

Patients' and Health Care Professionals' Perceptions of Blood Transfusion: A Systematic Review

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Abstract

Background

Blood transfusions are frequently prescribed for acute and chronic conditions; however, the extent to which patients' and healthcare professionals' (HCPs') perceptions of transfusion have been investigated is unclear. Patients' treatment perceptions influence how patients cope with illnesses or symptoms. HCPs' perceptions may influence treatment decision-making.

Study design and methods

A systematic review of studies post-1984 reporting adult patients' and HCPs' perceptions of blood transfusion. Seven databases were searched using a three-domain search strategy capturing synonyms relating to: 1) blood transfusion; 2) perceptions; 3) participant group (patients or HCPs). Study and sample characteristics were extracted and narratively summarized. Reported perceptions were extracted and synthesized using inductive qualitative methods to identify key themes.

Results

Thirty-two studies were included: 14 investigated patients' perceptions, 18 HCPs' perceptions. Surgical patients were the highest represented patient group. HCPs were from a wide range of professions. Transfusions were perceived by patients and HCPs as being of low-to-moderate risk. Risk and negative emotions were perceived to influence preference for alternatives. Five themes emerged from the synthesis, classified as *Safety/risk*, *Negative emotions*, *Alternatives (e.g., autologous, monitoring)*, *Health benefits* and *Decision making*. 'Safety/risk' and 'Negative emotions' were most frequently investigated over time, yet periods of research inactivity are apparent.

Conclusions

The literature has identified themes on how transfusions are perceived by patients and HCPs, which overlap with recognized discussion points for transfusion specialists. **These themes may help healthcare professionals when educating patients about transfusion or consenting patients.** Theory-based qualitative methods may add an important dimension to this work.

Keywords: Blood transfusion, treatment perceptions, beliefs, patient's perspective, healthcare professional-patient decision making.

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Introduction

The last decade has seen a marked increase in the numbers of randomized trials of the use of red cell transfusions and platelets, which has been reflected in updated guidance documents, such as North American AABB red cell guidelines, informed by an updated Cochrane systematic review¹. In turn, transfusion healthcare professionals (HCPs) have now focused more on the need to understand strategies that best support implementation of evidence based recommendations, alongside strategies of enabling greater patient involvement in consent to transfusion, safe administration and appropriate use of blood.

In the UK, The National Institute for Health and Care Excellence (NICE) guidelines recommended provision of patient information with an objective to consider patients' experiences and preferences for information on blood transfusion². A better understanding of patients' and HCPs' perceptions about blood transfusion could help to ensure that patients receive the information they require about blood transfusions, with equal consideration paid to the views of the HCPs. Likewise, Patient Blood Management (PBM) advocates patients being involved in decisions made about their transfusions³. However, this may not always be the case, indicated by literature reporting that transfusions may be refused by patients due to concerns about transfusion related risks and a lack of understanding by patients of the benefits and risks involved⁴. Exploring perceptions of transfusion may identify perceptions important to cover in transfusion consultations, whilst considering the broad range of patients receiving transfusions for both acute and chronic healthcare needs.

Perceptions may vary between patient groups which differ in terms of timing and frequency of transfusions, with transfusions being prescribed as a treatment in itself or as an adjunct to other treatments, such as chemotherapy or surgical procedures. Compared to patients receiving transfusions in emergency settings, where the transfusion may be given once, hematology patients often receive repeated transfusions and will thus be able to form perceptions before, during and after the transfusion. Perceptions may vary according to type of blood component being transfused

as the usage and risk profile of blood components vary, with platelets, for example, having the highest transfusion transmitted disease risk potential⁵. Different health professional groups may perceive transfusion differently from patients and between HCPs, with HCPs' views of transfusion

likely to be informed by their knowledge of the relevant clinical evidence and their own clinical experience, as has been demonstrated in respect of other treatments⁶. HCPs' perceptions and knowledge naturally influence clinical decision-making, in which patients may be partly involved⁷.

It has been argued that investigating perceptions using recognized theories is important as theory offers a systematic way of understanding events or situations⁸. Blood transfusion is a type of treatment and the investigation of perceptions of transfusion may thus be informed by existing behavioral and psychological theoretical literature of treatment perceptions^{9,10}. This literature reports that patients' perceptions, such as thoughts about how an illness could be curable or controlled through treatment, or emotional representations, such as fears or concerns⁹, influence coping strategies that patients select when choosing how to respond to their illnesses or symptoms⁹.

If transfusions are perceived by patients as beneficial to improve their health, transfusions may be willingly accepted by patients to manage their health condition, potentially reducing more general illness concerns.

The treatment perceptions literature can be applied to transfusions, of importance due to the varied use of transfusions and the different options for patient groups to be involved (i.e. in the decision making). The extent to which perceptions of blood transfusion have been investigated in a theory-based manner is unclear. No existing systematic review of patients' and HCPs' perceptions of blood transfusion was identified from a prior search of systematic reviews of this topic (Appendix A: Systematic review search strategies).

This review aimed to synthesize findings reported in the healthcare literature regarding perceptions of blood transfusion, using a qualitative approach to identify emergent themes that describe patients' and HCPs' perceptions and to consider how the themes may inter-relate.

Specific objectives were:

- To describe the designs and characteristics of studies used to investigate patients' and HCPs' blood transfusion perceptions
- To describe the patients and HCPs whose perceptions have been investigated, the time-point in the transfusion process when patients' perceptions were investigated and whether different perceptions are held about different blood components
- To identify the extent to which existing theories of behavior have been cited and applied in studies
- To identify and thematically synthesize the content of blood transfusion perceptions reported for patients and HCPs
- To report how emergent themes were distributed per period of study publication.

Methods

Study selection criteria

Empirical studies were eligible for inclusion if they met the study inclusion criteria listed in Table 1.

Patients participating in included studies were either transfusion recipients or were being prepared for a transfusion (i.e. patients donating blood for pre-operative autologous donation (PAD)). HCPs were required to be treating adult transfusion patients.

[INSERT TABLE 1]

Perceptions of blood transfusion practice, such as satisfaction with the service, recall of informed consent, training or policy fell outside the scope of the review. No limiters were applied to geographical region. The publication date of studies was from 1984 onwards; 1984 marking the date of a potential shift in perceptions of blood transfusion after the link between blood transfusion and AIDS transmission was announced¹¹.

Identification and selection of studies

Searches were run initially in February 2014 and updated in November 2015. The following databases were searched: Cochrane Central Register of Controlled Trials, the Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, Ovid MEDLINE, EMBASE, PsycINFO and PsyARTICLES.

Search terms related to three domains: 1) blood transfusion (e.g. red cell transfusion); 2) perceptions (e.g. belief or attitude); and 3) participant group (patients or HCPs, e.g. clinician). The search was applied to the studies' title and abstract fields.

Study screening

Studies were screened for inclusion by one reviewer (BA) at the title and abstract level, and subsequently at the full text level, against six inclusion criteria **that were tested for reliability** (Table 1). Review team members (FL+JF) independently assessed 1% (n=27 studies) of randomly selected titles and abstracts excluded by BA to evaluate the validity of the screening decisions.

Data extraction and synthesis

In total, 25 data elements were extracted (data extraction form **available on request**).

