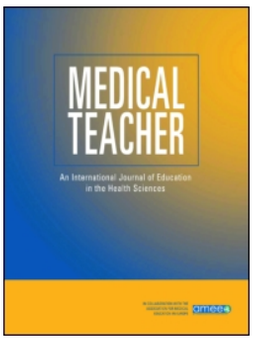

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Tools for structured team communication in pre-registration health professions education: a Best Evidence Medical Education (BEME) review: BEME Guide No. 41

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BEME GUIDE

Tools for structured team communication in pre-registration health professions education: a Best Evidence Medical Education (BEME) review: BEME Guide No. 41

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ABSTRACT

Introduction: Calls for the inclusion of standardized protocols for information exchange into pre-registration health professions curricula have accompanied their introduction into clinical practice. In order to help clinical educators respond to these calls, we have reviewed educational interventions for pre-registration students that incorporate one or more of these 'tools for structured communication'.

Methods: Searches of 10 databases (1990–2014) were supplemented by hand searches and by citation searches (to January 2015). Studies evaluating an intervention for pre-registration students of any clinical profession and incorporating at least one tool were included. Quality of included studies was assessed using a checklist of 11 indicators and a narrative synthesis of findings undertaken.

Results: Fifty studies met our inclusion criteria. Of these, 21 evaluated the specific effect of a tool on educational outcomes, and 27 met seven or more quality indicators.

Conclusions: Pre-registration students, particularly those in the US, are learning to use tools for structured communication either in specific sessions or integrated into more extensive courses or programmes; mostly 'Situation Background Assessment Recommendation' and its variants. There is some evidence that learning to use a tool can improve the clarity and comprehensiveness of student communication, their perceived self-confidence and their sense of preparedness for clinical practice. There is, as yet, little evidence for the transfer of these skills to the clinical setting or for any influence of teaching approach on learning outcomes. Educators will need to consider the positioning of such learning with other skills such as clinical reasoning and decision-making.

Introduction

Poor communication between members of the health care team is a recognized contributor to patient harm (Gordon et al. 2012; The Joint Commission 2015). To improve team communication, standardized protocols for information exchange between health professionals are being introduced into clinical practice (Haig et al. 2006; Weller et al. 2014).

Situation Background Assessment Recommendation is an example of a standardized protocol that can be used in a variety of situations to ensure that important items of information are not lost or miscommunicated (Leonard et al. 2004; Haig et al. 2006; De Meester et al. 2013). This protocol is often abbreviated as "SBAR", the mnemonic acting as a cognitive aid for remembering the protocol sequence. SBAR is one of many such cognitive aids: indeed recent reviews have identified more than 20 different mnemonics for team communication protocols, ranging from "GRRR" to "Just Go NUTS" (Riesenberg et al. 2009, 2010).

These developments are, in part, the result of efforts to apply lessons learned in aviation safety to health care.

Practice Points

- Pre-registration students, particularly in the US, are learning to use tools for structured communication, either in specific sessions or integrated into wider educational interventions.
- Students are mostly learning to use SBAR and its variants, in uni-professional groups and often in simulation.
- There is some evidence that learning to use one or more tools can improve the clarity and comprehensiveness of student communications, their perceived self-confidence and their sense of preparedness for clinical practice.
- As yet, there is little evidence relating to the transfer of these skills to the clinical setting.
- Reported studies suggest that clinical educators will need to consider the positioning of such learning with that for other skills such as clinical reasoning and decision-making.

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Supplemental data for this article can be accessed here.

Following major air disasters in the 1970s and 1980s, strenuous efforts to improve aviation safety led to the development of *crew resource management* (*CRM*), a comprehensive training program that encourages the use of standardized protocols to enhance communication between members of the flight crew (Gordon et al. 2013). Initiatives to apply CRM principles to healthcare began in the 1990s, gaining momentum following the publication in the U.S. of "*To Err Is Human: Building a safer Health System*" (Institute of Medicine 2000), which crystallized growing concern about the impact of medical error on patient safety.

Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS®) is a CRM-based program for the training of healthcare teams that aims to improve teamwork through training in leadership, situation monitoring, mutual support, and communication. In its "tools and strategies", TeamSTEPPS® includes a range of standardized protocols for information exchange between members of the health care team, including SBAR (King et al. 2008). Throughout our review, we will follow the TeamSTEPPS® convention of referring to such standardized protocols as "tools for structured communication".

In 2011, the World Health Organization recommended that trainee health professionals become familiar with and be able to use tools for structured communication before they enter clinical practice (World Health Organization 2011); and similar calls have been made by other clinical educators (Armitage et al. 2011; Keller et al. 2013; Hynes et al. 2015; Stojan et al. 2015). In order to help clinical educators decide how best to respond to these calls in their particular circumstances, we have reviewed the educational literature reporting the integration of tool(s) for structured communication into an educational intervention for pre-registration health professions students. We have investigated the influence of such interventions on students' knowledge, skills, and attitudes and the evidence for any influence of teaching method on the nature or extent of student learning. We have considered both interventions in which the tool(s) are the main focus of the learning and those in which they are component(s) of a more extensive module or course.

This paper reports the findings of our review, highlights areas for clinical educators to consider when planning the integration of tools for structured communication into their pre-registration curricula and suggests avenues for further research.

Table 1 gives a glossary of terms and abbreviations used in this review. Further information about CRM, TeamSTEPPS®, and SBAR can be found in Appendix 1 (available online as Supplementary Materials).

Table 1. Glossary of terms and abbreviations.

(a) Education and training approaches in aviation and health care.

Term	Description	Definition
CRM*	Crew resource management	An approach to the training of flight crews that aims to improve aviation safety by harnessing the power of teamwork to reduce the negative consequences of human error. CRM training programmes focus on developing the cognitive and interpersonal skills needed for effective teamwork, encouraging contributions from all team members whilst maintaining appropriate authority and a chain of command (Wiener et al. 2010)
TeamSTEPPS® *	Team strategies and tools to enhance performance patient safety	A comprehensive CRM-based programme for the training of healthcare teams developed by the US Agency for Healthcare Research and Quality (AHRQ) and US Department of Defence. TeamSTEPPS® aims to improve teamwork through training in four main domains: leadership, situation monitoring, mutual support and communication (King et al. 2008).
IPE	Interprofessional education	An approach to health professions education in which 'two or more professions learn about, from and with each other to enable effective collaboration and improved health outcomes' (World Health Organization 2010). IPE contrasts with traditional health professions education, in which individual professions learn in isolation from other professions.

