

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

**This is the authors' final version, post peer-review, of an article published in *Journal of Critical Care* 2014;29(4):634-640. The definitive version is available from [www.sciencedirect.com](http://www.sciencedirect.com)**

**The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study**

Eilidh M Duncan<sup>1,2</sup>, Brian H Cuthbertson<sup>3</sup>, Maria E Prior<sup>2</sup>, Andrea P Marshall<sup>4</sup>, Elisabeth C Wells<sup>5</sup>, Laura E Todd<sup>6</sup>, Denise Bolsover<sup>2</sup>, Rumana S Newlands<sup>2</sup>, Fiona Webster<sup>7</sup>, Louise Rose<sup>8</sup>, Marion K Campbell<sup>2</sup>, Geoff Bellingan<sup>9</sup>, Ian M Seppelt<sup>10</sup>, Jill J Francis<sup>11\*</sup>, for the SuDDICU International Study Group

<sup>1</sup>Aberdeen Health Psychology Group, Health Services Research Unit, University of Aberdeen, UK

<sup>2</sup>Health Services Research Unit, University of Aberdeen, UK

<sup>3</sup>Department of Critical Care Medicine, Sunnybrook Health Sciences Centre and Department of Anesthesia, University of Toronto, Toronto, Canada

<sup>4</sup>Centre for Health Practice Innovation, Griffith Health Institute, Griffith University, and The Gold Coast Hospital, Australia

<sup>5</sup>Centre for the Study of Social and Legal Responses to Violence, University of Guelph, Ontario, Canada

<sup>6</sup>Department of Family and Community Medicine, University of Toronto, Canada

<sup>7</sup>Department of Family and Community Medicine, University of Toronto, Canada

<sup>8</sup>Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Canada

<sup>9</sup>Intensive Care Unit, University College Hospital, London, UK

<sup>10</sup>George Institute for Global Health, University of Sydney, Australia

<sup>11</sup>School of Health Sciences, City University London, London, UK

\* Corresponding author:

Jill J Francis, PhD

Northampton Square

London, UK

EC1V 0HB

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.  
Email: Jill.Francis.1@city.ac.uk

**Keywords:** Antibiotic prophylaxis, Theoretical Domains Framework, Intensive Care Unit, qualitative research

## **Abstract**

### **Purpose**

Selective Decontamination of the Digestive tract (SDD) as a prophylactic intervention improves hospital-acquired infection and survival rates. Uptake of SDD is low and remains controversial. This study applied the Theoretical Domains Framework (TDF) to assess ICU clinicians' views about SDD in regions with limited or no adoption of SDD.

### **Materials and Methods**

Participants were health professionals with 'decisional authority' for the adoption of SDD. Semi-structured interviews were conducted as the first round of a Delphi study. Views about SDD adoption, delivery and further SDD research were explored. Directed content analysis of interview data identified sub-themes which informed item development for subsequent Delphi rounds. Linguistic features of interview data were also explored.

### **Results**

141 participants provided interview data. Fifty-six sub-themes were identified; 46 were common across regions. Beliefs about consequences was the most widely elaborated theme. Linguistic features of how participants discussed SDD included caution expressed when discussing the risks and benefits and words such as *worry*, *anxiety* and *fear* when discussing potential antibiotic resistance associated with SDD.

### **Conclusions**

We identified salient beliefs, barriers and facilitators to SDD adoption and delivery. What participants said about SDD and the way in which they said it demonstrated the degree of clinical caution, uncertainty and concern that SDD evokes.

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

## Background

Selective Decontamination of the Digestive tract (SDD) is an intervention used in intensive care units. Evidence from randomised controlled trials suggests that it has significant potential to reduce Hospital-Acquired Infections (HAIs). SDD involves the prophylactic application of topical non-absorbable antibiotics to the oropharynx and stomach with a short course of intravenous antibiotics. Despite much interest over many years and a large evidence base (36 randomised controlled studies) suggesting efficacy in reducing rates of HAIs and increasing survival [1-9] SDD has not been widely adopted into intensive care practice worldwide. SDD continues to be a controversial subject, and seems to receive limited support from clinicians [10,11]. The multi-national SuDDICU (Selective Decontamination of the Digestive tract in critically ill patients in Intensive Care Units) mixed-methods research program [12] aimed to establish reasons for the low adoption rate, barriers and facilitators to adoption of SDD and directions for further research.

