identifying *what* is the behaviour, *who* performs it and *with whom*, and *where and how frequently* it occurs. The co-definition phase of PD aims to provide a comprehensive description of the problem-space, considering the perspectives, priorities and concerns of the multiple stakeholders involved. At the second stage, both the BCW and PD intend to explore the solution-space: the former via the identification of suitable intervention functions and policy categories that relate to the specific determinants of behaviour which can predict positive changes; the latter via investigating alternatives in light of appropriate technologies, processes, products, services, that can respond to the current problems through the adoption of new ways of doing and interacting with the physical and social surrounding. In the third and final stage, the BCW explores what change techniques and modes of delivery (means and technologies) are implementable, considering the APEASE criteria to guide appropriate choices (Affordability, Practicability, Effectiveness and Cost-Effectiveness, Acceptability, Side-Effects/Safety, Equity); correspondently, PD considers the ways in which solutions can be collaboratively implemented, tested and adjusted according to the shared-vision of the stakeholders impacted by the proposed innovations.

Findings

Developing a Shared Understanding

From the first stakeholder workshop, a total of one-hundred and thirty-six statements gathered from staff in interviews were converted into prompt cards to be analysed by the group. Participants, divided into two teams, sifted through the cards selecting and ordering those they found to be more relevant considering their impact on clinical practice. The selected cards were then plotted into care journey maps prepared by the researchers in an attempt to connect the suboptimal behaviours of specific professional groups (i.e. doctors, nurses, health care assistants, laboratorians), to particular points in time (admission, symptoms, actions/resources, diagnostic, treatment, discharge).

The workshop finished with a group discussion about the activities in which participants could reflect on their different perspectives and results. These differences were mainly because of

² 2 In a previous qualitative study, O’Kelly et al. (2016) conducted interviews with twenty-one staff from ED at the same hospital (among HCAs, nurses, and doctors from all grades) to identify issues around UTI diagnosis and management. The findings were grouped into six themes regarding Dip Stick testing (why test; who to test; indirect pressures; interpretation of tests; guidelines; and NHS culture and system pressures). The issues identified in the interviews with staff were the basis of the first activities involving the core stakeholder group.

their varied expertise and understanding of Urinary Tract Infection, also because, due to the overwhelming number of findings to make sense of, the two groups had to analyse different sets of statements. The reflective discussion worked primarily to establish a common knowledge base regarding the challenges of diagnosing and treating UTI in the ED department, also helping to establish group cohesion for future activities, since many participants had never worked together before the workshop.

From the analysis of the results of the first workshop, an adapted thematic networks map (Attride-Stirling, 2001) was assembled by the researchers, as an effort to depict a concise visual representation of the many, complex variables which constitute the problem-space. This map was the primary tool used in the second workshop, which had as its main objective to determine a sound list of behavioural challenges: as indicated by the Behaviour Change Wheel framework, challenges need to be framed in terms of who performs the behaviour and with whom, where they do it, when and how frequently they do it (Worksheet 01 – Michie et al., 2014, p.240).

Identifying/Prioritising Behavioural Challenges

The thematic networks map was presented to the group and the participants were invited to revise the map by changing, adding or subtracting information from it. With the resulting, revised map, twelve behavioural challenges were identified and listed. The resulting list of challenges was the product of participatory processes that took into consideration a plethora of issues initially identified through interviews with diverse ED staff, that were then discussed, analysed and organised by expert stakeholders, and finally condensed in a manageable number of challenges that can be acted upon through future interventions. The next step was to establish priorities of action, so that specific solutions can be collectively envisioned and developed.

The prioritisation process took place in two stages: the first involved the core group of stakeholders through an online voting system in which participants ranked how much they thought each of the behavioural issues listed directly impacted three distinct dimensions of care: the care provided to patients; the work practice of staff; and the health system in broader terms. The second prioritisation exercise involved the ED group and was done on-site, on a fifteen- minute voting activity, during a senior staff weekly meeting. Participants were asked to individually select their first and second priorities, from the same list of twelve challenges used by the core group of stakeholders.