Reliability analysis was performed on: 1) presence / absence of theory; and 2) reported perceptions. A colleague (AP) with experience in identifying theory, independently assessed the presence or absence of theory for 10% of randomly selected studies. For the reported perceptions, data related to perceptions of blood transfusion meeting the inclusion criteria were extracted. Such data points consisted of excerpts of both raw data (i.e. participant quotes and/or quantitative findings) and/or text reporting results as interpreted by study authors. A second reviewer (FL) independently extracted the perceptions from 10% of a randomly selected sub-sample of studies.

Quality assessment of included studies

Quality was assessed for descriptive purposes rather than to inform study inclusion/exclusion.

Studies were appraised for quality by BA using validated quality assessment checklists¹². Scores produced using the checklists were reported as percentages (of quality criteria met) to enable comparison between studies.

Data analysis

Extracted data were tabulated for analysis and reported using narrative summary for all extracted data other than the reported perceptions¹³. A four-stage inductive qualitative synthesis¹⁴ was conducted to synthesize and interpret reported perceptions. First, one researcher (BA) reviewed and classified the extracted perceptions into subthemes using *in vivo* coding, where actual phrases from the excerpts were retained and used to name the subthemes¹⁵. Second, BA organized the subthemes into thematic groups using techniques from thematic analysis; *searching for themes*, by considering inter-relationships between subthemes¹⁶. The themes, subthemes and perceptions contained within them were discussed with review team members (FL+JF) to reach consensus on a refined set of themes (synthesis stage 3)¹⁷. BA then investigated intersections between the themes by reviewing the data to identify subthemes that intersected, whereby the subtheme could be allocated to more than one theme (synthesis stage 4).

Results

The search returned 2,696 unique results and two^{18,19} additional studies were identified from a systematic review identified in the search²⁰. 100% agreement on screening decisions was reached.

As displayed in Figure 1, 32 studies were included in the systematic review.

[INSERT Fig. 1]

Study characteristics

Studies were conducted between 1990 and 2015. Fourteen studies investigated patients' perceptions^{19,21-33} and eighteen studies investigated HCPs' perceptions of blood transfusion^{18,34-50} (Table 2). Three studies included patients and HCPs, however, only the data from one sample group was extracted (patients^{22,26} and HCPs³⁶); meeting the scope of this review.

[INSERT TABLE 2]

The majority of studies were conducted in the UK^{22,25,26,30,31,38,40,45-47,50}, were conducted at more than one health facility^{18,19,22,23,27,28,34,35,37-42,44-47,49,50}, and in secondary healthcare settings^{19,22-30,32-40,42-44,47,49}.

Patients and HCPs participating in included studies

In total 1,558 patients participated in the included studies (48% male, aged between 18-95 years).

Patients were classified for this review as either transfusion recipients^{22-25,31-33} or patients being prepared for a transfusion^{21,26-29}. Two studies included both patient groups^{19,30}. Patients were broadly classified as: 1) receiving transfusions in the context of surgery only^{19,26-30}; 2) mixed groups of transfusion recipients participating in the same study^{21-25,33}; 3) patients receiving regular transfusions every two to four weeks³¹; or 4) patients receiving transfusions for anemia³².

In total, 2,678 HCPs participated in the included studies. Eleven studies investigated a mix of HCP professions^{18,34-38,42,43,45,46,49} whilst seven studies assessed one HCP specialty or seniority (i.e. physicians / consultants³⁹⁻⁴¹ surgeons⁴⁷, GPs:^{48,50} and hospital managers or representatives)⁴⁴. Most HCPs were male (59% reported for n=7 studies^{36,37,39,40,42,43,46}) with between 1 and 25 years of reported clinical experience^{36,40,42}.

Research designs and assessment approaches

Cross-sectional designs were most common^{18,21-27,29,30,35-37,42,43,46,48,49} (Table 2). Materials were published in reports of nine studies^{18,21,25,26,31,32,39,40,47} and additional materials were received from six study authors^{19,23,28,35,37,38} of 24 who were contacted.

Quality appraisal of included studies

Overall the quality of the set of included papers was moderate to high. Quality appraisal ratings ranged from 45-100%. Nine studies^{18,27,29-32,39,40,49} scored above 90%, with 90% considered by review team members (BA+FL+JF) as the threshold indicating a high-quality study. Studies detailing steps taken to analyze and verify the data received, for example, high quality assessment scores >90%^{18,27,29,30,32,39,40,49}. Studies where explanation was not provided of how the participants were selected, to ensure less biased responses, received lower scores (<65%)^{24,26,41,47,48}.

Time points patients' perceptions assessed

Two studies reported the time point at which the perceptions of patients who had received a transfusion were assessed, either within 48 hours of the transfusion²² or 'about 24 hours after the transfusion'³².

Blood components investigated

The majority of studies (n=19) did not report which blood component was being investigated^{18,21-26,30-33,35,36,38,41-43,48,50}. Perceptions of red blood cell transfusion were investigated in three studies, either in isolation⁴⁹ or compared with the alternative of 'monitoring' (i.e. '*managing a patient with borderline haemoglobin by watching and waiting instead of transfusing red cells*')^{39,40}. One study assessed HCPs' perceptions of transfusion of fresh frozen plasma (FFP)³⁷.

Citation of theory

Reliability analysis of the presence or absence of theory reached 100% agreement between two reviewers. Eleven theories were identified across 11 studies (see Appendix B for all theories). Three

studies cited multiple theories^{28,45,46} and in eight papers theory was cited in the introduction and discussion as well as being applied in the methods to inform the design of the study or study materials^{18,26,28,39,40,43,45,49}. Six theories (Theories 2-7, Appendix B) consist of predominantly risk-related constructs.

Perceptions of blood transfusion

Reliability of the extracted perceptions fell between 83% and 100%, with disagreements discussed until 100% agreement was reached for each study.

Inductive qualitative synthesis

In total, 79 data points (excerpts of data containing the reported perceptions) were extracted across the 32 studies. As the data points often contained more than one reported perception, perceptions were classified by BA into 195 subthemes, arranged into 13 initial themes. The themes and subthemes were iteratively consolidated into five over-arching themes of perceptions of blood transfusion containing 23 subthemes (Appendix C). The final five themes can be considered as either: 1) cognitive ('Safety/risk', 'Alternatives', 'Health benefits'), 2) emotional ('Negative emotions'), or 3) behavioral ('Decision making'). Cognitive and emotional themes contain patients' and HCPs' perceptions reported as either thoughts or emotions experienced or hypothetically considered in relation to transfusion. For the 'Decision making' theme, the content represents perceptions that may result in behaviors that are observable in the clinical setting. **Figure 3 displays the distribution of themes for each five-year period of publication. This shows that the themes 'Safety/Risk' and 'Negative emotions' have been frequently and increasingly investigated, while 'Health Benefits' and 'Decision making' received moderate research interest. Research relating to theme of 'Alternatives' reduced post 2005 and increased again in 2011 to 2015.**

Summary of themes

Safety / risk: Patients and HCPs reported a low perceived risk of contracting an illness from contaminated blood^{19,29,44,46} with one study reporting decreases over a 12 year time period in a

cohort of GPs' and their perceptions of blood transfusion risk⁴¹. Blood transfusion was ranked as having low / intermediate risk in comparison to other hazards (e.g. skiing, alcohol, nuclear reactors)^{43,45} and treatments (e.g. surgery or anaesthetic)^{30,35}. Some patients reported risks

associated with transfusions as being somewhat acceptable and unavoidable³³. Some physicians reported confidence in the safety of blood,¹⁸ whereas others acknowledged potential danger associated with transfusion, such as the possibility of errors³⁸ or transfusion-related acute lung injury³⁷.