Few published studies have examined healthcare professionals' views about SDD, and those that have do not use a theoretical framework [11,13]. This lack of a theoretical framework means that findings cannot be used to build a cumulative evidence base or to inform an appropriate direction for future research. This study aims to address this limitation by using a theoretical framework developed for investigating the determinants of healthcare professional behaviour; the Theoretical Domains Framework (TDF) [14]. The TDF, which integrates behavioural theories, was developed through a consensus process with health psychologists and health services researchers to systematically assess the behaviour change processes inherent to implementation of evidence-based practice. The TDF proposes that the determinants of healthcare professionals' behaviour cluster into 12 'domains' (such as 'social

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

influences’, ‘beliefs about consequences’, social/professional role and identity’). The content of each of the domains is described in Table 1.

The controversial nature of SDD and the uncertainty about its evidence base [1-9,15,16] suggests that clinicians both within and between different clinical specialities and professional groups may hold opposing views. This study therefore applied Delphi methodology to systematically assess agreement/disagreement with SDD within ICU healthcare professionals. The Delphi method is a structured iterative process which gauges views from a panel of experts (or key stakeholders) and involves multiple, sequential ‘rounds’ [17]. Originally developed as a method to achieve consensus [18], it can also be used as a way to assess levels of agreement/disagreement [19]. The Delphi study investigated views of ICU healthcare professionals working in three regions with limited or no adoption of SDD (the UK, Canada and Australia/New Zealand). We investigated views about SDD adoption and whether further SDD research is needed, ethical, acceptable and feasible. The Delphi study commenced with a qualitative round to identify the range of views. The findings from this first round were then used to develop two quantitative questionnaire rounds to assess stability of healthcare professionals’ views and the level of consensus within and between ICU healthcare professional groups [20]. This paper describes the findings from the first Delphi round, the semi-structured interviews, and reports on (i) *what* ICU healthcare professionals said about SDD and (ii) *how* they spoke about SDD.

The TDF was designed for investigating behaviours of individual healthcare professionals when either the target actions are recommended by a clinical guideline or when the evidence base in favour of a certain action is clear. To our knowledge, this is the first study to use the TDF to investigate an intervention that (a) would be adopted and delivered at the Unit level in a hospital context (rather than by individuals), and (b) where there is uncertainty about the evidence base.

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

We aimed to identify the range of beliefs, interpretation and views about the current evidence base relating to the use of SDD in key stakeholder groups and answer the following research questions: (1) What are the views of key stakeholders of the internal / external validity and adequacy of the existing evidence base for SDD, and how willing are they to participate in further research? (2) What are the views of key stakeholders about the likely positive and negative consequences of implementing SDD in ICUs? (3) What are the views of key stakeholders about the likely barriers to implementing SDD in ICUs?

## **Methods**

This study was part of the multi-national SuDDICU mixed-methods research program. Full study design and methods are published elsewhere [12]. In brief, the SuDDICU collaboration is an international investigator-initiated independent research collaboration that has assessed the evidence base and outcomes for the use of SDD and the risks, benefits, and barriers to its use.

### **Participants and sampling**

The sample consisted of key stakeholders most likely to have ‘decisional authority’ for the adoption/or delivery of SDD within ICUs from three geographical regions (UK, Canada and Australia/New Zealand). We recruited healthcare professionals from four groups; (i) intensive care physicians (hereafter referred to as ‘intensivists’), (ii) intensive care pharmacists (hereafter referred to as ‘pharmacists’), (iii) clinical microbiologists/infectious disease physicians with intensive care responsibility (hereafter referred to as ‘microbiology/ID physicians’), and (iv) intensive care leads (including medical leads, nurse managers and senior ICU nurses).

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

Purposive sampling was used to achieve sample diversity according to predetermined factors (geographical location, ICU size, academic affiliation). In line with recommended Delphi sample sizes [21], we aimed to retain ten participants per stakeholder group within each region by the end of the Delphi rounds (i.e. 120 participants in total). Using purposively sampling and allowing for attrition, we over-recruited (over 10 per group), so that we ultimately sampled approximately 13 participants, per group, in each of the 4 groups for each geographical zone. No participant who was approached and agreed to participate was declined participation.

### **Materials**

A semi-structured interview topic guide was designed through an iterative process by the international research team. The topic guide was designed to elicit beliefs within all domains of the TDF alongside questions about willingness to participate in, and the need for, further SDD research. The topic guide was piloted in each region with one representative from each of the four stakeholder groups who was not part of the sample to assess face validity, clarity and time for completion. Minor edits were made to the topic guide following piloting to clarify wording. The topic guide is presented in Additional File 1. To ensure a shared understanding of SDD, participants were first asked to give their definition of SDD and then requested, for the remainder of the interview, to consider SDD as “*the application of antibiotics in three ways; orally, to the mouth and throat, gastric application to the stomach and a short course of IV antibiotics*”. This definition is based on the most commonly applied SDD regimen in clinical studies and practice as well as the largest trial to date on the subject [16].

