

Using theories of behaviour to understand transfusion prescribing in three clinical contexts in two countries: Development work for an implementation trial

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AT, SJS, MPE, JMG conceived the study and, with CH, acquired funding. JJF, MJ, JMG, MPE were theoretical and methodological advisers. All authors advised on clinical and methodological issues, provided ongoing critique and approved the final version of the manuscript.

Acknowledgements

This study was funded by the Department of Health for England and the Canadian Blood Services. We thank the participants for generously sharing their views. Jill Francis is 50% funded by the Chief Scientist Office of the Scottish Government Health Directorates. Jeremy Grimshaw holds a Canada Research Chair. Alan Tinmouth is supported by a Canadian Blood Services / Canadian Institutes of Health New Investigator Award. Dean Fergusson is supported by a Canadian Institutes of Health New Investigator Award The views expressed are not necessarily those of the funding bodies. We thank Dr Rafat Islam for her contribution in developing the interview topic guide for the Canadian study.

Competing interests

The authors declare that they have no known competing interests.

Abstract

Background

Blood transfusion is an essential part of healthcare and can improve patient outcomes. However, like most therapies, it is also associated with significant clinical risks. In addition, there is some evidence of over-use. Understanding the potential barriers and enablers to reduced prescribing of blood products will facilitate the selection of intervention components likely to be effective, thereby reducing the number of costly trials evaluating different implementation strategies. Using a theoretical basis to understand behaviours targeted for change will contribute to a “basic science” relating to determinants of professional behaviour and how these inform the selection of techniques for changing behaviour. However, it is not clear which theories of behaviour are relevant to clinicians’ transfusing behaviour. The aim of this study is to use a theoretical domains framework to identify relevant theories and to use these theories to identify factors that predict the decision to transfuse.

Methods

The study involves two steps: (1) interview study and (2) questionnaire study. Using a previously identified framework we will conduct semi-structured interviews with clinicians to elicit their views about which factors are associated with monitoring rather than transfusing red blood cells. Interviews will cover the following theoretical domains: Knowledge; Skills; Social/professional role and identity; Beliefs about capabilities; Beliefs about consequences; Motivation and goals; Memory, attention and decision processes; Environmental context and resources; Social influences; Emotion; Behavioural regulation; Nature of the behaviour. The interviews will take place independently in Canada and the United Kingdom and involve two groups of physicians in each country (United Kingdom: adult and neonatal intensive care physicians; Canada: intensive care physicians and orthopaedic surgeons). We will content analyse the interview transcripts to select relevant theoretical domains; use consensus processes to map these domains on to theories of behaviour; develop questionnaires based on these theories; and mail them to each group of physicians in the two countries. From our previous work, it is likely that the theories will include: Theory of Planned Behaviour, Social Cognitive Theory and the evidence-based strategy, Implementation Intention. The questionnaire data will measure predictor variables (theoretical constructs) and outcome variables (intention and clinical decision) and will be analysed using

multiple regression analysis. We aim to achieve 150 respondents in each of the four groups for each postal survey.

Background

Blood transfusion

Blood transfusion is an essential part of modern healthcare, and can improve patient outcomes. However, like most therapies, it is also associated with significant clinical risks[1]. It is in addition a scarce and costly resource[2]. There is published evidence of variation and sub-optimal clinical transfusion practice in all aspects of transfusion. For example, there is on-going evidence of large differences between hospitals and clinical teams in the use of red cell transfusions (and other blood products) for the same surgical procedures with no clear explanation based on clinical factors e.g., pre-operative haemoglobin, peri-operative blood loss[3]. In a large multicentre study of Canadian ICU patients transfused over a 2-year period, the percentage of patients transfused varied from 20-54% across 11 different centres[4]. A recent regional audit in the United Kingdom in patients undergoing primary hip replacement surgery showed a range of 23-58% in the proportion of patients who were transfused[2]. The majority of patients who were transfused received only 1 or 2 units of blood and most were discharged with a haemoglobin concentration above 10g/dl. If they had not been transfused, they would still have had a haemoglobin concentration above 8g/dl, which would not be expected to impair postoperative recovery[5]. Some teams carry out even major procedures without blood transfusion by attention to patient care throughout the peri-operative period[6]. The combination of algorithms for blood management and restrictive transfusion thresholds may in these situations offer a more effective approach to blood conservation than the implementation of single interventions such as autologous transfusion[7].