Negative emotions: Many factors, such as disease or infection risk,^{19,32} adverse events,^{36,38} or general apprehension about receiving a transfusion²³ were evident in reported concern or worry in patients and HCPs. Some physicians reported that they would be concerned if new viral / bacterial threats emerged, and therefore would reduce their level of blood product use¹⁸. Some patients did not report concerns about receiving transfusions¹⁹. Some HCPs reported concerns about watching and waiting instead of transfusing (i.e. in situations where a patient may become symptomatic)^{39,40}.

Alternatives: Some surgical patients, surgeons, GPs and anesthesiologists reported preferring alternatives to reduce perceived risk associated with transfusion^{19,27,45,46}. Willingness to pay for autologous transfusion (PAD) was also high for patients reporting dread of receiving an allogeneic transfusion^{28,29}. HCPs' motivations to consider alternatives for their patients were mixed, and influenced by evidence, technique complexity, patient demand, the patient's condition and perceptions of free and safe blood supplies^{34,39,40,44,47}.

Health benefits: Patients tended to perceive transfusions as beneficial, understanding why the transfusion was necessary^{22,25}, with benefit outweighing risk³³. However, while some HCPs perceived transfusion to be beneficial⁴³, others reported that not transfusing, and instead monitoring the patient's condition, may reduce transfusion risks^{39,40}. Some hospice and hospital inpatients also found it difficult to perceive the benefit of the transfusion³¹, in some cases due to ill health associated with their medical conditions³³.

Decision making: HCPs reported making transfusion decisions on a case-by-case basis^{39,40,42}, with a shift from blood being considered as *'good for everybody'*³⁴ and decisions being to a lesser extent influenced by cost, the patient's age or the availability of blood^{42,49}. For HCPs, acute or risk of

bleeding, functional deterioration and anemia (from chemo-and/or radiotherapy) were reasons for transfusions, and low hemoglobin levels and pallor increased the likelihood of deciding to transfuse^{35,37,42}. Some patients surveyed before and after transfusion counselling were less likely to report post counselling that doctors relied too much on transfusion²⁶. Reasons for transfusion were reported by patients as generalized weakness, trauma and surgery^{22,23}; with patients reporting that physicians often made the transfusion decisions³². Some patients in a low-income country would not consent to transfusion due to infection risk²⁴.

Intersections between themes

Intersections between the themes were proposed (synthesis stage 4; Appendix D) and represented in a conceptual model (Figure 2) to portray the intersection between the themes that are either cognitive or emotional, with the behavioral 'Decision making' theme positioned to the right of the model. The model's central arrow portrays a relationship, based on the findings of the synthesis, between the cognitive or emotional themes, which are proposed to influence actions that patients and HCPs perform in clinical settings subsequent to 'Decision making' (i.e. providing consent to be transfused or prescribing a transfusion).

[INSERT Fig 2.]

[INSERT Fig 3.]

Discussion

Key findings

This systematic review identified 32 studies reporting adult patients' and HCPs' perceptions of blood transfusion. Most studies were conducted in the UK, were cross-sectional and investigated the perceptions of patients after transfusion or of patients receiving or being prepared for transfusions in relation to surgery. Studies involving HCPs tended to include HCPs from mixed professions in secondary healthcare settings. Theories including risk constructs were most frequently cited in this literature, with most studies citing or applying one single theory. Studies included in the review were considered to be of moderate to high quality.

The synthesis of the reported perceptions highlighted that patients and HCPs view transfusion with low to moderate risk, but that some perceptions of transfusion-associated risk, or negative emotions, were associated with the use or consideration of transfusion alternatives. Some patients perceived benefit from transfusion^{22,25}, however, other patients found the benefit difficult to discern due to the impact of their illness^{31,33}. It was also reported that HCPs led the decision making about transfusion³².

Comparison of themes to other literature

The findings were synthesized into four cognitive or emotional themes ('Safety / risk,' 'Negative emotions', 'Alternatives' and 'Health benefits') and one behavioral theme: 'Decision making'. 'Safety / risk' and 'Negative emotions' were the most highly researched themes, potentially driven by interest towards understanding perceptions of blood transfusion risk following historical threats to global blood supplies. The cognitive or emotional themes broadly correspond to existing subscales of treatment perceptions from the Beliefs about Medicines Questionnaire (BMQ)¹⁰ (summary available on request). Based on this convergence, if faced with a health threat (illness or symptoms, as proposed in the Common-Sense Self-Regulation Model (CS-SRM)⁹), and a transfusion is proposed, patients may form and deal with perceptions that are familiar to them, from their experiences with

other treatments. Patients may utilize the range of coping strategies proposed in the CS-SRM, such as positive appraisal (appraising an encounter more positively to reduce negative emotions)⁵¹. For instance, patients having transfusions in emergency settings may hold negative emotions about

transfusion, but positively appraise it as a life-saving intervention.

Implications for practice

The findings of this review can be used by HCPs when discussing transfusion decisions with their patients in consultations, with the identified themes converging with UK guidance on issues to be discussed with transfusion patients, such as the risks, benefits of transfusion and possible alternatives⁵². Greater emphasis could be given to address patient concerns about having a transfusion, as some patient concerns related to disease or infection risk from blood transfusion^{19,32} were elevated in comparison to reported HCP concerns, which were more linked to the possibility of adverse events, such as allergic reactions³⁶. These findings, however, may not be wholly applicable to low- and middle-income countries, which may have varying resources and levels of risk exposures.

This review identified that some patients in a low-income country held concerns about transfusion because of perceived risks²⁴, indicating that greater discussion of these themes would be beneficial.

Implications for future research

The overall findings of the review highlight several research gaps, where perceptions could be explored further, taking into account key settings where transfusions are frequently prescribed.

Transfusions are reported to be highly used in medical contexts in the UK, such as emergency and hematology, compared to surgical, (67% medical vs. 27% surgical; red blood cell transfusions, 2014)⁵³. By contrast, samples in the included studies were less likely to include medical patients, or results from these groups were blended with perceptions from other patient and HCP groups.

Perceptions of repeatedly transfused patients may be distinct from those of 'one-off' transfusion patients and their perceptions may influence patient behaviors, such as regular involvement in

shared decision making or in transfusion safety monitoring⁴. In addition, no study explored patients' or HCPs' views of transfusion using platelets, widely used in hematology settings.

The present review identified existing studies of transfusion perceptions that predominantly focused on theories of risk. Other potential influences on perceptions of transfusions could be explored by drawing on a broader range of theories. A future study could be **designed to use qualitative research**

methods to include **interview** questions related to the 'Necessity' of blood transfusion that could help to identify perceptions highlighting gaps where transfusions may be able to be spared.

Perceptions of patients and HCPs from the same hospitals could be explored using comparable patient- and HCP-tailored study materials, to investigate convergence or divergence of perceptions within a specific clinical area, providing patients with the opportunity to report their perceptions before or during the transfusion. **By using qualitative research**, patients' concerns or comfort with the transfusion could be discussed.

Strengths

Strengths of this review include the theoretical approach that has been taken by the review team to understand and synthesize the perceptions, and the development of a conceptual model of blood transfusion perceptions, making the themes of perceptions potentially more accessible. Use of the inductive synthesis method led to identification of some similarity in how patients and HCPs perceive transfusion (i.e. a level of correspondence in broad thematic areas, such as safety/risk).

Likewise, areas of divergence in patients' and HCPs' perceptions, such as differences in concerns about blood transfusion, further support the need for greater patient-HCP collaboration, whereby patients can express perceptions that the HCP may themselves not hold or anticipate.