### **Procedure**

Experts in each of the four stakeholder groups were identified by clinicians on the SuDDICU project team and through databases of existing clinical networks. Recruitment procedures are

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

reported in full elsewhere [12,20]. Research teams in each geographical region conducted interviews by telephone which were recorded and transcribed verbatim. Transcripts were checked for accuracy against interview recordings and anonymised.

### **Analysis**

First, analysis focused on *what* participants said about SDD. Interview content was independently coded by two researchers into sub-themes using directed content analysis[22]. A sub-theme was defined as a statement whose content may indicate a perceived influence on SDD adoption or delivery. Sub-themes that expressed the same theme or were polar opposites of the same theme were grouped together and were considered as repeats of the same sub-theme. This analysis was performed using an iterative and parallel process with the UK, Canada and Australia / New Zealand SUDDICU researchers (who had adopted an identical topic guide and sampling strategy). The next stage in the analysis involved grouping of the sub-themes into ‘overarching themes’, which were the pre-specified TDF domains (and an additional ‘further research’ category). This was carried out independently by two researchers using the TDF as an analytic framework, and content analysis methods previously employed by the research team in the context of intensive care [23]. Where there was disagreement between coders these were discussed with a third researcher. Similarities and differences in the views expressed across the three regions were explored.

Second, further qualitative analysis was carried out at a more interpretive level [24] to analyse *how* participants spoke about SDD (i.e. the linguistic features of the data). This analysis step focussed on the ‘beliefs about consequences’ domain sub-themes as this was the domain most widely elaborated by participants and involved clinical judgements about likely benefits and risks. Two researchers (ED and MP) independently examined the linguistic features of the data to enhance understanding of the breadth and depth of views coded within each sub-theme, and the similarities and differences between the manner in which participants spoke about their beliefs were considered.

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

## **Ethics**

Each region obtained separate research ethics approval: UK North of Scotland Research Ethics Service, reference 10/S0801/69, approval date 24 November 2010; Research Ethics Board of Sunnybrook Health Sciences Centre, reference 306-2010, approval date October 18, 2010; Nepean Blue Mountains Local Health Network Human Research Ethics Committee, HREC No. 11/08, 17 March 2011.

## **Results**

### **Participant characteristics**

Two hundred and forty-six clinicians were invited to participate and 141 (from 84 hospitals) accepted (57% response rate). Participants' mean age and years of experience were comparable across the three regions (Table 2).

The results are presented in two sections below relating to *what* and *how* participants discussed SDD. Following this, we present results of the item generation process for the quantitative questionnaire rounds of the Delphi study.

### **What participants said about SDD**

An overview of sub-theme content is given below under the 12 domain headings of the TDF [14]; for illustrative quotes please see Additional File 2.

#### **1. Beliefs about consequences**

Both positive and negative consequences of SDD were identified. A widely discussed concern was that SDD potentially leads to the development of antibiotic resistance. Concerns were also raised about the potential for SDD to increase the risk for *Clostridium difficile*. The potential benefits of delivering SDD were described; including reduction in rates of Ventilator Associated Pneumonia (VAP) and length of stay (in ICU and/or hospital).

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

However, some participants expressed scepticism about the benefits of SDD, particularly a mortality benefit. The importance of weighing the risks and benefits of SDD was stressed, for example, whether potential decreases in mortality and VAP are worth the risk of increased antibiotic resistance. Some concern was expressed that the delivery of SDD would increase nurses' workload, however, this perception was not reported by any of the nurse participants. Financial outcomes were also discussed including the potential for cost-savings (due to reducing VAP and length of stay), but also the potential for an increase in financial costs (due to the cost of drugs and the human resources that might be required).

## 2. Memory, attention and decision processes

Participants discussed the *decision processes* to enable SDD adoption. The importance of assessing the available literature and adopting a team-based approach was emphasized. The need for 'buy-in' of professional groups was identified with variation across regions as to which professions would need to buy in. For example, in Australia/New Zealand and Canada, nursing buy-in was perceived to be crucial but this professional group was not singled out by UK participants.