Planning Interventions

The analysis of the prioritisation exercises conducted with both groups showed similarities and slight differences in the top priorities defined by each group. The adopted strategy to deal with these different results focused on a solution that embraces the complementary roles performed by each group of stakeholders as a strength to be explored. Per this perspective, each group can work within their established priorities in a complementary coordinated effort. The core group will focus on behaviour change interventions to impact care at the higher, organisational level; this group is formed by professionals that do not work directly in ED, hence their views on the ward's day-to-day practice is limited by their lack of practical experience.

The core group's focus on systemic changes will be complemented by the ED group's focus on practice-based interventions, according to the priorities established by ED staff. This process has been initiated via the development of interventions with two middle-grade ED doctors that are conducting Quality Improvement projects around UTI diagnosis and management as a requirement for the completion of their medical training. These doctors will utilise behaviour change methodologies, facilitated by the researchers, and collect frequent sets of data on patient outcomes to establish whether the interventions are having short-term, measurable effects in clinical practice. The first step of this process includes the preparation of support materials that will be used by the doctors during hand-over meetings (with other doctors and nurses) in which they will establish a participatory dialogue within the ED. The aim of these discussions will be to adopt a bottom-up approach as to enable ED staff members to devise their own collective solutions for ED care provision.

Conclusion

The findings of this work in progress suggest that it is feasible/potentially effective to employ a behaviour approach to healthcare quality improvement in a participatory ways. Understanding both as three-staged processes with clear alignments and similar goals in each stage will allegedly facilitate their combined application in quality improvement projects. Furthermore, the apparently obvious choice for using methods and tools from participatory design – a field with more than four decades of organised knowledge³ – in behaviour change projects remains unexplored as a means to address proper stakeholder involvement, and how and by whom behaviour change interventions are planned, designed and implemented.

The advantages of adopting a behaviour change approach to improving UTI diagnosis and management when compared to other quality improvement methods is not explored in this study, which is certainly a limitation. A review of the literature showed that behaviour is a component of many challenges in healthcare service provision and that the use of behaviour change frameworks has had encouraging results in enhancing patient and service outcomes in certain contexts. Regarding the necessity for some level of expert knowledge, the behaviour change approach is perhaps no different from any other; some of the people implementing the approach need to understand its stages, methods, tools and evaluation processes, as it would be the case with Lean, Six Sigma, PDSA etc.

It is beyond doubt that stakeholder engagement has a definite role when adopting behaviour change as a strategy for quality improvement in healthcare. Participation is repeatedly referred in the literature as a fundamental element of intervention design, and of healthcare improvement more broadly. The current study investigates the direct use of specific participatory design methods and tools in alignment with defined stages of a behaviour change framework combined into an integrative approach. At the very first level, we can assert that Participatory Design and the behaviour change wheel approaches are compatible: it is possible to conduct a synergistic process in which one method provides the behavioural tools whereas the other provides the means for its collaborative application. Though the study is still in

³ 3 If we adopt as a milestone the 1971 conference of the Design Research Society which had Design Participation as its core theme.

development, our participatory approach for stakeholder engagement in behaviour change interventions (Table 2) outlines the logic that will guide the subsequent stages, describing specific tools that can be utilised in each stage of the intervention. The Behaviour Change Wheel tools have been undergoing significant adaptations through the study regarding their format and appearance, as to be more suitable for collective, participatory use (since their current design is clearly intended for desktop, individual use). This adaptation process is indicative of the necessity to better integrate the specific tools of the two complementary approaches explored in this study, a topic that will be further examined in upcoming publications.

Bratteteig and Wagner (2016) have recently published a paper in which Participatory Design is discussed mainly with regards to the evaluation of its results. Their paper's core contribution lays in the way it connects participatory process with participatory outcomes, perhaps in an unprecedented way. Among the indicators that these authors outline, we have identified three that can illustrate a positive preliminary evaluation of our study's short-term outcomes. Firstly, the coordinated involvement of professionals from different specialties that perform a variety of functions within the hospital has facilitated their exposure to multiple viewpoints regarding the principal issues at stake. The constant exchange of ideas facilitated by the participatory approach provided for *an enhanced knowledge of the systems in which the participants are implicated*.