Limitations

A limitation stems from the lack of specification in studies of the blood component being investigated. HCPs from diverse clinical areas, investigated in the same study, may have been considering different blood components than their colleagues when reporting their perceptions, or

patients reporting their perceptions may not have been aware of the blood component being transfused. If patients lack information about the risks or reasons for the transfusion, this may impact their ability to fully evaluate the treatment's efficacy compared to any alternatives, as noted in the treatment perceptions literature⁵⁴.

Conclusion

In conclusion, this systematic review identified cognitive, emotional and behavioral themes of blood transfusion perceptions, themes that were shared by a wide range of patients and HCPs. Although 32 studies were included in this review, there is limited literature in this area. In particular, studies originating in low- to middle-income countries and studies focused on patients' and HCPs' perceptions for single clinical specialties are lacking. Despite rising numbers of research studies exploring the broad range of themes related to 'Safety/Risk' and 'Negative emotions' there was an unexplainable absence of any research on this topic between 2006 and 2010. As alternatives to transfusion are recommended to be considered when appropriate, future research should continue to explore perceptions of transfusion alternatives, especially when barriers have been cited for their use or consideration^{44,47}. The increase in "Decision making" themes post 2011 coincides with the launch of PBM initiatives during this time^{55,56}. To further advance blood transfusion perceptions research, the use of qualitative methods in settings where transfusions are routinely provided are suggested as an area of future research.

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Table 1 Study inclusion criteria

No.	Inclusion criterion
1	Full text English Language publication from a peer reviewed journal
2	Published since 1984
3	Assessing perceptions of blood transfusion of any blood component
4	Reporting empirical data about perceptions of blood transfusion through a primary study
5	Participant sample including patients and / or HCPs
6	Reported participant samples not below 18 years old or HCPs who treat patients below 18
	years' old

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Table 2 Included studies and study characteristics

Patient study	Country & sites (n)	Research setting	Study design	Samples included in analysis	Reported sample characteristics	Reported reasons for the transfusion or diagnoses (n)
Cheung et al., (2014)	Canada, Toronto (1)	Tertiary care hospital	Cross-sectional	25 patients prepared for a transfusion	Age: 38–84 (mean 61) Male 11, Female 14	Diagnoses: oncologic (19), Myelodysplastic syndrome (2), Not reported (4)
Orme et al., (2013)	UK, South England (1)	Hospice	Interview	10 transfusion recipients	Age: 67 - 95 (mean 79.5) Male 7, Female 3	Diagnoses: myelodysplasia (7), non-Hodgkin's lymphoma (1), myelofibrosis (1), sideroplastic anemia (1).
Davis et al., (2012)	UK, London & Oxford (2)	Secondary h/c	Cross sectional qualitative	110 transfusion recipients (post-operative + regular recipients; ambulatory hematology)	Age: 18–93 (mean 60) Male 60, Female 50 Caucasian 77, Non-Caucasian 33	
Luby et al., (2012)	Pakistan, Karachi (12)	Secondary h/c (1) and tertiary care centres (11)	Cross sectional	141 transfusion recipients	Age: (mean 33) Male 50, Female 91 Occupation = 80 housewives, 20 manual labourers, & 20 office workers.	Reason: surgical blood loss (77), anemia (28), generalized weakness (15) & trauma (13).
Shah et al., (2012)	Dhaka, Bangladesh (1)	Secondary h/c	Cross sectional / observational	126 transfusion recipients (transfusion medicine dept.)	Age: (mean 33 for males, 37.9 females) Male 81, Female 45	
Adams et al., (2011)	USA, Ohio (1)	Secondary h/c	Interview	21 transfusion recipients	Age: (n) 18–30 2 31–50 2 51–70 7 71–90 10 Male 5, Female 16	Reason: all anemia (diverse range of causes).

Fitzgerald et al., (1999)	Australia, Adelaide (1)	Secondary h/c	Interview	19 transfusion recipients	Age: (n) 21-30: 3 31-50: 4 51-70: 8 71-90: 4 Male 14, Female 5	Diagnoses: cancer (6), clotting disorders (2), organ failure (2), emergency (3), surgery (6)
Murphy et al., (1997)	UK, London (1)	Secondary h/c	Cross sectional	51 transfusion recipients (medical / surgical wards)	Age: 17-82 years Male 34, Female 17	
Khan et al., (2012)	UK, Scotland; Aberdeen (1)	Secondary h/c	Cross sectional	14 patients attending surgical pre-assessment clinic	None reported	
Graham et al., (1999)	Canada, Ottawa (2)	Secondary h/c	Cross sectional	80 Cardiac patients (40 PAD / 40 non-PAD) & 73 Orthopedic patients (38 PAD / 35 non-PAD).	Age: (mean) 59.0 Cardiac PAD / 63.5 Cardiac non-PAD / 63.2 Orthopedic PAD / 71.5 Orthopedic non-PAD. Male = 88 Cardiac PAD / 80 Cardiac non-PAD / 40 male Orthopedic PAD / 34 male Orthopedic non-PAD.	Reason: Range of surgical procedures.
Lee et al., (1998)	USA, Massachusetts & Maine (3)	Secondary h/c	Randomized between subjects design	412 patients (prior to PAD)	Age (mean) 56.05 (15.14) Female 230 Mean annual income (\$) 44,924 College education 66	Patients scheduled for autologous donation before planned surgical procedures
Lee et al., (1997)	USA, Boston (1)	Secondary h/c	Cross sectional	235 patients (prior / following PAD)	Age: (mean) 50.45 Female 63 % Mean household income = \$57993 College education 64%	Patients scheduled for autologous donation before planned surgical procedures
Court et al., (2011)	UK, Swindon (1)	Secondary h/c	Cross sectional	132 transfusion recipients 32 non-recipients (blood cross-matched)	Age: 21-84 years 141, Female 201 Male	Post-operative: 66 transfusion recipients (66-7% elective) / 26 non-recipients (80-8% elective).

Moxey et al., (2005)	Australia, Hunter & Central Coast Regions (multi-site)	Primary h/c, secondary h/c, rehabilitation clinics	Interview	23 transfusion recipients 6 PAD recipients 9 other (post-surgical patients) *	Age: (n) 30–39: 0 40–49: 3 50–59: 2 60–69: 9 70–79: 18 80+: 6 Male 22, Female 16
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HCP Study	Country & sites (n)	Research setting	Study design	Samples included in analysis	Reported sample characteristics	Years of clinical experience
Hartford et al., (2015)	Mozambique (3)	Workplace (hospital)	Cross sectional	216 Physicians (94%), nurses (2%) & technicians (4%)*	Reported physicians' specialty: internal medicine (36%), surgery (34%), paediatrics (19%), anaesthesia (10%), and other (1%).	47% were postgraduate (resident) trainees
Vetter et al., (2014)	US, Birmingham Alabama (1)	Secondary h/c	Cross sectional	73 Anesthesiologists' (n=34) & surgeons (n=39)	Age: 47 (mean) in years Gender (m=68): Male 54, female 14	Post residency practice duration (mean 14 years)
Müller et al., (2014)	Netherlands (4)	Secondary h/c	Cross sectional	46 Intensive Care Unit (ICU) physicians & fellows	Age: 20–35 year 24% 36–50 year 63%, 51–65 year 13% Gender: 65% male	Critical care specialist 72% Fellow training in intensive care 28%
Hedde et al., (2012)	Canada, UK, Norway, Italy, USA (6 site: 2 in US)	Secondary h/c	Interview (n=7) & focus group (n=12)	72 in/outpatient nurses and physicians (Italy only) <i>sampled from diverse clinical areas*</i>		
Islam et al., (2012)	Canada, UK (multi-site)	Secondary h/c	Interview	10 ICU physicians	Gender: 9 male, 1 female	Variations in training & practice in transfusion
Francis et al., (2009)	UK, England & Scotland (multi-site)	Secondary h/c	Interview	11 ICU consultants	Gender: 10 male, 1 female Age: 36–52 years	1 to 21 years