## 3. Knowledge

Participants were broadly aware of what delivery of SDD entails and most had some knowledge of the evidence relating to SDD. However, some were uncertain about which patient groups should receive SDD. In addition, dissatisfaction with the existing evidence base was reported, with the length of follow-up in randomised trials being a particular issue. Longer-term studies were perceived necessary to assess the potential impact of SDD on the development of antibiotic resistance.

## 4. Motivation and goals

Some participants reported that SDD was not a salient issue for them and was not a topic of discussion in their units or among their colleagues. Participants expressed the belief that VAP

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

was already adequately addressed by other interventions and therefore were not motivated to pursue other options such as SDD. In addition, some perceived other clinical priorities as more important at the present time, for example, ensuring that the existing VAP bundle procedures were properly delivered. Finally, there were some reports that SDD was considered “old news” and no longer a relevant clinical topic but contrasting views were also expressed.

#### 5. Environmental context and resources

The environmental context of the current evidence base was raised as a concern by some participants. It was felt that, compared with the Netherlands where most of the evidence has been generated, there are national differences in patient characteristics, ICU ecology/microbial flora, and standards of care that limit generalisability. Other resource and contextual issues concerned the need for additional educational and financial resources and the need to have pre-prepared pastes available.

#### 6. Professional role and identity

Some participants reported that SDD conflicted with their professional obligations, i.e. giving prophylactic antibiotics when it was a professional duty to reduce antibiotic use. For some, the perception was that professional groups (microbiology/ID physicians) hold conflicting opinions on antibiotic use that could influence SDD adoption.

#### 7. Behavioral regulation

Many participants noted that current national and international guidelines on infection control do not have a clear position on SDD and this absence of recommendations was perceived to influence willingness to adopt SDD.

#### 8. Social influences

Participants suggested that adoption would require a clinical champion or SDD expert to put SDD on the agenda, educate others and drive SDD forward. Some also felt that their practice

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

was influenced by the practices of other ICUs. Specifically they felt reassured that their position to not deliver SDD was in line with other ICUs.

#### 9. Skills

Participants reported that ICU staff already have the necessary skills to deliver SDD.

#### 10. Nature of the behaviors

The behaviours involved in SDD delivery were not judged overly complex or an important barrier to SDD adoption.

#### 11. Beliefs about capabilities

As would be expected given the sampling strategy, many participants felt confident in their own ability to influence SDD adoption and/or delivery. However, some non-intensivists did not share this confidence.

#### 12. Emotion

Emotional factors were not considered to be barriers to adopting SDD.

#### Views on further research

Although not a domain from the TDF, participants were also explicitly prompted to discuss their views on participating in further SDD research specifically the need to: a) investigate the effectiveness of SDD (i.e. in a RCT); b) test implementation strategies to encourage uptake of SDD. Most participants expressed willingness to support an effectiveness trial of SDD. Some participants, however, felt that enough research had already taken place to provide the evidence to make a decision on SDD adoption. Those participants supporting the need for future research indicated it should include: (1) longer follow up of antibiotic resistance than previous studies; (2) a control group comprising current standards of care; and (3) a cost-benefit analysis. Most participants were less willing to support an implementation trial, in part, due to insufficient evidence on effectiveness.

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

As displayed in Additional File 1, there was substantial consistency in the sub-themes across the three geographical regions. Forty-six of the fifty-six sub-themes identified emerged in all three geographical regions.

The findings reported above describe *what* participants said about SDD. The following section describes *how* they said it. We describe the inferences that we have drawn from analysis of some of the linguistic features of the interview data.

### **How participants discussed the consequences of SDD**

There were interesting findings relating to the linguistic features of the transcripts within the data coded as ‘beliefs about consequences’. Two major findings were identified: (i) the clinical caution and uncertainty expressed, and (ii) the language of concern used by participants to discuss risks of SDD.

#### *Clinical caution and uncertainty*

Commonly used language when discussing benefits and risks of SDD included terms such as ‘probable’, ‘possible’, ‘proposed’, ‘supposed’, ‘hoped’. For example, when discussing the benefit of reduced HAIs:

*I guess by delivering SDD it **may well be** that we can decrease the incidence of particularly Gram-negative pathogens in the intensive care I'm **not so sure** about Gram-positives. It would **hopefully** be that we have less colonization. (ANZ interviewee 211)*

Similar language of uncertainty was used when discussing the impact of SDD on length of patients’ stay in hospital/ICU and the impact on mortality;

*Now I **suppose** what you would **envisage** is that if you have fewer infections, patients **may** stay ventilated for shorter periods of time and **may** have a shorter length of stay, so **conceivably** those would be the benefits in terms of financial benefits (UK Interviewee 23)*

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

However, the potential benefit of SDD to decrease VAP seemed to be discussed in more certain terms. For example;

*Certainly the evidence at that time showed it reduced pneumonia, no question (CA Interviewee 127)*

#### *The language of concern*

The type of language interviewees used in their discussions about the potential for SDD to increase antibiotic resistance highlighted underlying concerns. Participants used words such as ‘concern’, ‘worry’, ‘anxiety’ and ‘fear’ when discussing the issue of antibiotic resistance.