Changing transfusion practice

Variation in the use of blood suggests the potential for a reduction in blood usage without having a negative impact on patient care. Many different forms of behaviour change interventions are used in current clinical practice by hospitals and blood transfusion services world-wide with the aim of changing transfusion practice including the dissemination of guidelines, retrospective or prospective audits, educational events, and algorithms for blood prescribing[8, 9]. A systematic review found that all interventions for the reduction of transfusion studied in clinical trials seemed to be effective, with a reduction in inappropriate transfusions of 12-83%[8] and of 9-77% for the total number of units transfused[9]. However, there were significant limitations to the quality of this evidence. Most of the studies were uncontrolled before-and-after studies which

are prone to secular changes, maturation bias, and bias in favour of the intervention. Most were single-centre studies and many were performed more than 10 years ago. The universal success in the published studies raises the possibility of publication bias. These concerns about the true effectiveness and the durability of the effect of these interventions were raised by one study, which reported a return to the baseline rate of transfusions 3 months after the completion of the intervention, and a follow-up report from another study[10, 11] that reported a return to previous transfusion practice. Finally, none of the studies formally reported cost-effectiveness comparisons.

Implementation Research

There is recognition that the findings from clinical and health services research will not change population health outcomes unless health care systems, organizations and professionals adopt them in practice[12]. A consistent finding is that the transfer of research findings into practice is unpredictable and in many cases slow and haphazard[13]. A review of quality of care studies from UK primary care concluded that “in almost all studies the process of care did not reach the standards set out in national guidelines or set by the researchers themselves”[14]. Recognition of this quality gap has led to increased interest in more active quality improvement strategies, and over the past 10 years a considerable body of quality improvement research has developed [12, 13, 15]. This demonstrates that interventions can be effective, although providing less information to guide the choice or to optimise the components of complex interventions in actual practice[16]. Hence, there is still a need to develop a basic science of implementation.

The starting position for implementation research is the recognition that uptake of clinical research, implementation of knowledge and delivery of evidenced-based health care are forms of clinical behaviour, and therefore identifying factors that predict clinicians’ behaviour that are amenable to change may guide the design and choice of interventions with the highest chance of success[17]. It therefore includes the study of influences on healthcare professionals’ behaviour and interventions to enable them to use research findings more effectively. While interventions to change clinical practice can be aimed at a number of levels (individual health care professionals; health care groups or teams; organisations providing health care; the larger health care system; or environment), the majority of interventions have been aimed at individual practitioners, as ultimately it is the individual clinician who decides much of the face-to-face health care.

The use of behavioural theory in changing the behaviour of healthcare professionals

While the effectiveness of interventions varies across different clinical problems, contexts and organisations, studies in general have provided scant theoretical or conceptual rationale for their choice of intervention[18] and only limited descriptions of the interventions and contextual data. In particular, it has been argued previously[19] that our understanding of potential barriers and enablers to quality improvement is limited, and hindered by lack of a “basic science” relating to determinants of professional and organisational behaviour and potential targets for intervention. The challenge for quality improvement service developers is to develop, use and evaluate a theoretical base to support the choice and design of interventions as well as the interpretation of quality improvement study results.