Cozzolongo et al., (2005)	Italy, Apulia region (multi-site)	Primary h/c	Cohort study design	306 (time 1)/ 170 (time 2) primary care physicians		
D'Souza et al., (2004)	UK, London (multi-site)	Primary h/c	Mixed methods	488 GPs		
Amin et al., (2004)	Canada, five provinces (multi-site)	Sourced via Canadian Medical Association Directory (2002)	Cross sectional	45 physicians (28 internists, 10 cardiovascular surgeons & 7 haematologists)		
Leibovitz et al., (2004)	Israel (multi-site)	Secondary h/c	Cross sectional	274 physicians (79 Internists, 69 oncologists, 79 Geriatricians, 47 family physicians) 74 nurses (oncology & internal medicine wards)	Gender (n female / male): Internists 16 / 63 Oncologists 24 / 45 Geriatricians 21 / 58 Family physicians 26 / 21 Nurses 72 / 2	Years of practice (mean) Internists 20, Oncologists 21, Geriatricians 25, Family physicians 17, Nurses 20.
Lee et al., (2003)	Canada, Kingston Ontario (1)	Secondary h/c	Cross sectional	33 physicians, 43 residents (21 family medicine, 19 internal medicine & 17 anaesthesia)	Gender: 51% female Age: (mean) 33 Family status: 54% married, 30% with children	
Graham, et al., (2002)	Canada, Ontario (8)	Secondary h/c	Interview	19 hospital chiefs or representatives from surgery (n=7), anaesthesia (n=3), transfusion medicine/hematology or laboratory medicine (n=7) and pharmacy (n=2).		

Ferguson et al., (2001)	England, Trent region (multi-site)	Primary h/c	One-way between subjects design	88 GPs, 143, Anaesthetists	
Lowe et al., (2001)	England, Trent region (multi-site)	Primary h/c	Cross sectional	88 GPs, 143, Anaesthetists	Gender: 264 male, 233 female Age (mean): 35.8
Torella et al., (2001)	England, north-west region (multi-site)	Secondary h/c	Cohort study design	571 surgeons n per year: 151 (1990), 226 (1994) & 194 (1999) <i>(sampled from diverse clinical areas) *</i>	
Treloar et al., (2001)	Australia, (multi-site)	Secondary h/c	Interview	12 prominent clinicians, 12 surgeons, 14 anaesthetists	
Thonneau et al., (1991)	France, Bicetre (1)	Primary h/c	Cross sectional	6 doctors (family planning)	
Salem-Schatz et al., (1990)	USA, (3)	Secondary h/c	Cross sectional survey	76 surgeons, 46 anesthesiologists	Clinical role: n=50 attending physicians & 72 residents.

* Decision rule applied - non-eligible samples (i.e. *pediatricians, post-surgical patients) represent less than 50% of the total sample, data inseparable from other samples' data, therefore all data extracted.