For example,

*We are quite **afraid** of the risk of bacterial resistance with the use of antibiotics (CA Interviewee 120)*

Microbiology/ID Physicians were identified by some interviewees as being a particular professional group with concerns;

*“my microbiology friends, I think, are **worried** about the emergence of resistance” (UK Interviewee 32)*

#### **Generation of questionnaire items for later Delphi rounds**

Across the 141 transcripts, data were coded in to all 12 of the TDF domains and the ‘further research’ theme and we identified 54 sub-themes. The sub-themes formed the basis of questionnaire items for the subsequent Delphi rounds [12] and are presented in Additional File 1 alongside illustrative quotes. As shown in Additional File 1, the ‘beliefs about consequences’ domain theme was the most elaborated in the interviews and therefore had the greatest number of sub-themes. We present an example of coding into a TDF domain theme (‘beliefs about consequences’) and sub-themes in Table 3. Although sub-themes are worded as questionnaire items which indicate one direction of belief (e.g. ‘I am opposed to SDD’), all negative, positive and neutral utterances of a belief (e.g. ‘I am in favour of SDD’ and ‘I have

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640. no strong feelings about SDD') were coded together and generated one questionnaire item.

The questionnaire items were framed to provide a balance of item direction (i.e. favourable to SDD, unfavourable to SDD or neutral), to avoid a pro-SDD bias and to reflect good practice in constructing questionnaire items.

## **Discussion**

This study provides a qualitative perspective on ICU healthcare professionals' views about SDD in regions where SDD is not commonly used. Participants' views indicated a number of barriers to the adoption of SDD; the most widely discussed being in the TDF domain 'beliefs about consequences'. A great many of the sub-themes were held in common across all three geographical regions. Therefore, there appeared to be substantial consistency in the views raised about SDD across these three distinct regions.

The ICU healthcare professionals interviewed in this study displayed a degree of clinical caution and uncertainty when talking about potential benefits such as SDD reducing HAIs, improving mortality rates or reducing the length of patients' stay in hospital. There appeared to be more certainty expressed about the effects of SDD on VAP but, for other benefits and risks, uncertainty prevailed. Further examination of uncertainty was included within the later rounds of the Delphi study [20]. The risk of SDD contributing to increased antibiotic resistance was extensively discussed and interviewees used the language of concern, expressing worry, anxiety and fear. This fear would seem to be upheld by the existing evidence on antibiotic resistance [7-9].

These findings help us understand why the implementation of SDD has been low in most areas of the world. Despite one of the larger evidence bases in the field of critical care, the impact of the evidence is low. It is clear from these results that, although clinicians' knowledge of the evidence base could be improved, fear of driving antibiotic resistance is a major limiting factor that needs to be more clearly understood before clinicians will

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

implement this regimen [7-9]. It is fascinating to reflect that an evidence base suggesting effectiveness in 36 RCT amassed over a 30 year period [1-6] is not compelling enough to overcome a perceived risk of driving antibiotic resistance that, to date, has not been upheld in the existing literature [7-9].

The interview topic guide was based on a theoretical framework of clinical behaviour [14] which ensured good coverage of potential barriers and facilitators to SDD adoption.

However, a limitation of the study is that using the TDF meant that there was a trade-off between prompting participants using closed questions to cover all domains, and using open questions which could provide richer data for qualitative analysis. Nevertheless, the topic guide did provide data suitable for qualitative analysis (including the data coded under ‘beliefs about consequences’ from which the linguistic findings are based) and the results add to previous research which has employed a purely quantitative approach [11,13] and was not theory-based.

Previous research investigating views towards SDD and barriers is limited [11,13]. A study from the Netherlands mainly looked at work load and “patient friendliness” of SDD and identified that SDD increased workload for nurses and doctors and was less patient friendly [13]. Similarly we identified concerns about increased nursing workload in this study.