Secondly, the most recent developments of the project include the active involvement of two participating doctors who will conduct quick intervention cycles adopting behaviour change principles introduced by the present study. This effort demonstrates the *integration and adoption of new process into every-day practice*, an outcome that speaks to the meaningful involvement of staff, and the purposefulness of the approach to these key stakeholders in the hospital community. Changing practice is one of the most challenging goals for quality improvement, and the early adoption of new methods in the clinical context is regarded as a positive result of the participatory framework sought by our pilot study.

Finally, the participatory agenda that governs the present study has *enabled choices that were created by users* to be devised through all key stages of the process, from the early assessment of the behavioural challenges to the development of solutions for on-site trials. Bratteteig and Wagner state that even when all decisions are not taken in a participatory fashion, the framing of choices by those impacted by the intervention can be regarded as a significant participatory result. Throughout this study, choices have constantly been constructed – via the activities and methods employed – and put to decision – via varied discussion sessions and voting systems – utilising a participatory approach. Considering the evidence from literature, the lessons learnt and preliminary results of our case study, we are confident to support that an integrative approach, combining participatory design and behaviour change constitutes a promising strategy for accomplishing effective and empowering quality improvement in healthcare service provision.

References

- Aldersey-Williams, H., Bound, J., & Coleman, R. (Eds.) (1999). *The Methods Lab: User research for design*. London: Design for Ageing Network, DAN. Available at: <http://www.education.edean.org/pdf/Tool039.pdf>.
- Atkins, L., & Michie, S. (2015). Designing interventions to change eating behaviours. *Proceedings of the Nutrition Society*, 74(2), 164-170, DOI:10.1017/S0029665115000075.
- Attride-Stirling, J. (2001). Thematic networks: An analytic tool for qualitative research. *Qualitative Research*, 1(3), 385-405.
- Batalden, P. B., & Davidoff, F. (2007). What is “quality improvement” and how can it transform healthcare? *Quality and Safety in Health Care*, 16(1), 2-3.
- Bergold, J., & Thomas, S. (2012). Participatory research methods: A methodological approach in motion. *FQS*, 13(1), DOI: 10.17169/fqs-13.1.1801.
- Boaden, R., Harvey, J., Moxham, C., & Proudlove, N. (2008). *Quality improvement: Theory and practice in Healthcare*. Coventry: NHS Institute for Innovation and Improvement.
- Brandt, E., Binder, T., & Sanders, E. (2013). Tools and techniques: ways to engage, telling, making and enacting. In *Routledge international handbook of participatory design* (pp. 145-181). New York: Routledge.
- Bratteteig, T., Bodker, K., Dittrich, Y., Mogensen, P. H., & Simonsen, J. (2013). Methods: Organising principles and general guidelines for participatory design projects. In *Routledge international handbook of participatory design* (pp. 117-144). New York: Routledge.
- Bratteteig, T., & Wagner, I. (2016). What is a participatory design result? In: *Proceedings of the 14th Participatory Design Conference*. [online] Aarhus: PDC, pp.141-150. Available at: <http://ojs.ruc.dk/index.php/pdc/article/view/5464>.
- Cahill, J. (1998). Patient participation: A review of the literature. *Journal of Clinical Nursing*, 7(2), 119-128. 17
- Collins, K. (2016). Participation in behaviour change: technique or tyranny? In *Beyond behaviour change: Key issues, interdisciplinary approaches and future directions* (pp. 199-216). Bristol: Policy Press.
- Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2014). *Developing and evaluating complex interventions: New guidance*. Medical Research Council.
- Crawford, M.J., Rutter, D., Manley, C., Weaver, T., Bhui, K., Fulop, N., & Tyrer, P. (2002). Systematic review of involving patients in the planning and development of health care. *BMJ*, 325(7375):1263.

Cullinan, S., Fleming, A., O'Mahony, D., Ryan, C., O'Sullivan, D., Gallagher, P., & Byrne, S. (2014). Doctors' perspectives on the barriers to appropriate prescribing in older hospitalized patients: A qualitative study. *British Journal of Clinical Pharmacology*, 79(5), 860–869.