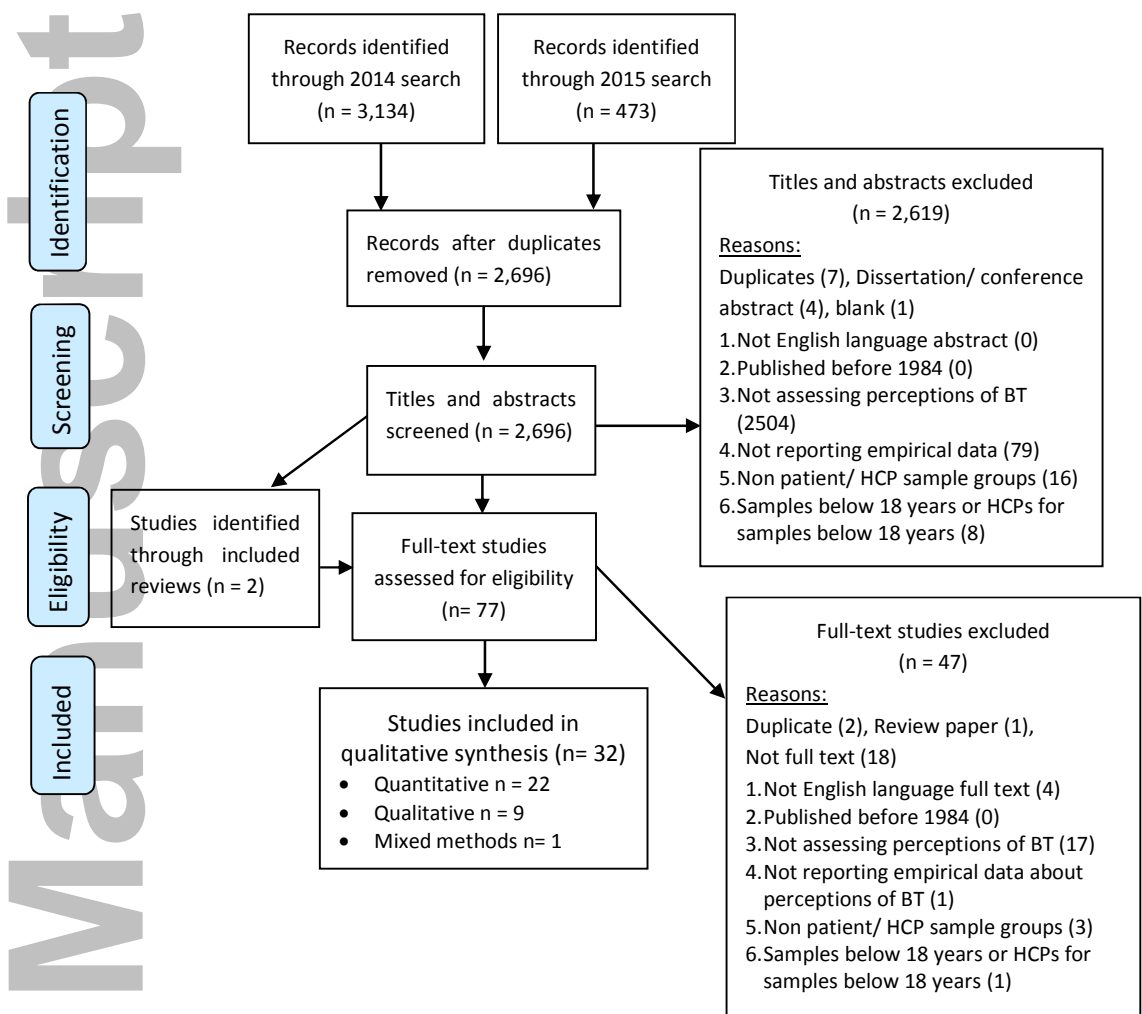


Figure 1 PRISMA diagram

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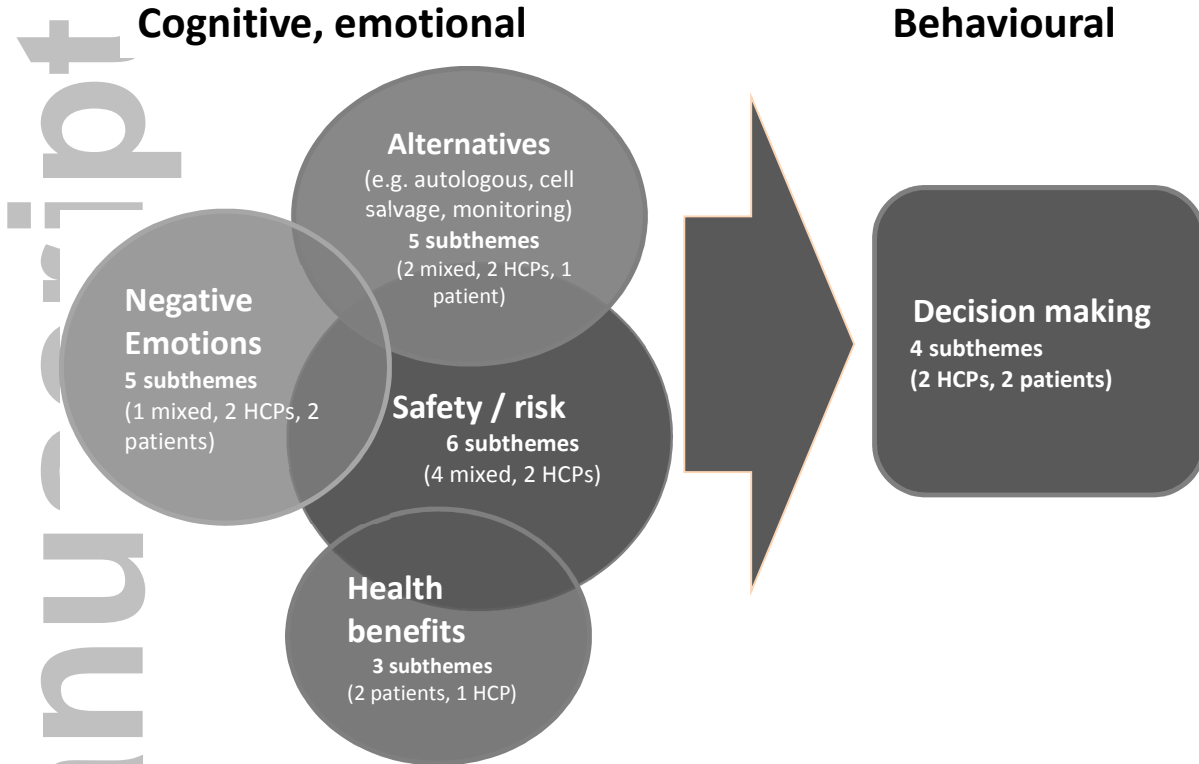


Figure 2 Conceptual model of blood transfusion perceptions based on qualitative synthesis of systematic review findings

Note. Text within each theme of the model shows the number of subthemes assigned to the model, at stage 1 of the synthesis, and whether these subthemes represent patients', HCPs' or mixed (both groups') perceptions.

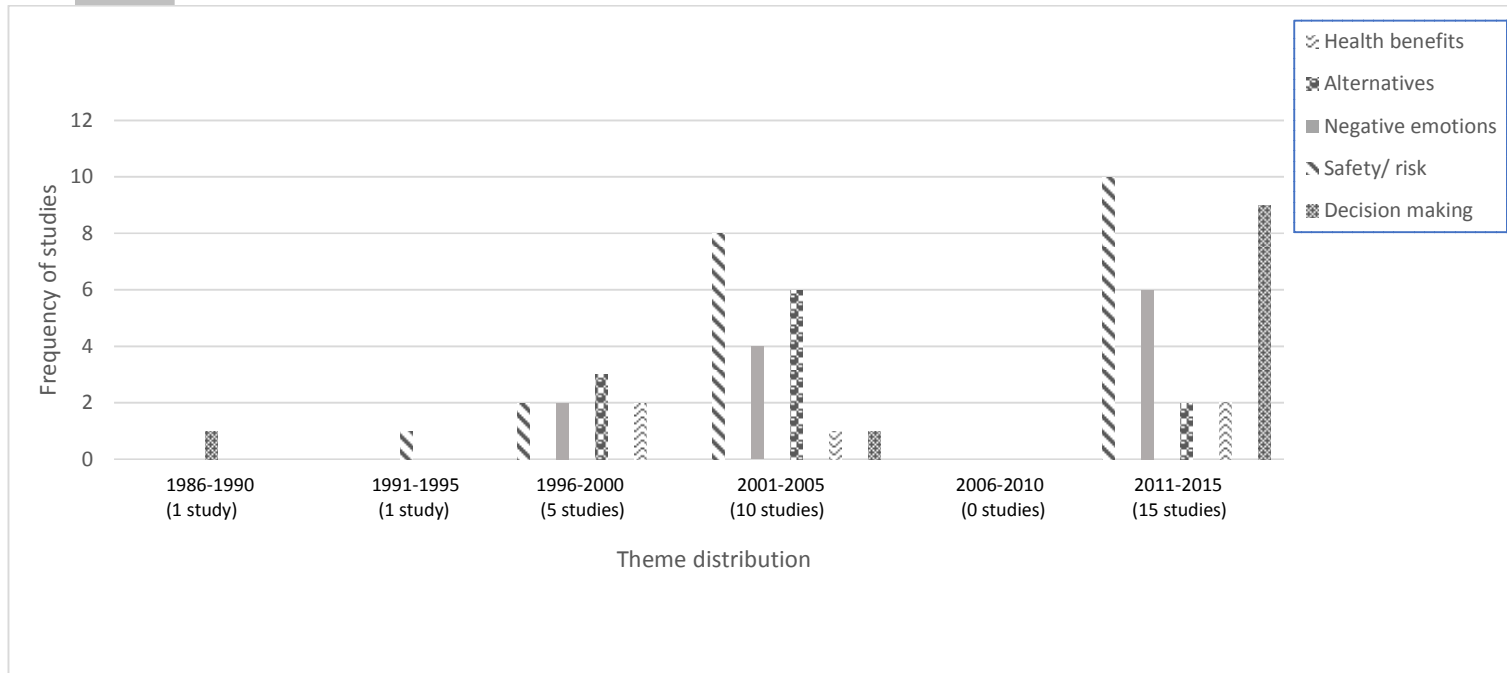


Figure 3 Reported themes of perceptions by publication years

Appendix A

Pilot search strategy:

University of York Centre for Reviews and Dissemination and The Cochrane Database of Systematic Reviews

perception* or representation* or belie* AND *blood transfusion*

Systematic review search strategy:

Embase search strategy for Cochrane CENTRAL and Database of Systematic Reviews (CDSR), Database of Abstracts of Reviews of Effects (DARE), MEDLINE, EMBASE