However this was not expressed by nursing participants. Findings relating to the nursing participants are elaborated in a separate publication [25].

A UK survey identified that the main factors preventing wider spread use of SDD in UK practice was *lack* of supportive evidence base and concerns about antibiotic resistance [11].

In the current study we identified issues relating to the clarity as opposed to the lack of evidence and a perceived need for more effective communication of the evidence base to clinicians.

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

Our study has a number of strengths. Firstly is its theoretical basis, the TDF which enables a wider range of barriers to be identified than participants might otherwise report [26]. Second is that using the TDF as a basis allows for the results to be linked to an evidence base for intervention design [27] if appropriate. Domains identified as problematic could be linked to theory-based intervention techniques to change behaviour [27]. Third is the inclusion of participants from three geographical areas, and four professional groups. Previous research examining ICU health professionals' views has focused on views within a single country and has not included all professions identified in this study as key stakeholders in the decision to adopt SDD. Limitations of the study include the potential for selection bias as participants self-selected to participate in the study. This is common to all such studies but in this situation could lead to two possible effects: 1. Clinicians in favour of SDD more commonly participate in the study and this biases the study in favour of a more positive view on SDD; 2. Clinicians with strong views against SDD more commonly participate in the study and this biases the study in against SDD. We are unable to identify participants' beliefs prior to this study but since so few utilise SDD in their practice, option 1 above seems less likely.

The language used in discussions about antibiotic resistance suggests that any future SDD implementation efforts would need to address the concern this issue holds for ICU healthcare professionals. The uncertainty evident in the interviewees' discussions about the risks and benefits of SDD suggests that either clinicians feel that the current evidence base for SDD is unclear, or that efforts are needed to communicate the evidence base to clinicians more clearly. Further research could explore these linguistic findings in more depth using a discourse analysis approach.

## **Conclusions**

This is the first time the TDF has been used within a Delphi study and to explore an intervention when there is uncertainty about the evidence base and no clear guidelines on

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

action. Using the framework resulted in identification of salient beliefs and the barriers and facilitators to adoption and implementation of SDD. Examining both what participants said about SDD and the way in which they said it was instructive and demonstrated clearly the degree of clinical caution, uncertainty and concern that SDD evokes. This study adds to the existing evidence base in identifying that clinicians' beliefs about the consequences of SDD affect their perception of the balance of risks and benefits for SDD, with a very clear expression of concern about the effects of SDD on antibiotic resistance.

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

## **Abbreviations**

ANZ – Australia/New Zealand

CA – Canada

HAI – Hospital-Acquired Infections

ICU – Intensive Care Unit

ID – Infectious Diseases

SDD – Selective Decontamination of the Digestive tract

SuDDICU – Selective Decontamination of the Digestive tract in critically ill patients in Intensive Care Units

TDF – Theoretical Domains Framework

UK – United Kingdom

VAP – Ventilator Associated Pneumonia

## **Authors' contributions**

EMD conducted the UK interviews and analysis, contributed to the international analysis and lead on the writing of the manuscript. BHC conceived of the study, participated in its design and coordination, contributed to the interpretation of the data, and participated in drafting the manuscript. MEP conducted the UK interviews and analysis, contributed to the international analysis and participated in drafting the manuscript. APM conducted the Australian/New Zealand interviews and analysis and participated in revising the manuscript. ECW, LET, conducted the Canadian interviews and analysis and participated in revising the manuscript. DB conducted the UK analysis, and participated in revising the manuscript. RSN and FW conducted the Canadian analysis and participated in revising the manuscript. LR, MKC, GB, IMS conceived of the study, participated in its design and coordination, contributed to the interpretation of the data and participated in reviewing the manuscript. JJF conceived of the study, led its design and coordination, contributed to the analysis and interpretation of the

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640. data, and participated in drafting and reviewing of the manuscript. All authors approved the final manuscript.

## **Acknowledgements**

The SuDDICU collaboration is a collaboration of the Canadian Critical Care trials group (CCCTG) and the Australia and New Zealand Intensive Care Society Clinical Trials Group (ANZICS CTG) and is supported by the both organisations.

This project was funded in the UK by the NIHR Health Technology Assessment programme and will be published in full in the Health Technology Assessment journal series. Visit the HTA programme website for more details [www.hta.ac.uk/2299](http://www.hta.ac.uk/2299). The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the Department of Health. We acknowledge the support of a Canadian Institutes of Health Research operating grant that funded the Canadian study. We acknowledge the support of an Australian Intensive Care Foundation grant that part funded the Australia and New Zealand study. We acknowledge the support of the Australian and New Zealand College of Anaesthetists grant that part funded the Australia and New Zealand study.