The UK Medical Research Council has proposed a framework for developing and evaluating complex interventions[20, 21] and this provides a useful structure for approaching implementation research in general including the utilisation of blood products. The revised framework[21] gives prominence to the development of the intervention, which includes *identifying the evidence base, identifying or developing theory and modelling the process or outcomes*. We interpret these three research activities for implementation research as follows:

- 1) *Identifying the evidence base* encompasses two distinct components in implementation research: verification of an evidence-practice gap (i.e. would quality of health care be improved if clinicians’ behaviour changed?) and identification of specific evidence-based behaviour change techniques (‘active ingredients’) that are likely to lead to change.
- 2) *Identifying or developing theory* is essential for understanding the likely mechanisms of behaviour change. This informs questions such as how best to deliver and optimise the techniques.
- 3) *Modelling the process or outcomes* involves an empirical investigation by which the theorised pathways that change or maintain the current behaviour are tested in a real or simulated clinical context. Results of this investigation feed back into (1) the evidence base relating to the behaviour change techniques and (2) confirming, disconfirming or developing theory.

The MRC framework thus proposes a systematic, theory- and evidence-based approach to the identification of the ‘active ingredients’ for achieving professional behaviour change. By using a theoretical basis to identify determinants of behaviour and to select behaviour change

interventions, the chances of finding a significant improvement in response to a specific set of interventions should increase, thereby reducing the number of costly trials evaluating different implementation strategies. Additionally, this approach should allow for the combination of complementary techniques and possibly identification of clinical contexts that require different approaches to target different groups of physicians.

However, this first requires the selection of an appropriate theoretical framework. A number of psychological theories have been used to explore the factors associated with the behaviours of health care practitioners, e.g. the Theory of Planned Behaviour[22], and Social Cognitive Theory[23]. Psychological theories are numerous, and, in order to rationalise their use, a consensus group of UK health psychologists derived 12 theoretical ‘domains’ that incorporated all relevant theories, and which could be used to investigate the implementation of evidence-based practice[24]. A Table reproducing these domains and the theoretical constructs they include is shown in Additional File 1. These theoretical domains offer a comprehensive list of potentially relevant constructs for the behaviour of transfusing. Based on these constructs, it may be possible to adopt a systematic approach to selecting appropriate theories.

Clinical Contexts

While medical specialties represent significant users of red blood cells, as a broad generalisation, transfusion practices in medicine and paediatrics have been less evaluated by comparison to surgical specialities in audits of transfusion. Within the medical specialties, neonates represent a clinical group in which patients can be heavily exposed to blood and blood components, and the risks of blood (including variant CJD) assume greater significance in view of potential for longer survival. The evidence base to guide transfusion practice is strongest in adult critical care though still incomplete. The evidence base in neonates is slowly developing, and a number of recent randomised controlled trials have been published which, although reporting different findings, begin to inform and direct behaviour[25, 26]. As in adult intensive care there is the emergence of over-transfusion as a problem. Within the UK, the PlaNeT study[27], which collected prospective data on over 150 enrolled severely thrombocytopenic neonates and 300 platelet transfusions administered to nearly 100 neonates at seven different NICUs in Southern and Eastern England, has helped raise the awareness of transfusion and created a network of interested neonatologists. Orthopaedic surgery remains one of the largest users of red blood cells, but there is little evidence to guide transfusion practice. However, at least one large randomized

controlled trial in hip fracture patients is underway in the United States with expected completion of enrolment in 2009[5].

United Kingdom and Canadian Blood Services

The NHS Blood & Transplant (NHSBT) Service is responsible for managing all the products and services, including promoting blood, tissue and organ donation to the public; managing the supply of blood to hospitals in England and Wales; and working with hospital staff to promote the safe and appropriate use of blood. The current structures in place to support blood transfusion at hospitals are based around hospital liaison teams of medical staff, nurses and blood bank managers. Through Regional Transfusion Teams and Regional Transfusion Committees these individuals are pivotal in promoting compliance with the UK Chief Medical Officer's 'Better Blood Transfusion' initiative[28] and developing a programme of activities in line with the objectives agreed by the National Blood Transfusion Committee. Such activities include:

- Workshops on specific topics to identify examples of good practice within local Trusts
- Regional audit
- Educational meetings
- Development of benchmarking schemes
- Acting as a resource for Hospital Transfusion Teams in Trusts with outlying performance in Transfusion practice.
- Regularly reporting on the output of the Regional Committee to the National Committee.