- 1 BLOOD TRANSFUSION.ti,ab.
- 2 (transfus* or pretransfus* or posttransfus* or retransfus* or red cell* or red blood cell* or platelets* or fresh plasma or frozen plasma or FFP or platelet concentrate*).ti.
- 3 (pretransfus* or posttransfus* or retransfus* or red cell transfusion* or red blood cell transfusion* or platelet transfusion* or plasma transfusion* or fresh plasma or frozen plasma or FFP or platelet concentrate*).ab
- 4 (blood adj3 (use* or usage* or requir* or administ* or need*)).ti
- 5 (blood product* or blood component* or blood management or blood replacement)).ti.
- 6 1 or 2 or 3 or 4 or 5
- 7 ((BLOOD TRANSFUSION or (transfus* or pretransfus* or posttransfus* or retransfus* or red cell* or red blood cell* or platelets* or fresh plasma or frozen plasma or FFP or platelet concentrate*) or (pretransfus* or posttransfus* or retransfus* or red cell transfusion* or red blood cell transfusion* or platelet transfusion* or plasma transfusion* or fresh plasma or frozen plasma or FFP or platelet concentrate*) or (blood adj3 (use* or usage* or requir* or administ* or need*)) or (blood product* or blood component* or blood management or blood replacement)) adj4 (percei* or perception or belie* or attitude* or experience* or perspective* or thought* or knowledge or representation* or view*)).ti,ab.
- 8 (medic or medics or medical staff or clinician* or doctor* or consultant* or registrar* or healthcare* or health worker* or nurs* or hospital staff or personnel* or clinical staff* or patient* or physician* or recipient* or technician* or practitioner*).ti,ab.
- 9 7 and 8
- 10 limit 9 to (human and yr="1984 - 2014")

EBSCOhost search strategy for PsycINFO, PsyARTICLES

- S1 TI BLOOD TRANSFUSION
- S2 AB BLOOD TRANSFUSION
- S3 TI transfus* or pretransfus* or posttransfus* or retransfus* or red cell* or red blood cell* or platelets* or fresh plasma or frozen plasma or FFP or platelet concentrate*
- S4 AB pretransfus* or posttransfus* or retransfus* or red cell transfusion* or red blood cell transfusion* or platelet transfusion* or plasma transfusion* or fresh plasma or frozen plasma or FFP or platelet concentrate*

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- S5** TI blood N3 (use* or usage* or requir* or administ* or need*)
- S6** TI blood product* or blood component* or blood management or blood replacement)
- S7** TI (percei* or perception or belie* or attitude* or experience* or perspective* or thought* or knowledge or representation* or view*)
- S8** AB (percei* or perception or belie* or attitude* or experience* or perspective* or thought* or knowledge or representation* or view*)
- S9** S1 OR S2 OR S3 OR S4 OR S5 OR S6 N4 (S7 OR S8)
- S10** TI (medic or medics or medical staff or clinician* or doctor* or consultant* or registrar* or healthcare* or health worker* or nurs* or hospital staff or personnel* or clinical staff* or patient* or physician* or recipient* or technician* or practitioner*)
- S11** AB (medic or medics or medical staff or clinician* or doctor* or consultant* or registrar* or healthcare* or health worker* or nurs* or hospital staff or personnel* or clinical staff* or patient* or physician* or recipient* or technician* or practitioner*)
- S12** S10 OR S11
- S11** S9 AND S12

(date range and human limiters were applied)

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Appendix B

Table of theories identified in the review

Theory identified	Study (author, year)	Location in article
1. Theoretical Domains Framework (TDF)¹	Francis et al (2009) ²	Intro, Discussion Informed topic guide: 'interview study using semi-structured one-to-one interviews, based on the theoretical domains' (p. 629)
	Islam et al., (2012) ³	Intro, Discussion Informed topic guide: 'interview study using semi-structured one-to-one interviews, based on the TDF' (p. 3)
2. The social amplification of risk⁴	Ferguson, Farrell, Lowe & James (2001) ⁵	Intro: informed study design (p.130), Discussion
	Lowe, Farrell, Ferguson & James (2001) ⁶	Intro, Methods: informed study design (p.181)
3. Psychometric model of perceived risk⁷	Ferguson, Farrell, Lowe & James (2001) ⁵	Intro, Discussion Informed measure: 'A series of cognitive factors believe to influence risk perception were also examined' (p. 131)
	Lowe, Farrell, Ferguson & James (2001) ⁶	Intro, Methods: informed study design (p.181)
	Lee, Mehta & James (2003) ⁸	Intro: informed study design (p. 773), Discussion
4. Risk theory^{9,10}	Moxey, O'Connell, Treloar, Han & Henry (2005) ¹¹	Discussion
	Amin, Wilson, Tinmouth & Hébert (2004) ¹⁴	Intro: informed study design (p.3), Discussion
5. The risk compensation theory^{12,13}		
6. Theoretical Model of Willingness to Pay (WTP) for Autologous Blood Donation (ABD)¹⁵	Lee, Liljas, Neumann, Weinstein & Johannesson (1998) ¹⁶	Intro, Discussion Informed measure: 'to determine WTP for ABD in our population, each patient was asked the following questions...' (p.1166)
	Lee, Liljas, Neumann, Weinstein & Johannesson (1998) ¹⁶	Intro, Methods: informed study design (p. 1165), Discussion
7. Prospective reference theory¹⁷⁻¹⁹		
8. Common Sense Self-Regulation Model (CS-SRM)²⁰	Khan, Watson & Dombrowski (2012) ²¹	Intro, Methods: informed HCP data analysis (p.295), Discussion
9. Availability heuristic²²	Salem-Schatz, Avorn, & Soumerai (1990) ²³	Intro, Discussion Informed measure: 'to evaluate whether risk estimates were influenced by clinician's experience...' (p. 478)
10. Typology of five sources of power²⁴		Intro, Discussion Informed measure: 'we also assessed the nature of the influence of attending physicians on residents' transfusion decisions' (p. 478)
11. Parse's theory of human becoming²⁵	Adams & Tolich (2011) ²⁶	Methods: Study design (p. 26)

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Appendix C

Themes and subthemes with quotations

Extracted data	Stage 1 of synthesis	Stage 2 of synthesis
Example of extracted content of perceptions reported by authors / participant quotes (italics)	Subtheme labels (total n=23) Number of studies with data coded into subtheme	Themes (n=5)
<p>61.5% of 26 post-operative patients viewed transfusion risk as less than surgical risk (p.186)¹. <i>"Blood has the potential to kill; therefore, it is not like another medication"</i> [Nurse] (p.1690)².</p>	<p>Risk compared with other treatments (n= 2 HCP studies, 2 patient studies)</p>	<p>Safety / Risk</p>
<p>For 76 physicians and trainees, blood transfusion was of intermediate ranking [from 10 hazards, i.e. nuclear reactors, caffeine, sharing injection needles, genetically modified foods] in [terms of] dread and severity and knowledge and control' (p.774)³.</p>	<p>Risk compared with other hazards (n= 3 HCP studies)</p>	
<p>50% of 482 GPs reported that blood transfusion in the 1990s carried a high hepatitis C infection risk (p.333)⁴. 87% of 38 post-operative patients perceived a low risk of HIV from allogeneic blood transfusion (p.24)⁵.</p>	<p>Risk of contracting an illness from contaminated blood (n=4 HCP studies, 6 patient studies)</p>	
<p>75 GPs and 135 Anaesthetists rated acute reaction (40 / 33%) as more likely than delayed reaction (1 / 6%) (p.183)⁶. 67.5% of 126 patients in Bangladesh rated allergic reaction as most possible from a transfusion (p. 677)⁷.</p>	<p>Adverse reaction to a blood transfusion (n=1 HCP study, 3 patient studies)</p>	
<p>None of n=75 GPs and n=135 Anaesthetists rated there to be a risk of death from blood transfusion (p. 183)⁶. 5% of 126 patients in Bangladesh thought that there was a risk of death from a blood transfusion (p. 677)⁷.</p>	<p>Risk of death from blood transfusion (n=2 HCP studies, 1 patient study)</p>	
<p>'The current safety of the blood supply was suggested as a factor decreasing the perceived need for any blood-sparing technology' (p.135)⁸. 19% of 73 physicians rated blood transfusions as "very often risky" (score of 4) or "always risky" (score of 5) (1304)⁹.</p>	<p>Generalised risk (n=7 HCP studies)</p>	
<p>29% of 38 post-surgical patients voiced concern with receiving allogeneic blood, mainly due to concern towards contracting a disease or infection (91%), receiving wrong blood type (18%) or adequacy of screening process (9%)' (p.23)⁵. 93% of 45 physicians would be concerned and reduce the level of blood products utilization following a new viral and/or bacterial threat in the future (p.3)¹⁰.</p>	<p>Generalised concern about blood transfusion (n=3 HCP studies, 5 patient studies)</p>	<p>Negative emotions</p>
<p><i>"I might be concerned in some situations about watching and waiting"</i> (p.635)¹¹. For 38 medics there was some concern about the inappropriate use of PAD blood in that it was 'poorly targeted' (i.e. collected in situations where it was unlikely to be used) and given back to the patient regardless of need (p.234)¹².</p>	<p>Concern about use of alternatives (n=3 HCP studies)</p>	
<p>'Apart from the worry of infection from a blood transfusion [for patients], it was not seen to be an uncomfortable procedure. (p.598)¹³.</p>	<p>Worry relating to transfusion risk (n=2 patient studies)</p>	