The Health Services Research Unit at the University of Aberdeen is core funded by the Chief Scientist Office of the Scottish Government Health Directorates. Views expressed are those of the authors and do not necessarily reflect the view of the Chief Scientist Office.

The SuDDICU International collaboration includes-

SuDDICU UK study group- Jill Francis, City University London; Geoff Bellingan, University College Hospital; Marion Campbell, University of Aberdeen,; Brian Cuthbertson, Sunnybrook Health Sciences Centre; Eilidh Duncan, University of Aberdeen,; Martin Eccles, University of Newcastle; Graeme MacLennan, University of Aberdeen,; Maria Prior,

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group.

The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

University of Aberdeen; Louise Rose, University of Toronto,; Kathy Rowan, Intensive Care

National Audit and Research Committee; Rob Shulman, University College Hospital,; Peter

Wilson, University College Hospital

SuDDICU Canada study group- Brian Cuthbertson, Sunnybrook Health Sciences Centre; Jill

Francis, City University London, UK; Karen Burns, St Michaels Hospital; Deborah Cook,

McMaster University; Peter Dodeck, St. Paul's Hospital,; Niall Ferguson, University Health

Network; Jeremy Grimshaw, Ottawa Health Research Institute,; Richard Hall, Dalhousie

University and The Queen Elizabeth II Health Sciences Centre; Lynn Johnston, Dalhousie

University; Salmann Kanji, The Ottawa Hospital; John Marshall, St Michaels Hospital;

Lauralyn McIntyre, Ottawa Health Research Institute; John Muscedere Kingston General

Hospital; Joe Pagliarello, University of Ottawa; Louise Rose University of Toronto; Laura

Todd, University of Toronto; Fiona Webster, University of Toronto; Charles Weijer, Western

University; Elisabeth Wells, Sunnybrook Health Sciences Centre.

SuDDICU Australia and New Zealand Study Group- Ian Seppelt, Nepean Hospital, and the

George Institute for Global Health, Sydney; Brian Cuthbertson, Sunnybrook Health Sciences

Centre; Louise Cole, University of Sydney; Arina Dan, The George Institute for Global

Health,; Simon Finfer, Royal North Shore Hospital and the George Institute; Jill Francis, City

University London, UK; Jeff Lipman, Royal Brisbane and Women's Hospital; Andrea

Marshall, Griffith University and Gold Coast Hospital and Health Service; John Myburgh, St

George Hospital Sydney and the George Institute for Global Health; David Paterson, Royal

Brisbane and Women's Hospital, University of Queensland; Leonie Weisbrodt, Nepean

Hospital.

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

## References

- [1] Silvestri L, van Saene HK, Milanese M, et al: Selective decontamination of the digestive tract reduces bacterial bloodstream infection and mortality in critically ill patients. Systematic review of randomized, controlled trials. *J Hosp Infect.* 65: 187-203, 2007
- [2] Silvestri L, van Saene HK, Milanese M, et al: Impact of selective decontamination of the digestive tract on fungal carriage and infection: systematic review of randomized controlled trials. *Intensive Care Med.* 31: 898-910, 2005
- [3] Liberati A, D'Amico R, Pifferi S, et al: Antibiotic prophylaxis to reduce respiratory tract infections and mortality in adults receiving intensive care. *Cochrane Database Syst Rev.* Issue 4: Art. No.: CD000022. DOI: 10.1002/14651858.CD000022.pub3., 2009
- [4] de Jonge E, Schultz MJ, Spanjaard L, et al: Effects of selective decontamination of digestive tract on mortality and acquisition of resistant bacteria in intensive care: a randomised controlled trial. *Lancet.* 362: 1011-1016, 2003
- [5] Oostdijk EAN, De Smet AMGA, Bonten MJM, et al: Effects of decontamination of the digestive tract and oropharynx in intensive care unit patients on 1-year survival. *Am J Respir Crit Care Med.* 188: 117-120, 2013
- [6] de Smet AM, Kluytmans JA, Blok HE, et al: Selective digestive tract decontamination and selective oropharyngeal decontamination and antibiotic resistance in patients in intensive-care units: an open-label, clustered group-randomised, crossover study. *The Lancet Infectious Diseases.* 11: 372-380, 2011

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

[7] Daneman N, Sarwar S, Fowler RA, et al: Effect of selective decontamination on antimicrobial resistance in intensive care units: a systematic review and meta-analysis. *The Lancet Infectious Diseases*. 13: 328-341, 2013