This regional structure provides a unique network alongside hospital colleagues to support studies aimed both at understanding transfusion practice and evaluating different interventions to change practice.

The Canadian Blood Services performs many similar functions in Canada since taking over in 1997 from the Canadian Red Cross as the sole supplier of blood products for nine of the provinces and the three territories in Canada. These functions include the collection, processing and distribution of conventional blood components, and the distribution of fractionated blood products. Included in the mandate of the Canadian Blood Services is the promotion of the optimal use of blood products, and the advancement of transfusion science through research and development. In the former capacity, the Canadian Blood Services works with hospital-based transfusion medicine services and physicians. In the latter role, they fund research projects in both laboratory-based science and clinical epidemiology related to transfusion medicine. The

funding opportunities offered by the Canadian Blood Services include the Kenneth Fyke award for innovation in blood services delivery, and partnerships with the federal granting agency, the Canadian Institutes of Health Research.

Aims and Objectives

The aim of the study is to use constructs from psychological theories to identify factors that predict the decision to transfuse.

The objectives are:

1. To conduct semi-structured interviews (based on the theoretical domains framework) with transfusion prescribers in two clinical contexts in both the United Kingdom and Canada, to identify theoretical constructs (and therefore psychological theories) relevant to the use of red blood cells;
2. To develop a questionnaire based on the identified theories;
3. To conduct separate postal questionnaire surveys of intensive/critical care physicians and neonatal physicians in the United Kingdom, and intensive/critical care physicians and orthopaedic surgeons in Canada;
4. To identify the psychological constructs that, within a theoretical framework, predict the decision by neonatal and critical care consultants and orthopaedic surgeons to transfuse red blood cells (as opposed to continuing to monitor the patient).

Methods

Clinical setting

We will work with two groups of clinicians in each country - Intensive/critical care physicians and neonatal physicians in the United Kingdom and Intensive/critical care physicians and orthopaedic surgeons in Canada. Physicians in intensive care are significant users of red blood cells and there has been a landmark trial, in which mortality was compared in two groups of patients randomised to receive red cells at a more or less restrictive haemoglobin trigger threshold[29, 30]. In the UK, there is an evolving network of critical care physicians across Scotland, Wales, Northern Ireland and England, who have supported the ATTICS study[31-33] in Scotland and the Intensive Care Study of Coagulopathy (ISOC[34]) in all four countries, and it is expected that the heightened awareness of transfusion generated through these studies will facilitate a high response rate to the questionnaires planned in this survey. Similarly in Canada,

there is a well established critical care research network (Canadian Critical Care Trials Group), which has carried out much of the seminal work on blood transfusions including the TRICC and TRIPICU trials evaluating restrictive transfusion triggers in adult and paediatric patients, respectively.

Interview Study

We will conduct interviews with clinicians from each clinical area including physicians at regional centres/academic/teaching and district/community hospitals. Using the previously identified framework[24] we will ask a series of questions related to the practice of ‘watching and waiting’ rather than transfusing red blood cells. The interview will cover the following domains: Knowledge; Skills; Social/professional role and identity; Beliefs about capabilities; Beliefs about consequences; Motivation and goals; Memory, attention and decision processes; Environmental context and resources; Social influences; Emotion; Behavioural regulation; Nature of the behaviour. We will not necessarily use these technical terms but will phrase the issues appropriately for the clinical context (see Additional File 2).

These interview sessions will be conducted by a trained interviewer. The sessions will be tape recorded and transcribed for analysis. We anticipate interviewing up to 10 clinicians from each group. The total number of interviews will be determined by the time it takes to reach data saturation such that no further specific beliefs will be gathered by additional interviews.

The interview transcripts will be analysed in two stages. In Stage 1, we will code all domains that clinicians report create problems for them when making the decision to watch and wait rather than transfuse red cells. (This paper is now in press.[35]) A domain will be considered ‘relevant’ if frequently mentioned responses indicate that it might affect the decision to transfuse or not. The specific beliefs within each domain will also be coded. In Stage 2, the specific beliefs in each of the relevant domains will be used to identify constructs in the following manner.