Darnton, A. (2008). *GSR behaviour change knowledge review reference report: An overview of behaviour change models and their uses*. Government Social Research. [online] London: Government Social Research, Civil Service. Available at: <https://www.gov.uk/government/publications/government-social-research-behaviour-change-guidance-for-social-researchers-in-government>.

Davies, P., Walker, A.E., & Grimshaw, J.M. (2010). 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. *Implementation Science*, 5(14), DOI: 10.1186/1748-5908-5-14.

Dixon, J. (2016). Spreading improvement: How to accelerate and the importance of archetypes. In *The future of people powered health: Insights from leaders and thinkers on how digital and social innovation can contribute to better outcomes*. London: Nesta.

Dixon-Woods, M., McNicol, S., & Martin, G. (2012). Ten challenges in improving quality in healthcare: Lessons from the Health Foundation's programme evaluations and relevant literature. *BMJ Quality & Safety*, DOI: 10.1136/bmjqs-2011-000760.

Eriksén, S., Georgsson, M., Hofflander, M., & Nilsson, L. (2014). Health in hand: Putting mHealth design in context. In: *Proceedings of the UsaRE 2014 Conference - Second International Workshop on Usability and Accessibility - Focused Requirements Engineering*. [online] Karlskrona: Blekinge Institute of Technology, pp. 36-39. Available at: https://www.researchgate.net/publication/266326902_Health_in_Hand_-_Putting_mHealth_Design_in_Context.

Frankel A., Haraden C., Federico F., & Lenoci-Edwards J. (2017). *A framework for safe, reliable, and effective care*. Cambridge, MA: Institute for Healthcare Improvement and Safe & Reliable Healthcare. Available at: <http://www.ihl.org/resources/Pages/IHIWhitePapers/Framework-Safe-Reliable-Effective-Care.aspx>. 18

Gladman, J., Conroy, S., Ranhoff, A., & Gordon, A. (2016). New horizons in the implementation and research of comprehensive geriatric assessment: Knowing, doing and the 'know-do' gap. *Age and Ageing*, 45, 194–200, DOI: 10.1093/ageing/afw012.

Gregory, J. (2003). Scandinavian approaches to participatory design. *International Journal of Engineering Education*, 19(1), 62-74.

Guttmacher, S., Kelly, P.J., & Ruiz-Janecko, Y. (2010). *Community-based health interventions*. San Francisco: Wiley.

Hallsworth, M., Snijders, V., Burd, H., Prestt, J., Judah, G., Huf, S., & Halpern, D. (2016). *Applying behavioural insights: Simple ways to improve health outcomes*. Doha: World Innovation Summit for

Health, WISH.

The Health Foundation (2013). *Quality improvement made simple: What everyone should know about health care quality improvement*. London: The Health Foundation.