[8] Houben AJM, Oostdijk EAN, van der Voort PHH, et al: Selective decontamination of the oropharynx and the digestive tract and antimicrobial resistance: a 4 year ecological study in 38 intensive care units in the Netherlands. *Journal of Antimicrobial Chemotherapy*. 69: 797-804, 2014

[9] Oostdijk EAN, De Smet AMGA, Blok HEM, et al: Ecological effects of selective decontamination on resistant gram-negative bacterial colonization. *Am J Respir Crit Care Med*. 181: 452-457, 2010

[10] Vincent J, Jacobs F: Effect of selective decontamination on antibiotic resistance. *The Lancet*. 11: 337-338, 2011

[11] Bastin AJ, Ryanna KB: Use of selective decontamination of the digestive tract in United Kingdom intensive care units. *Anaesthesia*. 64: 46-49, 2009

[12] Cuthbertson BH, Francis J, Campbell MK, et al: A study of the perceived risks, benefits and barriers to the use of SDD in adult critical care units (The SuDDICU study). *Trials*. 11: 117, 2010

[13] Jongerden IP, de Smet AM, Kluytmans JA, et al: Physicians' and nurses' opinions on selective decontamination of the digestive tract and selective oropharyngeal decontamination: a survey. *Crit Care*. 14: R132, 2010

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

[14] Michie S, Johnston M, Abraham C, et al: Making psychological theory useful for

implementing evidence based practice: a consensus approach. *Qual Saf Health Care*. 14: 26-33, 2005

[15] Stoutenbeek CP, van Saene HK, Little RA, et al: The effect of selective decontamination of the digestive tract on mortality in multiple trauma patients: a multicenter randomized controlled trial. *Intensive Care Med*. 33: 261-270, 2007

[16] de Smet AM, Kluytmans JA, Cooper BS, et al: Decontamination of the digestive tract and oropharynx in ICU patients. *N Engl J Med*. 360: 20-31, 2009

[17] Dalkey NC, Helmer O: An experimental application of the Delphi method to the use of experts. *Manage Sci*. 9: 458-467, 1963

[18] Dalkey NC: The Delphi method: an experimental study of group opinion. , 1969

[19] Park RE, Fink A, Brook RH, et al: Physician ratings of appropriate indications for three procedures: Theoretical indications vs indications used in practice. *Am J Public Health*. 79: 445-447, 1989

[20] Francis JJ, Duncan EM, Prior ME, et al: Selective Decontamination of the Digestive tract in critically ill patients treated in Intensive Care Units: a mixed-methods feasibility study (the SuDDICU study). *Health Technology Assessment*. , in press

[21] Akins RB, Tolson H, Cole BR: Stability of response characteristics of a Delphi panel: Application of bootstrap data expansion. *BMC Med Res Method*. 5, 2005

[22] Hsieh HF, Shannon SE: Three approaches to qualitative content analysis. *Qual Health Res*. 15: 1277-1288, 2005

Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose R, Campbell MK, Bellingan G, Seppelt IM, Francis JJ, for the SuDDICU International Study Group. The views of health care professionals about Selective Decontamination of the Digestive tract: an international, theoretically-informed interview study, *Journal of Critical Care* 2014;29(4):634-640.

[23] Francis JJ, Stockton C, Eccles MP, et al: Evidence-based selection of theories for

designing behaviour change interventions: Using methods based on theoretical construct

domains to understand clinicians' blood transfusion behaviour. *Brit J Health Psy.* 14: 625-

646, 2009

[24] Ritchie J: The Applications of Qualitative Methods to Social Research, in Ritchie J,

Lewis J (eds): *Qualitative Research Practice*. London, Sage Publications Ltd., 2003, pp 24-46

[25] Marshall AP, Weisbrodt L, Rose L, et al: Implementing selective digestive tract

decontamination in the intensive care unit: A qualitative analysis of nurse-identified

considerations. *Heart & Lung.* 43: 13-8, 2014

[26] Dyson J, Lawton R, Jackson C, et al: Does the use of a theoretical approach tell us more

about hand hygiene behaviour? The barriers and levers to hand hygiene. *J Infect Prev.* 12: 17-

24, 2011

[27] Michie S, Johnston M, Francis JJ, et al: From theory to intervention: mapping

theoretically derived behavioural determinants to behaviour change techniques. *Appl*

*Psychol.* 57: 660-680, 2008