Independent judges will use the list of beliefs (from the Stage 1 analysis) and a list of constructs included in each theoretical domain (Additional File 1) to match the beliefs with the constructs.

The identified constructs from the relevant domains will be discussed by the research team to agree the theoretical models that represent these constructs.

Questionnaire Study

Study Design

The predictor variables will be the constructs within the psychological theories selected in the interview study. The outcome variables will be behavioural intention and simulated behaviour for ‘watching and waiting instead of transfusing red blood cells’.

Questionnaire Content

Based on the interview study results, we will use the theories that most clearly represent the construct domains identified and that can be operationalised in a questionnaire format. From our previous work, it is likely that the following theories (that have been evaluated in other health care settings) will be included: the Theory of Planned Behaviour[22], Social Cognitive Theory[23] and the evidence-based strategy, Implementation Intention[36]. These theories have been examined thoroughly in other health care settings, they include explanatory factors that are amenable change and they include non-volitional components which assume that individuals do not always have complete control over their actions (e.g. the impact of insufficient financial resources). Table 1 contains examples of the variables within the theories and example questions and Additional File 3 shows an example of a finished instrument used for the UK study of intensive care consultants.

TABLE 1 HERE

Measures

To evaluate behavioural intention (to watch and wait instead of transfusing red blood cells) and its possible predictors, the questionnaire will include questions with multi-item scales to assess elements of the identified psychological theories. Responses will be elicited using a 7-point Likert scale. The content for these questions assessing specific beliefs regarding the practice of watching and waiting rather than transfusing with red blood cells will be derived from standard practice [e.g., [22, 37]] and from the interviews.

We will use three proxy measures of behaviour – strength of intention, ‘direct estimation’ of intention and simulated behaviour (see Additional File 3).

The questionnaire will measure simulated behaviour. A number of clinical scenarios will be developed for each clinical group. The clinical scenarios will use different combinations of patient characteristics (e.g. diagnosis, co-morbidities and laboratory results) and for each

scenario, physicians will be asked to report their clinical decision about whether to transfuse. Examples of scenarios are attached (Additional File 3).

Implementation of the postal questionnaires

A covering letter, which will explain the purpose and nature of the study, will be included with the initial copy of the questionnaire. The letter will explain the importance of completing the questionnaire, outline how the results will be used, and ensure the confidentiality of the responses. A reminder letter will be sent at week 2 with an additional copy of the questionnaire.

Analysis and Sample Size

The questionnaire data will allow us to assess the relationships between predictor (theoretical constructs) and three outcome measures (strength of intention, direct estimation of intention and simulated behaviour). These relationships will be assessed using multiple regression analysis. Sample size calculations for the multiple regression analysis depend on the number of cases per predictor variable[38]. A minimum sample size of $50 + 8m$, where m is number of predictor variables is required for the multiple regression analysis. To test individual predictors, a sample size of $104 + m$ is required. We estimate approximately 12 predictor variables, which will require 146 respondents to test for multiple correlations and 116 to test individual predictor variables. We will aim to achieve 150 respondents for both surveys. Assuming a conservative response rate of 50%, we will send the survey to 300 in each group.

Project Advisory Group

We will establish a Project Advisory Group in each country that will contain clinical as well as academic representatives and international collaborators. It will meet at intervals dictated by the work.

International comparisons

The studies in the two countries will be run independently through the steps outlined previously. By using methods in common, we will have the opportunity to compare results for physicians working in similar clinical settings in two different countries, and working in two different clinical settings within the same country. Specifically, we will investigate the following comparisons: Intensive Care consultants (United Kingdom compared with Canada); Intensive Care consultants compared with orthopaedic surgeons (within Canada); Intensive Care consultants compared with neonatologists (within United Kingdom). This will add an important dimension to the interpretation of the results of this project as it will enable us to identify

whether relevant domains, theories and patterns of prediction converge or diverge across different health care systems and clinical contexts.