(b) Tools for structured communication

Mnemonic	Components
SBAR*	Situation, background, assessment, recommendation (or request or response)
ISBAR	Introduction (or identify, situation, recommendation (or request)
ISBARR	Introduction (or identify), situation, recommendation, read back
ISOBAR	Identify, situation, observation, background, agree plan/actions, read back
ISOBARR	Introduction, situation, background, assessment, recommendation, read back
I PASS (the) BATON	Introduction – patient, assessment, situation, safety concerns – background, actions, timing, ownership, next
SIGN-OUT	Sick (or DNR?), identifying data, general hospital course, new events – overall status, upcoming possibilities, tasks
SAIF-IR	Summary statement(s), active issues, If-then contingency planning, follow up – interactive questioning, read-backs
DESC	Describe, explain, share, compromize
CUS	Concerned, uncomfortable, scared
The 3Ws	What I see, What I'm concerned about, What I want
4-step tool	Attention, concern, solution, question
SOAP	Subjective, objective, assessment, plan
ITEP	Individual therapy and evaluation plan
GRRR	Greeting, respectful listening, reviewing, recommending or requesting more information,
Just Go NUTS	Name, unique, tubes, safety

Explanations of relevant approaches to education and training are given, together with clarification of common mnemonics that summarize tools for structured communication. We define tool for structured communication as a standardized protocol for information exchange between members of the health care team, the aim of which is to improve the effectiveness of communication. For terms marked*, further information can be found in Appendix 1 (available online as Supplementary Materials)

Review methodology

Framing the question

We defined pre-registration health professions education as any course of initial, undergraduate (or equivalent) training taken by students not yet qualified to practice. We defined an educational intervention as an event, activity or series of activities that formed a discrete component of a course or module. Specific characteristics of educational interventions included the aims and/or learning outcomes, subject content, setting, timing and duration, instructional methods, and assessment.

Our concept of a tool for structured communication was that of a standardized protocol for information exchange i.e. "a process that structures information exchange in such a way that the provider of the information and/or the recipient of the information can systematically present/recall information in a focused manner" (Herschel et al. 2001).

We defined a health care team as two or more individuals, from the same or different professions, working together to complete a given task (Agency for Healthcare Research and Quality, 2005). Given the extensive focus of health professions education on communication with patients (Von Fragstein et al. 2008), our review focused on tools for structured communication between health care professionals.

Our concept of learning was based on the aspects of competence outlined in Miller's framework for clinical assessment (Miller 1990). We explored studies of the contribution of structured tools to students' knowledge ("knows" and "knows how") and skills and behaviors ("shows how" and "does"). Given the importance of attitude-based competencies for effective team working (Flin et al. 2008), we also considered reports of the effect of such tools on students' self-perceptions and attitudes, including their perceived preparedness for clinical practice.

Since the introduction of tools for structured communication into healthcare settings is relatively recent, we adopted an exploratory approach that considered a broad overall question: *how does the teaching of a tool for structured communication within and between teams contribute to student learning?*

Pilot phase

Initial scoping searches with two databases yielded ~2000 citations, from which the lead reviewer and the information scientist identified 20 as potentially relevant to our review. All reviewers discussed these articles, in order to clarify our inclusion criteria and build consistency of interpretation. This exercise resulted in eight articles agreed for inclusion. Citations for these articles were used to refine and check the appropriateness of our full search strategies and to inform the construction of our data extraction form.

Sources of papers and search strategies

MEDLINE, EMBASE, PsycINFO, Web of Science (Science Citation Index & Social Science Citation Index), CINAHL Plus, ASSIA, British Education Index, Australian Education Index, ERIC and TIMElit (Topics in Medical Education Database) were searched electronically, from January 1990 to March 2014. Key words and synonyms used are summarized in Appendix 2; an example of a full search strategy in Appendix 3 (available online as supplementary materials). All citations retrieved were entered into an EndNote database (Endnote X5.01 (Bld5774) Thomson Reuters 2011, Philadelphia, PA, London, UK) and then into Distiller SR systematic review software (Distiller SR Evidence Partners, Ottawa, Canada), for screening. Duplicate citations were removed. Reference lists of all included papers and relevant systematic reviews were hand searched for additional citations. To reduce the risk of missing recent articles not in standard databases, a search of Google Scholar for 2013 onwards was undertaken using the terms SBAR (or) ISBAR. A search for citations of studies meeting seven or more quality indicators was undertaken using SCI Web of Science (to end January 2015). Other than conference proceedings cited in electronic databases or reference lists of included articles, "grey" literature (Grey Literature Network Service 2015) was not searched.

Inclusion/exclusion criteria

Our inclusion/exclusion criteria (see Appendix 4 for summary, available online as Supplementary Materials) were as follows:

> Population: undergraduate students from any clinically (i.e. patient-focused) health care profession. Undergraduates were considered to be students engaged in a course of initial, pre-registration training regardless of their qualification on entry.
>
> Intervention: any educational activity or series of activities that included teaching of a tool for structured communication of sufficient substance to be reported as such in the primary literature. A recognizable acronym or mnemonic for the tool was not required. Interventions involving "tools" such as Medical Early Warning System (MEWS), whose primary purpose is to reduce patient harm through routes other than communication, but which have been used as the basis for communication, were excluded, as were tools designed to assist communication between professional and patient and those designed primarily to assess students' communication skills.
>
> Study types: primary research articles of any study type that described and evaluated an intervention that incorporated a tool for structured communication. Studies were not excluded on the grounds of study design, geographical location or language.
>
> Outcomes: whilst we anticipated that educational interventions that incorporated tool(s) for structured communication would advance student learning primarily in the area of patient safety, we recognized that such learning could be transferable to other situations. We therefore considered all reported outcomes from such educational interventions and did not exclude studies on the grounds of outcome type.