- Hignett, S., Jones, E., Miller, D., Wolf, L., Modi, C., Shahzad, M.W., Banerjee, J., Buckle, P., & Catchpole, K. (2015). Human factors & ergonomics and quality improvement science: Integrating approaches for safety in healthcare. *BMJ Quality & Safety*, 24(4), 250-254.
- House of Lords, Science and Technology Select Committee (2011). *Behaviour change* (2nd report of session 2010-12). London: House of Lords.
- Israel, B. A., Eng, E., Schulz, A. J., & Parker, E. A. (Eds.) (2013). *Methods for community-based participatory research for health* (2nd ed.). San Francisco: Jossey-Bass.
- Kensing, F., Simonsen, J., & Bødker, K. (1996). MUST - A method for participatory design. In: *Proceedings of the 4th Biennial Participatory Design Conference*. [online] Cambridge: PDC, pp.129-140. Available at: <http://ojs.ruc.dk/index.php/pdc/article/view/140>.
- Kok, G., Gottlieb, N. H., Peters, G.-J. Y., ... & Bartholomew, L. K. (2015). A taxonomy of behavior change methods: An intervention mapping approach. *Health Psychology Review*, DOI: 10.1080/17437199.2015.1077155.
- Maguire, M. (2001). Methods to support human-centred design. *International Journal of Human-Computer Studies* 55(4), 587-634.
- Martin, B., & Hanington, B. (2012). *Universal methods of design: 100 ways to research complex problems, develop innovative ideas, and design effective solutions*. Beverly: Rockport.
- Michie, S., Atkins, L., & West, R. (2014). *The Behaviour Change Wheel: A guide to designing interventions*. London: Silverback Publishing.
- Michie, S., & Johnston, M. (2012). Theories and techniques of behaviour change: Developing a cumulative science of behaviour change, *Health Psychology Review*, 6(1), 1-6, DOI: 10.1080/17437199.2012.654964. 19
- Michie, S., van Stralen, M.M., & West, R. (2011). The Behaviour Change Wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, 6(42), DOI: 10.1186/1748-5908-6-42.
- Michie, S., Wood, C. E., Johnston, M., Abraham, C., Francis, J. J., & Hardeman, W. (2015). Behaviour change techniques: The development and evaluation of a taxonomic method for reporting and describing behaviour change interventions (a suite of five studies involving consensus methods, randomised controlled trials and analysis of qualitative data. *Health Technology Assessment*, 19(99), 1-187, DOI: 10.3310/hta19990.
- National Health System, NHS (2013). *Transforming participation in health and care: The NHS belongs to us all*. Leeds: NHS England.
- National Health System, NHS. (2014). *Five year forward view*. NHS.
- NHS, Institute of Health Service Management & NHS Confederation (1998). *In the public interest: Developing a strategy for public participation in the NHS*. Cambridge: Bridge Consultancy.

The National Institute for Health and Care Excellence, NICE. (2015). *Urinary tract infections in adults*. Quality Standard. [online] NICE. Available at: <https://www.nice.org.uk/guidance/qs90>.

The National Institute for Health and Care Excellence, NICE. (2007). *Behaviour change: General approaches*. Guideline. Manchester: NICE.

Niedderer, K., Cain, R., Clune, S., ... Hekkert, P. (2014). *Creating sustainable innovation through design for behaviour change*. Full Project Report. University of Wolverhampton, Project Partners & Arts and Humanities Research Council.

Ogden, J. (2016). Celebrating variability and a call to limit systematisation: The example of the Behaviour Change Technique Taxonomy and the Behaviour Change Wheel. *Health Psychology Review*, 10(3), 245-250, DOI: 10.1080/17437199.2016.1190291.

O'Kelly, K., Phelps, K., Regen, E., Kondova, D., & Conroy, S. (2016). A qualitative study investigating the behavioural and psychological factors contributing to the misdiagnosis of urinary tract infection in adults – “to dip or not to dip”. [poster] In: *EUGMS Congress*, Lisbon: EUGMS.

Ostergaard, K. L., Karasti, H., & Simonsen, J. (2016). Nurses' journey toward genuine participation: Becoming and learning. In: *Proceedings of the 14th Participatory Design Conference*. [online] Aarhus: PDC, pp.57-60. Available at: <http://ojs.ruc.dk/index.php/pdc/article/view/5482>.

Perry, C., Chhatralia, K., Damesick, D., Hobden, S. & Volpe, L. (2015). *Behavioural insights in health care: Nudging to reduce inefficiency and waste*. London: The Health Foundation. 20