Discussion

This study will be based on a theoretical domains framework that is derived from theories of behaviour, to identify relevant theories, and use the theories to predict intention and simulated behaviour. Intention has been defined as “indications of how hard people are willing to try, or how much effort they are planning to exert, in order to perform a behavior” [[22] p. 181]. A prerequisite of this approach is that the interim endpoint (e.g. measure of intention) must be predictive of real world outcomes. This is the case for behavioural intention in non-clinical populations as demonstrated by reviews of both observational and experimental studies. Godin and Kok[39] reported averaged correlations between intention and different health-related behaviours ranging from 0.35 to 0.56 (i.e. intention was accounting for between 12% and 31% of the variance in behaviour). Armitage and Connor[40], from 63 independent studies reporting prospectively measured behavioural data, reported that the Theory of Planned Behaviour (TPB) variables that directly influence behaviour (intention and perceived behavioural control) accounted for a similar proportion of the variance in behaviour. When behavioural measures were self-reported, the TPB accounted for more of the variance in behaviour than when behaviour measures were objective or observed. A meta-analysis of 10 meta-analyses by Sheeran[41] reported that intention accounted for almost a third of the variance in behaviour. Finally, Webb and Sheeran[42] reviewed experimental studies to relate change in intention to change in behaviour. From meta-analysis of 47 experimental tests of the intention-behaviour relationship they concluded that a “medium-to-large” change in intention leads to a “small-to-medium” change in behaviour. Eccles et al[43] and Godin et al[44] have demonstrated that a similar relationship is apparent in the smaller number of available studies of healthcare professional behaviour.

These reviews demonstrate that there is a reliable, but not perfect, relationship between stated intention and behaviour. Considerable research effort has been directed to addressing the ‘intention-behaviour gap’ and two approaches have been proposed. One addresses the variability of the link by focusing on moderators of the intention-behaviour relationship, such as intention certainty and attitudinal versus normative control[45][46]. According to this approach, it is possible to predict which individuals will enact their intentions (e.g. those whose intentions are

attitudinally controlled). A second approach focuses on mediators of the intention-behaviour relationship, or processes that might be regarded as ‘post-intentional’, such as implementation intention[36], and action plans and coping plans[47]. This approach identifies processes that assist individuals to enact their intentions, thereby minimising the size of the intention-behaviour gap. Our approach will allow us to explore both approaches.

Future work

This study corresponds to specific aspects of the UK’s revised MRC framework for developing complex interventions[21], namely, *identifying relevant theory* and *modelling process and outcome*. The results of this project will be used to develop one or more interventions to change clinicians’ behaviour. These will be piloted and then tested in a multi-site cluster randomised controlled trial.

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Table 1. Examples of likely relevant theories, the variables within the theories and questionnaire items, for the behaviour, *managing patients with borderline haemoglobin by watching and waiting instead of transfusing red cells.*

Theory	Predictor Variables	Illustrative items
Theory of Planned Behaviour [22]	Attitude Subjective norm (perceived pressure) Perceived behavioural control; Intention	In general, The benefits of managing patients with borderline haemoglobin by watching and waiting instead of transfusing red cells outweigh the harms. (Attitude)
Social Cognitive Theory [23]	Self-efficacy Goals relevant to watching and waiting	I am confident that I can manage a patient with borderline haemoglobin by watching and waiting instead of transfusing red cells. (Self-efficacy)
Implementation Intention [36]	Action plan	I have a clear plan of how I will manage patients with borderline haemoglobin by watching and waiting instead of transfusing red cells.

Additional files provided with this submission:

Additional file 1: additional file 1 - theoretical domains.pdf, 510K

<http://www.implementationscience.com/imedia/8840459152533263/supp1.pdf>

Additional file 2: additional file 2 - icu interview topic guide uk.pdf, 865K

<http://www.implementationscience.com/imedia/1467938032253326/supp2.pdf>

Additional file 3: additional file 3 - icu questionnaire uk.pdf, 48K

<http://www.implementationscience.com/imedia/7854611232533263/supp3.pdf>