Study selection

Screening and initial data extraction was undertaken using Distiller SR systematic review management software (Distiller SR Evidence Partners, Ottawa, Canada).

> Title and abstract screening: All identified studies were screened against our inclusion/exclusion criteria by two independent reviewers. Studies were rejected if both reviewers agreed on lack of relevance. Where at least one reviewer

thought the citation potentially relevant, retrieval of the full article was undertaken, unless it was not easily available, in which case the citation was screened by a third reviewer and a consensus about whether to pursue retrieval reached. Authors were contacted directly when other channels of retrieval failed.

Full text screening: Two independent reviewers assessed retrieved articles against our inclusion/exclusion criteria. Wherever possible, reviewers with a clinical background were teamed with those with an educational background. Agreement between reviewer pairs was quantified using Kappa statistics with quadratic weights (Fleiss et al. 1969). Discrepancies were resolved by discussion and consensus. Where necessary, articles in languages other than English were screened by the lead reviewer working with a fluent or native speaker. If the use or nature of a tool were not apparent from the article, authors were contacted for further information where possible.

Data extraction

A comprehensive data extraction form was prepared and tested with the pilot sample of eight articles. The final form (Appendix 5, available online as Supplementary Materials) was assembled in Distiller SR and data extraction undertaken by reviewer pairs. Discrepancies in data extraction were resolved by consensus following transfer of data to a spreadsheet (Microsoft Excel Version 14).

Quality assessment of studies

Our pilot phase suggested that the literature relating to the teaching of tools for structured communication would be relatively recent, diverse and often descriptive (Cook et al. 2008). We wished to assess the quality of our included studies in a way that allowed in depth consideration of the most rigorous studies available, yet retained an element of "breadth" that captured the scope of this emerging literature. We assessed study quality during data extraction, using a generic checklist of quality indicators (Table S2 of Appendix 6, available online as Supplementary Materials) that were designed to reflect qualities of intellectual rigor applicable to all studies (Buckley et al. 2009; Passi et al. 2013). Having considered the range of quality indicators met by included studies, we agreed that studies meeting seven or more quality indicators would provide the balance we sought. These studies were then considered in greater depth.

Evidence synthesis

We undertook a narrative synthesis of our review findings (Popay et al. 2006). Recommended narrative synthesis tools were considered and those appropriate to our review selected. A preliminary synthesis of data from all studies that met our inclusion criteria was prepared by tabulation, grouping and clustering and drafting of short textual summaries of aspects of the data set. Where appropriate, subgroup analyses, and tests for statistical significance were carried out. A thematic analysis of the main messages from studies meeting seven or more quality indicators was undertaken, with members of the review team working in pairs to identify themes, with subsequent consolidation of themes identified into major areas of interest.

For our synthesis, we adopted a "weight of evidence" approach that considered both methodological quality and relevance of included studies (Evidence for Policy and Practice Information and Co-ordinating Centre 2010). Overall, methodological quality was assessed during data extraction using our quality indicators.

Results

A: study search and selection

Appendix 7 (available online as Supplementary Materials) summarizes the process of literature searching and selection. Database searches identified 5977 citations as potentially relevant to our review and a further 46 were obtained from hand/citation searches (44) or other sources (2), giving a total of 6023. Screening of titles and abstracts identified reduced this number to 759, of which 727 were retrieved as full articles. Eight citations were not available in the UK, 20 contained insufficient information to allow retrieval and four were books.

Of the 727 full text articles screened, 50 met our inclusion criteria and so were included in our review ("Included Studies"). The most common reasons for exclusion were that studies did not refer to the teaching of a tool for structured communication (513), did not involve students in initial training (129) or were not considered to be primary research (25). One text was excluded, as it was an early report of a later included study.

Of the 759 articles identified for full screening, 27 were in languages other than English. Full texts of all except one of these (which was not available in the UK) were obtained. Of these, 11 contained sufficient information in an English abstract to be excluded without further translation. A further 15 (nine French, three German, and one each of Swedish, Italian, and Danish) were screened by the lead reviewer working with a fluent or native speaker.

There was good agreement between reviewers during full text screening (Weighted Kappa =0.73 (95%CI: 0.71–0.76)).

B: overview of included studies

Of our 50 included studies, 38 (76%) were from the USA or Canada, eight (16%) were from UK/Europe and the remainder Australia or the Far East. All were either description (22) or justification (28) studies (Cook et al. 2008). Study designs reported were mostly "before and after" (40%) or case studies (34%). Four studies (8%) were classified as randomized-controlled trials and six (12%) reported the use of mixed methods as defined by Johnson et al. (2007). Reporting of a theory or framework to inform study design or evaluation was rare (de Feijter et al. 2012).

Twenty-seven (54%) of our included studies met seven or more of our quality criteria. The number of quality indicators met did not differ according to year of publication (mean quality scores of 6.1, 5.8, and 5.9 in 2007–2010, 2011–2012, and 2013–2014, respectively (Jonckheere-Terpstra test: $p = 0.978$)) or by profession (mean score of 6.2 in medicine, 5.6 in nursing/other allied health, and 6.1 in interprofessional studies (ANOVA: $p = 0.690$).

In 21 studies (42%), the evaluation undertaken provided specific evidence of the contribution of one or more tools for structured communication to the educational outcomes of the intervention. In the remaining 29 studies (58%), the

Table 2. Summary of included studies.