- Richards, T., Montori, V.M., Godlee, F., Lapsley, P., & Paul, D. (2013). Let the patient revolution begin: Patients can improve healthcare: It's time to take partnership seriously. *BMJ* 346:f2614, DOI: 10.1136/bmj.f2614.
- Ridley, J., & Jones, L. (2002). *User and public involvement in health services: A literature review*. Edinburgh: Scottish Human Services.
- Robertson, T., & Simonsen, J. (2012). Challenges and opportunities in contemporary participatory design. *Design Issues*, 28(3), 3-8.
- Robertson, T., & Simonsen, J. (2013). Participatory design: An introduction. In *Routledge international handbook of participatory design* (pp. 01-17). New York: Routledge.
- Ross, A.J., Reedy, G.B., Roots, A., Jayne, P., & Birns, J. (2015). Evaluating multisite multiprofessional simulation training for a hyperacute stroke service using the Behaviour Change Wheel. *BMC Medical Education*, 15(143), DOI: 10.1186/s12909-015-0423-1.
- Sanders, E., Brandt, E., & Binder, T. (2010). A framework for organizing the tools and techniques of participatory design. In: *Proceedings of the 11th Biennial Participatory Design Conference*. [online] Sydney: PDC, pp.195-198. Available at: <http://ojs.ruc.dk/index.php/pdc/article/view/1910>.
- Scoville R., Little K., Rakover J., Luther K., & Mate K. (2016). *Sustaining improvement*. IHI White Paper. [online] Cambridge, MA: Institute for Healthcare Improvement. Available at: <http://www.ihl.org>.
- Sinnott, C., Mercer, S.W., Payne, R.A., Duerden, M., Bradley, C.P., & Byrne, M. (2015). Improving medication management in multimorbidity: Development of the Multimorbidity Collaborative Medication Review And Decision making (MY COMRADE) intervention using the Behaviour Change Wheel. *Implementation Science*, 10(132), DOI: 10.1186/s13012-015-0322-1.
- Solomon, S. (2005). A new wave of behavior change intervention research. *Annals of Behavioral Medicine*, 29(2), 1-3, DOI: 10.1207/s15324796abm2902s_1.
- Somekh, B., & Lewin, C. (Eds.) (2011). *Theory and methods in social research* (2nd ed.). Thousand Oaks: Sage.
- Spotswood, F. & Marsh, A. (2013). Conclusions: What is the future of 'behaviour change'? In *Beyond behaviour change: Key issues, interdisciplinary approaches and future directions* (pp. 283-298). Bristol: Policy Press.
- Suntornsut, P., Wongsuwan, N., Malasit, M., Kitphati, R., Michie, S., Peacock, S.J., & Limmathurotsakul, D. (2016). Barriers and recommended interventions to prevent melioidosis in northeast Thailand: A focus group study using the Behaviour Change Wheel. *PLOS Neglected Tropical Diseases*, 10(7), DOI: 10.1371/journal.pntd.0004823. 21
- Tonkin-Crine, S., Yardley, L., Coenen, S., Fernandez-Vandellos, P., Krawczyk, J., Touboul, P.,
- Verheij, T., & Little, P. (2011). GPs' views in five European countries of interventions to promote prudent antibiotic use. *British Journal of General Practice*, 61(586), e252-61, DOI: 10.3399/bjgp11X572445.
- Vredenburg, K., Mao, J.-Y., Smith, P. W., & Carey, T. (2002). A survey of user-centered design practice. In: *Proceedings of the Conference in Human Factors in Computer Systems, CHI*. Minneapolis, ACM Press, pp.471-478.
- Wadsworth, Y. (1998). What is Participatory Action Research? *Action Research International*, Paper 2. Available on-line: <http://www.scu.edu.au/schools/gcm/ar/ari/p-ywadsworth98.html>.

Webb, J., Foster, J., & Poulter, E. (2016). Increasing the frequency of physical activity very brief advice for cancer patients: Development of an intervention using the Behaviour Change Wheel. *Public Health, 133*, 45-56.

World Health Organization, WHO (2015). *Global action plan on antimicrobial resistance*. Geneva: WHO. Available at: http://www.wpro.who.int/entity/drug_resistance/resources/global_action_plan_eng.pdf.

Yardley, L., Morrison, L., Bradbury, K., & Muller, I. (2015). The Person-Based Approach to intervention development: Application to digital health-related behavior change interventions. *Journal of Medical Internet Research, 17*(1), e30, DOI: 10.2196/jmir.4055.

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Val Mitchell graduated from Loughborough University with a degree in Ergonomics. After working as an ergonomist in a design consultancy in Sweden and in the health service, Val joined Loughborough University as a researcher. She has managed and worked on many research and consultancy projects particularly relating to the design of ICT and mobile communication product and services. Her PhD entitled: "Methods for Exploring User Needs for Future Mobile Products and Services" was conducted in collaboration with a major UK

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