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'Fifty-four [transfusion] recipients (38%) were apprehensive about receiving transfusions: 34 were afraid of transfusion per se' (p.25)¹⁴.

'Because nurses and physicians consider transfusion practice important, the risk is enormous and we are so frightened of harming patients that everyone meditates on the problem' (FG1 Site 5, p.1690)².

38.2% of 73 physicians were concerned about medical error adverse events (given wrong blood) (p. 1306)⁹.

Apprehension about receiving a transfusion
(n=2 patient studies)

Fear of transfusion errors
(n=2 HCP studies)

'One of the main influences on uptake of PAD [for clinicians, surgeons & anaesthetists] was described as patient demand. Some [clinicians and surgeons] commented that use of cell-salvage is also restricted because it did not reduce the need for allogeneic blood transfusion' (p.232 & 234)¹².

I am confident [to watch and wait] provided that the patient is stable and in the ICU "Depending on the situation, if the patient is stable it's not hard; if they are unstable it is very difficult." (ICU 2) (p. 5)¹⁵.

'52% of 77 GPs and 59% of 79 Anaesthetists would choose a blood substitute over donor blood' (p.185)⁶. 82% of 38 post-surgical patients preferred to use PAD before surgery, either due to protection from disease (65%), peace of mind (16%), compatibility (19%) or to reduce burden on national blood supply (26%) (p.25)⁵.

'Willingness to pay [for autologous transfusion] increases greatly as dread of getting a transfusion of someone else's blood increases' (p.9)¹⁶.

Patients do better in general: "...there is accumulating data that shows patients do better if you minimize the amount of blood that they get." (ICU 1) (p.6)¹⁵.

Factors perceived to influence the use of alternatives
(n=5 HCP studies, 3 patient studies)

Alternatives (e.g. autologous, cell salvage, monitoring)

Confidence of using alternatives
(n=2 HCP studies)

Preference for alternatives to allogeneic transfusion
(n=3 HCP studies, 1 patient study)

Dread increases 'willingness to pay' for autologous transfusion
(n= 2 patient studies)

Advantages / disadvantages of alternatives
(n=3 HCP studies)

Some hospice patients (n=10) perceived great benefit from transfusion while others did not "...you know I feel better after, sometimes the next day I feel very lively" ' (P8, p.174)¹⁷.

Blood transfusion was perceived to be very beneficial (Dimension 3: Benefit = very important benefit vs. little or no benefit [equal to prescription drugs]) (p.774)³.

76% of 110 patients understood that their transfusion was necessary, either due to blood loss (mostly patients receiving one-off transfusions) or because of low blood count (mostly reported by regular recipients) (p.169)¹⁸.

Some patients perceived benefit, i.e. felt better after a transfusion
(n=2 patient studies)

Health benefits

Benefit compared with other treatments
(n= 1 HCP study)

Necessity of transfusion
(n=2 patient studies)

'Patients were more likely to disagree or strongly disagree [after transfusion counselling] with the fact that doctors relied too much on transfusion' (p. 297)¹⁹

Internists, oncologists, geriatricians, family physicians and nurses: 'Indications for transfusion': acute bleeding (89%), functional deterioration (73%), and anaemia resulting from chemo- and/or radiotherapy (62%) (p.544)²⁰.

Transfusion counselling changed patients' perceptions
(n=1 patient study)

Decision making:

Transfusion prescription clinical indications and contraindications
(n=2 HCP studies)

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Major influences on reducing need for allogeneic blood transfusion [in clinicians] include 'a "radical change away from considering blood transfusion good for everybody"; tolerance of lower haemoglobin levels ...' (p.232)¹².

Transfusion prescription: influences
(n= 6 HCP studies)

'Twenty percent of 126 transfusion recipients stated that they would refuse blood transfusion even if they are in need, because of the risk of requiring an infectious disease' (p.677)⁷.

Patient decision making
(n=4 patient studies)

"I do not recall talking about the transfusion or completely understanding about it but all I remember thinking is that it was life and death and I just wanted to get better" (Patient 55; p.169)¹⁸.

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Appendix D Examples of intersection between themes

Intersection	Example of intersection	Quotes
Intercepting cognitive and emotional themes		
Safety / risk + Alternatives	Blood substitutes for HCPs or autologous transfusion (PAD) for patients was in some cases preferred to reduce potential risk ¹⁻³ .	'[HCPs] who report higher levels of risk are up to five times more likely to choose a blood substitute over donated blood (p.134)' ² . '82% surgical patients preferred to use PAD before surgery ... due to protection from disease (65%)' ¹ (p.25).
Safety / risk + Alternatives + Negative emotions	Patients chose PAD to avoid infection transmission, indicating concerns about the general safety of the blood supply ⁴ . Other patients (n=495) would be willing to pay (WTP) for PAD, more greatly as perceptions dread and severity of blood transfusion increased ^{5,6} .	'Forty-four patients (56%) [pre donated] to avoid infection with HIV, hepatitis virus or other blood-borne pathogens or indicated concerns about the general safety of the blood supply' (p.991) ⁴ . The WTP for instance, varies from about \$50 for 235 patients with low dread to about \$4000 for people with a very high dread' (p.9) ⁵ .
Safety / risk + Health benefits	Patients perceived the consequences of not being transfused to outweighed possible risk implications ⁷ .	'Participants rationalized verbally, [e.g.] ... the risk was infinitesimal ('one in a million' was quoted four times), or that the consequence of not being transfused far outweighed the possibility of infection' (p.598) ⁷ .
Proposed relationship: cognitive and emotional to behavioral theme		
➤ Decision making	For HCPs, concern following viral or bacterial threats to the blood supply, would lead to a reduction in blood product utilization ⁸ . Some patients accepted the transfusion to improve their health and others would refuse ^{9,10} .	'93% [of physicians] would be concerned about and therefore reduce the level of blood and blood products utilization following a new viral and/or bacterial threat in the future' (p.3) ⁸ . '20% [of 126 patients in Bangladesh] would refuse transfusion if in need due to the risk of acquiring an infectious disease' (p.677) ¹⁰ .

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