(a) SBAR and variations only (tool-specific evaluations)

			Profession(s)			Effect on knowledge						Effect on skills					Effect on attitudes				
Author	Tool	Description	Medicine	Nursing	Other Health	Need for effective comm'n	Team/ collaborative working	Own commun'n styles	Structured tools	Handover	Patient safety	Clarity of commun'n	Ability to voice concerns	Active listening/ commun'n	Adjustment to content	Commun'n skills (general)	Towards use of tools	Self-confidence	Team working/ mutual support	Professionalism	Prep'dness for clinical practice
(Bagnasco et al. 2011)	SBAR	Situation background assessment recommendation		X													+				
(Berg et al. 2010)		"	X	X		+	+										+	+			
(Darcy Mahoney et al. 2013)		"		X													+				+
(Fay-Hillier et al. 2012)		"		X		+	+	+				+	+				+				+
(Jenkins et al. 2011)		"		X								+						+			+
(Kesten 2011)		"		X					+			S+									
(Krautschied 2008)		"		X								+									
(Liaw et al. 2011a)		"		X								+									
(Mitchell et al. 2013)		"	X								S+										
(Keller et al. 2013)	SBARR	SBAR (request)	X	X		+	+										+	+	+		+
(Marshall et al. 2012)	ISBAR	(Identify) SBA (request)	X			+			+			+									
(Foronda et al. 2014)	ISBAR	(Identification) SBA (recommendation)		X		+				+		S+					+	+			
(Marshall et al. 2009)	ISBAR	(Identify) SBA (recommendation)	X									S+	S+		S+						
(Shanks et al. 2013)	ISBARR	(Identify) SBAR (recommendation Read back)		X								0									

(b) Included studies: SBAR and variations only (whole intervention evaluations)

			Profession(s)			Effect on knowledge						Effect on skills					Effect on attitudes				
Author	Tool	Description	Medicine	Nursing	Other Health	Need for effective comm'n	Team/ collaborative working	Own commun'n styles	Structured tools	Handover	Patient safety	Clarity of commun'n	Ability to voice concerns	Active listening/ commun'n	Adjustment to content	Commun'n skills (general)	Towards use of tools	Self-confidence	Team working/ mutual support	Professionalism	Prep'dness for clinical practice
(Bartges 2012)	*SBAR*	Situation background assessment recommendation		*X*						+		*S+*									
(Brock et al. 2013)	*SBAR*	"	*X*	*X*	*X*	*0*	*S+*	*S+*									*S+*	*S+*	*S+*		
(Darbyshire et al. 2013)	*SBAR*	"	*X*							+											
(Kearney et al. 2010)	*SBAR*	"	*X*	*X*	*X*		+				+								*S+*		+
(Ramirez et al. 2013)	*SBAR*	"		*X*														+		+	
(Shrader & Griggs 2014)	*SBAR*	"	*X*	*X*	*X*														*S+*		
(Lehr & Kaplan 2013)	*SBAR*	SBA (response)		*X*														+			+
(de Feijter et al. 2012)	*SBAR*	"	*X*			+					+							+			
(Gough et al. 2013)	*SBAR*	"	*X*	*X*	*X*													+	+		
(Masters et al. 2013)	*ISBAR*	(Introduction) SBA (recommendation)		*X*	*X*		+					+			+		+	+	+		
(Jones 2013)	*ISBARR*	(Introduction) SBA (recommendation Read back)		*X*							*S+*								+		
(Brewer & Stewart-Wynne 2013)	*ISOBAR*	(Identify) S (observations) B (agree plan read back)	*X*	*X*	*X*	+										+					

(c) Included studies: other CRM-derived tools and combinations including SBAR (all evaluations)

			Professions			Effect on knowledge						Effect on skills					Effect on attitudes				
Type	Author	Tool(s)	Medicine	Nursing	Other Health	Need for effective comm'n	Team/ collaborative working	Own commun'n styles	Structured tools	Handover	Patient safety	Clarity of commun'n	Ability to voice concerns	Active listening/ commun'n	Adjustment to content	Commun'n skills (general)	Towards use of tools	Self-confidence	Team working/ mutual support	Professionalism	Prep'dness for clinical practice
Tool specific	(Horwitz et al. 2007)	SIGN-OUT	X			+															S+
	(Farnan et al. 2010)	SIGN-OUT, ANTiC, read-back	X																		S+
	(Aebersold et al. 2013)	WWW, 4-step assertiveness tool		X									+				+				+
Whole intervention	*(Meier et al. 2012)*	SBAR, 2 challenge rule	*X*													*S+*		*S+*			
	(Senette et al. 2013)	I PASS the BATON		*X*	*X*	+	+	+									+		+		
	(Robertson et al. 2010)	SBAR, check back	*X*	*X*			*S+*												*S+*		
	(Liaw et al. 2014b)	SBAR, check back, call-out	*X*	*X*														*S+*	*S+*		
	(Liaw et al. 2014a)	SBAR, check back, call-out		*X*			*S+*														*S+*
	(Debourgh 2012)	SBAR, check back, call out, 2 challenge rule, DESC, CUS		*X*			*S+*											+			+
	(Johnson et al. 2011)	SBAR, check back, call out, 2 challenge rule, DESC		*X*															+		
	(Gordon 2013)	SBAR, check back, call out	*X*								*S+*										
	(Chu et al., 2010)	SAIF-IR	*X*				*S+*	*S+*	*S+*	*S+*		*S+*			*S+*		*0*				*S+*
	(Kruger et al. 2009)	CRM mnemonic (not specified)	*X*				*S+*											*S+*			*S+*
	(Baker & Durham 2013)	Team STEPPS* tools (not specified)	*X*	*X*	*X*						*S+*			*S+*					+		

(d) Included studies: SOAP notes and other tools (all evaluations)

			Profession(s)			Effect on knowledge/understanding						Effect on skills					Effect on attitudes				
Type	Author	Description	Medicine	Nursing	Other Health	Need for effective comm'n	Team/ collaborative working	Own commun'n styles	Structured tools	Handover	Patient safety	Clarity of commun'n	Ability to voice concerns	Active listening/ commun'n	Adjustment to content	Commun'n skills (general)	Towards use of tools	Self-confidence	Team working/ mutual support	Professionalism	Prep'dness for clinical practice
Tool specific	(Chen et al. 2014)	Subjective, objective, assessment, plan (SOAP)	X														+				
	(Franson et al. 2009)	Individual therapy and evaluation plan (ITEP)	X					S+													
Whole ntervention	*(*Klamen et al. 2009*)*	Subjective objective assessment plan (SOAP)	*X*							+							+				
	*(*Medina et al. 2008*)*	"			*X*							+									
Tool specific	(McGlade et al. 2012)	Structured template for written case reports	X									+									+
	(Lavsa et al. 2009)	Template for implementing the modified systematic approach to drug information queries			X							S+									S+
Whole intervention	(Bray-Hall et al. 2010)	Medication discrepancy tool (MDT)	*X*															*S+*			+
	(Ellison et al. 2008)	Communication and interpersonal skills checklist (CIPS)	*X*														+				
	(Cahan et al. 2010)	Perspective taking (a structured approach to communication)	*X*											*S+*					*S+*		
	(Eskildsen et al. 2012)	Ideal discharge for an elderly patient: a hospitalist checklist (adaptation)	*X*			+						+					+				

Tools for structured communication reported by all includes studies are listed according to type of tool and of evaluation, together with the profession(s) involved (x) and the effect on knowledge, skills and/or attitudes: (significantly) positive (S)+; no change (0). No studies reported negative effects.

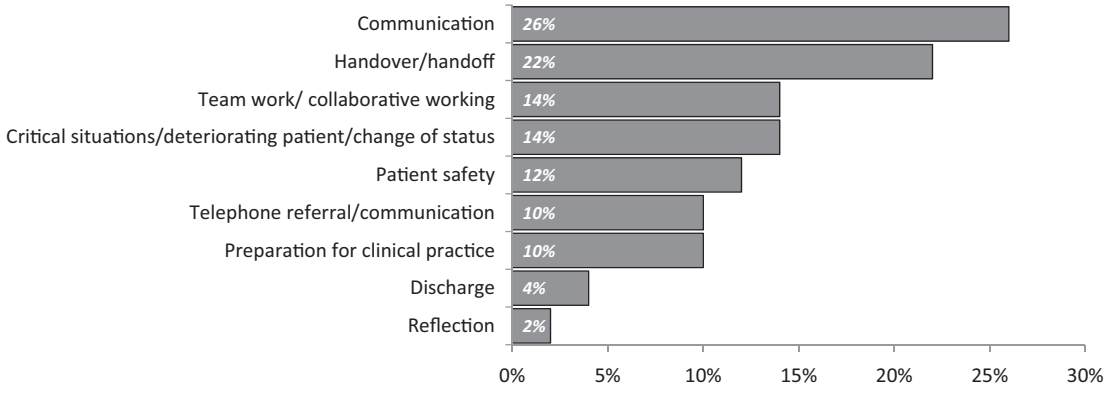

Figure 1. The aims of educational interventions incorporating tools for structured communication. The frequency of particular educational aims is shown as a proportion (%) of the number of interventions reported ($n = 50$). Seven studies cited two main aims rather than one: both of these were included in the analysis. 'Communication' includes all studies that cited general improvement in communication as their main aim, without further clarification.

evaluation only considered the educational intervention as a whole. In the synthesis that follows, we have distinguished between these, referring to them as "tool-specific" and "whole intervention" evaluations, respectively.

C: educational interventions

The following sections describe the educational interventions reported by all studies that met our inclusion criteria ($n = 50$, see Table 2a–d), including the aims of the intervention, the tools reported, the student groups involved, the educational settings, the teaching approaches employed, and the educational outcomes identified.

Aims of the interventions

Apart from a general desire to improve students' communication skills (13 studies, 26%), improving handover/handoff was the most commonly reported aim of reported educational interventions (11 studies, 22%) (Figure 1). Fewer studies reported other aims, such as improvement in the management of deteriorating patients or telephone referral skills. One study involving SBAR aimed to improve the quality of communication at surgical morbidity and mortality conferences (Mitchell et al. 2013).

The tools

Tools derived from CRM concepts were the most frequently reported, being the tool(s) of choice in the educational interventions of 40 (80%) included studies (Table 2a–d). SBAR and its variations were most common, with fewer studies reporting the teaching of tools designed to support the raising of concerns or the management of conflict. Only fourteen (35%) studies taught these tools as part of a wider CRM/TeamSTEPPS® training program, the remaining 26 (65%) in an intervention devised by the educational provider. Reports of the teaching of CRM-derived tools increased significantly over the period covered by our review, from 56% (9/16) of studies published between 2007 and 2010 to 85% (11/13) in 2011–2012 and 95% (20/21) in 2013–2014 (Fisher's exact test $p = .011$).

Authors used a range of mnemonics and abbreviations to describe the tools taught in their educational interventions (Table 2). Some authors' adapted standard formats such as SBAR to meet particular student need, by adding new components or by altering the meaning of existing items. Examples include the addition of Introduction (ISBAR) and Read Back (ISBARR) (Shanks et al. 2013) and changing Assessment to Agree plan/Actions (Brewer & Stewart-Wynne 2013) One study, (Senette et al. 2013), used I PASS THE BATON which the authors felt was particularly appropriate for their interprofessional student groups; and one study used SAIF-IR, a tool that includes components for both off-going and in-coming clinicians, as clinical educators felt that SBAR did not provide a suitable structure for handover (Chu et al. 2010).

Educational interventions in 43 (86%) included studies considered oral communication between members of the healthcare team (33 studies, 66%); or a combination of oral and written communication (10 studies, 20%). A further six (12%) reported an intervention that included a tool specifically for written communication, most commonly the Subjective, Objective, Assessment, Plan (SOAP) note (four studies, 8%). One study (Kearney et al. 2010) used SBAR primarily as a tool to facilitate reflection.

The students

Interventions involving medical or nursing students in single profession groups were most common (19 studies, 38%; and 17 studies, 34%, respectively). Twelve studies (24%) (Table 2a–d) reported interventions involving other health professions (paramedics, pharmacists, physicians' assistants, physiotherapists, and respiratory care practitioners). In 13 studies (26%), the participants' stage of training was not clear. Of the remainder, 21 (42%) reported interventions for senior students (year three or above). Interventions for junior students (year one or two) or for both junior and senior students were reported by 11 (22%) and five (10%) studies, respectively.

Educational settings and teaching approaches

Table S4 of Appendix 8 (available online as Supplementary Materials) summarizes the educational settings and teaching approaches used. Over half of reported interventions (27 studies, 54%) used more than one educational setting

and over three-quarters (38 studies, 76%) a combination of teaching approaches. Educational settings or teaching approaches chosen did not differ significantly between professions (Fisher's exact tests, see Appendix 10, available online as Supplementary Materials), although the limited statistical power of these tests meant that only strong relationships between these factors would have been detectable.

Thirty studies (60%) reported an intervention that used a simulated clinical environment for teaching, whilst 29 (58%) used a non-clinical/classroom setting (Table S4 of Appendix 8, available online as Supplementary Materials). Specific teaching approaches reflected this, with 37 (74%) of studies using simulation/role play and 32 (64%) small group tutorials or workshops. Teaching during clinical placements was less common (16 studies, 32%), as was web-based or e-learning (8 studies, 16%). Artefacts, such as pocket cards or lanyard reminders, were sometimes used (14 studies, 28%).

Twenty-six studies (52%) reported pilot initiatives. Requirements for student attendance reflected this, with 22 (44%) reporting voluntary participation. Interventions lasted from half a day or less (18 studies, 36%) to more than one week, (17 studies, 34%). Thirty-four studies (68%) reported the nature of their assessment: formative assessment was common (21 studies, 42%), summative assessment relatively rare (9 studies, 18%).

Underlying educational theories, models and frameworks

The educational theories and frameworks informing reported educational interventions ranged from general theories such as situated learning, to more specific models such as Jeffries' framework for simulation (Appendix 9, available online as Supplementary Materials). Interventions based on CRM/TeamSTEPPS® principles tended to refer to these frameworks rather than to underlying theoretical principles. Although not explicitly citing an underpinning model, some studies commented on aspects of learning or educational theory as informing their work. These included the cognitive, affective and psychomotor aspects of learning, experiential, adult and collaborative learning theories and mastery learning (data not shown). Active learning, with the opportunity to practice, share personal experiences and reflect on performance was thought to contribute to the success of a telephone referral intervention (Marshall et al. 2012).

Educational outcomes

Studies identified a range of benefits resulting from completing an intervention that included one or more tools for structured communication (Table 2a–d). Only one study (Shanks et al. 2013) reported no benefit from their intervention and no studies reported negative effects.

"Tool-specific" evaluations of interventions that aimed to improve oral or both oral and written communication reported statistically significant improvement in clarity of communication (eight studies, four statistically significant) and preparedness for clinical practice (seven studies, three statistically significant). They also reported improved awareness of the need for effective communication (six studies), of the usefulness of standardized forms of communication (seven studies) and of the importance of collaborative team working (three studies). Four studies reported improved self-confidence; three reported improvements in students' ability to raise concerns and one study in their ability to adjust the communication to the content being delivered. Evaluations of interventions that aimed to improve written communication reported improvement in the clarity of communication (one study), greater appreciation of the usefulness of standardized forms of communication (one study) and awareness of own communication styles (one study, statistically significant).

The frequency of reporting of educational outcomes (knowledge, skills or attitudes) was not found to be significantly associated with the types of educational setting or teaching approach used (Fisher's exact tests, see Appendix 10, available online in the Supplementary Materials). However, due to the low statistical power of this analysis, only strong relationships would have been detectable.

D: main messages for clinical educators

The sections that follow outline the main themes to be drawn from studies that met seven or more of our quality indicators.

i. Content and clarity of communication

Tool-specific evaluations provided some evidence that tools for structured communication can improve students' ability to give clear and comprehensive messages and/or to receive and understand information. The clarity and content of telephone referrals made by final year medical students significantly improved following training in the use of ISBAR (Identify, Situation, Background, Assessment, Request) compared with a control group and much of this improvement was still apparent six months later (Marshall et al. 2009, 2012); and medical students attending surgical morbidity and mortality conferences demonstrated significantly improved understanding of patient safety issues when presenters were required to use an adapted SBAR format to structure their presentations (Mitchell et al. 2013). Whole intervention evaluations reported similar benefits: medical students' communication skills were significantly improved following a surgical simulation curriculum based on the "TeamSTEPPS® Essentials" course, which included the use of SBAR and the "two-challenge" rule (Meier et al. 2012); and the use of ISOBAR in an interprofessional training ward facilitated communication at handover (Brewer & Stewart-Wynne 2013).

In one study, introduction of ISBARR across a pre-registration nursing curriculum resulted in no significant difference in students' ability to report a videotaped critical incident (Shanks et al. 2013). These authors suggest that the lack of improvement may have resulted from methodological limitations (small sample size and timing of the evaluation) and variations in the ability or willingness of faculty to implement the new curriculum. Methodological limitations notwithstanding, it is interesting to note that this study, unlike those that reported positive effects on the content and clarity of communication, attempted to measure the effect of incorporating SBAR into a whole

curriculum, rather than introducing it as part of a discrete intervention.

ii. Preparedness for clinical practice

"Tool-specific" evaluations also provide some evidence for improvements in students' perceptions of their preparedness for clinical practice; and suggest that this may be linked to increased self-confidence, including student perceptions of their ability to manage the situations that they will meet on placement. Nursing students who took part in a virtual clinical simulation that required the use of ISBAR (Foronda et al. 2014) reported increased self-confidence; and students who took part in an interprofessional course based on TeamSTEPPS® found that that SBAR was a valuable way to structure communication (Keller et al. 2013). Again "Whole intervention" evaluations report similar outcomes: a TeamSTEPPS®-based interprofessional simulation course significantly increased students' perceived self-efficacy and, by implication, their preparedness for clinical practice (Brock et al. 2013); and a TeamSTEPPS®-based course to enhance safe care for a deteriorating patient improved students' confidence in their ability to communicate effectively with other clinicians (Liaw et al. 2014b). A pre-rotation simulation program that included use of SBAR reduced anxiety among pre-registration nursing students (Lehr & Kaplan 2013); student confidence and preparedness for clinical practice were significantly increased following a CRM-based non-technical skills training program that included the use of a mnemonic/memory aid (Kruger et al. 2009); and by participation in a transitions in care curriculum relating to discharge that included a standardized medication discrepancy tool (Bray-Hall et al. 2010).

iii. Transfer of learning into practice

Finally, tool-specific evaluations provide evidence that students intend to transfer their learning to their clinical work (Aebersold et al. 2013; Darcy Mahoney et al. 2013) and that, in some cases at least, they are able to do so. Several months after an educational intervention on the use of SBAR in telephone referrals; over 90% of the medical student participants reported that they had actually used SBAR whilst on placement (Marshall et al. 2012). However, medical students found inconsistent demonstration of TeamSTEPPS® communication techniques by qualified staff a barrier to them implementing these approaches in their clinical practice (Keller et al. 2013).

iv. Choice of tool(s)

Several studies suggest that educators need to balance a desire to introduce students to authentic tool(s) that they will meet in clinical practice, with the need to introduce them to tool(s) that they can use effectively at their stage of training. Just over 10% of the medical students who had used SBAR to make a telephone referral whilst on placement experienced problems with doing so, including difficulties remembering the acronym and in ordering their thoughts; and interruptions from the recipient (Marshall et al. 2012). Paramedic students, participating in an interprofessional course to improve collaborative handoff, experienced difficulty in organizing patient data into the I PASS THE BATON format (Senette et al. 2013), leading these authors to suggest that students find it easier to receive information in this format than to give it. Difficulties they observed with their students using SBAR led Aebersold et al. (2013), to introduce an adapted version which they called "nursing crew resource management". Their adaptation used "What I see, What I want, What I'm concerned about" (3Ws) and the four step assertiveness tool, which encouraged students to "get attention, state the concern, offer a solution and pose a question". These authors report that the uptake of the adapted tool by students increased compared to that of SBAR (50 and 16%, respectively).

v. Positioning of teaching within the curriculum

In discussing their results, several authors expressed their support for positioning teaching about structured forms of communication later in pre-registration curricula, when students were "starting to be asked to make referrals" (Marshall et al. 2012) or when it could provide "just in time learning" that has "the potential for immediate effect on their behavior" (de Feijter et al. 2012).

However, timing of teaching may also be instrumental to the ability of students to learn to use tools effectively. In an intervention to improve nursing students' ability to recognize and manage a rapidly deteriorating patient (Liaw et al. 2011b), participants used an Airway Breathing Circulation Disability Exposure (ABCDE) protocol to assess the patient and SBAR (Situation, Background, Assessment, Recommendation) to report their findings. The simulation training improved students' ability to use SBAR effectively due, in large measure, to an improvement in their ability to communicate the "Assessment" part of the tool. These authors suggested that it was the concurrent teaching of the ABCDE protocol for patient assessment that allowed the students to use SBAR effectively.

vi. Teaching through simulation

Simulation, including role-play, was the teaching approach most commonly reported by included studies. Both tool specific and whole intervention evaluations of simulation-based activities provide some evidence of educational benefit from this approach. Medical and nursing students who took part in role plays requiring the use of TeamSTEPPS® tools, such as SBAR, felt increased competence and confidence in their ability to communicate effectively and to handle conflict, having been able to practice their skills in a "safe" environment (Keller et al. 2013); and taking part in a virtual clinical simulation using avatars significantly improved nursing students ability to give an ISBAR-based oral report (Foronda et al. 2014). TeamSTEPPS®-based interprofessional education for team communication that included simulation led to significant improvements in students' self-confidence (Brock et al. 2013); as did a similar simulation to improve students' ability to care for a deteriorating patient (Liaw et al. 2014b).

Evidence to support the use of simulation in preference to other teaching approaches is sparse. Students who had participated in role-play training were significantly better at communicating with SBAR than those who had received didactic teaching alone (Kesten 2011). Specifically, they

were significantly better at reporting the patient's treatment compared to the control group.

vii. Teaching in mixed professional groups (interprofessional education)

Several whole intervention evaluations suggest that tools for structured communication can be integrated successfully into interprofessional education (IPE). Reported effects of IPE incorporating tools such as SBAR include significant improvement in students' perceptions of interprofessional collaboration (Shrader & Griggs 2014) and improved confidence and attitudes towards interprofessional learning (Gough et al. 2013). TeamSTEPPS®-based IPE that included a range of tools improved attitudes towards collaborative working, team work and mutual support (Robertson et al. 2010; Brock et al. 2013); and were associated with significant improvements in students' self-reported confidence in their ability to communicate effectively with other team members (Liaw et al. 2014b). Cahan et al. (2010), who included "*perspective taking, a structured approach to team communication",* into their interprofessional curriculum found that medical students who took part were significantly more likely to ask for the nurses' perspective and to seek agreement on an action plan.

Evaluation of an intervention to teach effective handoff strategies to nursing and paramedic students (Senette et al. 2013) noted that, whilst nursing students preferred SBAR to I PASS THE BATON, paramedic students preferred other strategies, such as active listening, check-back and allowing opportunities for questions. This suggests that the mix of groups participating in an interprofessional intervention may influence the choice of tool(s) taught.

Discussion

Our review suggests that a focus on standardized protocols for communication between members of the healthcare team is a relatively recent phenomenon in pre-registration health professions education. Our earliest included study was published in 2007 and just over half of included studies reported pilot initiatives. However, the fact that we have been able to identify 50 reports of educational interventions for pre-registration students that incorporate a tool for structured communication is testament to the growing interest in this area. Our review considered all relevant studies regardless of geographical location or language. That most included studies were from North America is perhaps also testament to the extensive work of U.S. government agencies in developing CRM based patient safety programs (see Appendix I, available online as Supplementary Materials).

A substantial proportion of evaluations relied on self-reporting by participants, which may not reflect actual performance, particularly for inexperienced individuals (Meier et al. 2012; Stojan et al. 2015) and is a limitation common to many areas of health professions educational research. Where evaluations observed student communication directly, assessment instruments commonly included checklist items relating to students' use of the tool itself, which may lead to bias or limited assessment of wider communication skills (Marshall et al. 2009). Comparative studies were mostly before and after evaluations of a single group rather than evaluation of parallel groups (Cook 2012); and a considerable proportion of studies evaluated the whole intervention of which the tool for structured communication was a part, rather than the specific contribution of the tool itself to the educational outcomes. Reporting of theoretical frameworks to inform intervention design or evaluation approach was limited.

Our review suggests that educational interventions that incorporate tools for structured communication may improve students' ability to communicate effectively, their self-confidence and their perceived preparedness for clinical practice. Although our studies do not demonstrate causal links between these findings, it is plausible to suggest that understanding and skill in using a tool can give a novice clinician a tangible way of approaching communication with colleagues, reducing their anxiety and building their confidence in their ability to negotiate such situations successfully. However, while students intend to incorporate their learning into their clinical practice, whether they are able to do this successfully is perhaps open to question.

Despite a perception that tools for structured communication are vehicles for standardization (Thomas et al. 2009), our review suggests that students are likely to experience discrepancies between their learning and their experience in clinical settings. Where structured communication approaches are used inconsistently in the practice setting or when minor variations of standard tools are employed, this could reinforce a "theory v. practice gap" in the minds of some students and impact on future use of the tools by the learners.

Our review also suggests that, whilst standardized communication protocols can provide a structure within which messages can be framed, they cannot compensate for underlying weaknesses in clinical reasoning. As educational models and approaches to the development of clinical reasoning skills are developed (Bowen 2006; Levett-Jones et al. 2010; Posel et al. 2014), clear articulation of their relationship with communication is therefore appropriate. More practically, our findings suggest that the relative timings of communication and clinical reasoning teaching are an important consideration.

In a substantial proportion of our included studies, CRM-derived tools were part of unique intervention of the tutors' own devising, rather than part of a recognized CRM-based program, with very limited information given about how students were introduced to supporting CRM principles. This may indicate that tools such as SBAR are being used out of the context for which they were originally designed, potentially losing the supporting principles that foster their effective use.

Given that the raison d'etre of many tools is to improve communication between different healthcare professions (Leonard et al. 2004) and, consequently, to improve patient outcomes (De Meester et al. 2013), their incorporation into pre-registration IPE is a logical development. Our review indicates that such teaching to date has been primarily within uni-professional groups of medical or nursing students, but does include examples of successful incorporation into interprofessional programs. In their perceptive account of IPE involving nursing and paramedic students, Senette et al. (2013) highlight some of the complexities associated with teaching tools for structured communication inter-professionally, particularly the potential for

differences in approach and perspective between professions. Their observations echo concerns that application of CRM to the interprofessional setting "should be undertaken with a degree of thoughtfulness and care" (Reeves et al. 2013) and suggest that such integration should be undertaken with due regard to recognized principles for effective IPE (Centre for the Advancement of Interprofessional Education 2015).

Our review provides only limited information about the influence of teaching approach on the nature or extent of student learning. Although our included studies cite a variety of educational theories and models as underpinning their interventions, a focus on active learning through interactive teaching methods, particularly simulation, was apparent. The potential benefits of simulation in giving students the opportunity to practice their skills in a "safe" environment, are well recognized (Issenberg et al. 2003); and a recent review of simulation-based education for teaching CRM principles has reported improved learning compared to didactic methods (Fung et al. 2015). Our review is consistent with these findings; and suggests that clinical educators planning to incorporate tools for structured communication into their pre-registration curricula may wish to consider the use of simulation as a teaching approach.

Incorporation of tools for structured communication into pre-registration health professions curricula is a young but expanding field of interest. Although some evidence of the educational effects and implications of these innovations is available, there is still a great deal to be learned about how such tools can best be used to enhance student learning. There is a need to strengthen the evidence base for the reported benefits of structured tools by assessing the outcome of the communication as a whole, rather than students' adherence to the tool itself; and to explore how and why the use of a tool for structured communication leads to educational benefits. This latter could perhaps begin with investigation of the role of critical reflection, which has been identified as a mechanism that supports student thinking about patient safety more broadly (Ambrose & Ker 2014). Our review did not identify any "clarification studies" (Cook et al. 2008) and relatively few of our included authors speculated on the reasons for the effects they observed. Ways of maximizing translation of the use of structured tools into practice would also be a useful area of enquiry, given that our review provided mixed evidence for transfer of tools into clinical placement and did not identify any longitudinal studies of use beyond qualification.

More broadly, there is a need to explore further the extent to which tools for structured communication should be incorporated into pre-registration curricula, particularly their integration with wider teaching of decision-making and clinical reasoning; and to consider more specifically how the incorporation of such tools influences IPE outcomes. Given that translation of tools such as SBAR into languages other than English is beginning (Amalberti 2016), exploration of their value to pre-registration students in non-English speaking contexts would also be valuable. Our review identified few examples of interventions incorporating tools specifically for written communication, despite the importance of good written communication for patient safety (Kripalani et al. 2007) and none considered tools for structured communication in the context of mobile communications and other rapidly developing information technologies that are beginning to influence team communication in clinical practice (Johnston et al. 2015).

Whilst we have conducted our review in line with current best practice, our work has several limitations. Although we have made strenuous efforts to search the available literature, it is possible that some interventions are teaching tools for structured communication, but that these are not reported in sufficient detail to be captured by our searches. This may have led to some underreporting of the extent of such teaching, particularly of early studies prior to 2007. Whilst we have tried to encompass the scope of this emerging literature by considering all outcomes reported by relevant studies, this has resulted in a heterogeneous set of studies for which only limited synthesis is appropriate. Our quality checklist was designed to reflect intellectual rigor in approach and to be applicable to all studies (Buckley et al. 2009), and did not favor studies from one profession or year of publication. However, it could be argued that separate checklists for particular study designs and/or weighting of particular quality indicators would provide a more nuanced assessment of study quality. Whilst we were mindful that our chosen checklist did not include all possible quality indicators for qualitative studies (Tong et al. 2007; Tracy 2010), most included studies were descriptive or justification studies with qualitative investigations often not theoretically framed (Keller et al. 2013). In our narrative synthesis, our selection of emerging themes from the data was necessarily subjective, and was based on our judgement of what would be most relevant to clinical educators and future researchers.

Conclusions

Pre-registration students, particularly in the US, are learning to use tools for structured communication, either in specific sessions or integrated into wider educational interventions. Reports suggest that students are mostly learning to use SBAR and its variants, in uni-professional groups and often in simulation. Learning to use one or more tools may improve the clarity and comprehensiveness of student communications, their perceived self-confidence and their sense of preparedness for clinical practice. However, there is as yet little evidence relating to the transfer of these skills to the clinical setting. Clinical educators need to consider the positioning of such learning with that for other skills such as clinical reasoning and decision-making. This is an early but growing literature in which reported evaluations of interventions are mostly descriptive or justification studies using self-reporting of changes in knowledge, skills or attitudes.

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