



SBAR improves communication and safety climate and decreases incident reports due to communication errors in an anaesthetic clinic: a prospective intervention study

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2013-004268
Article Type:	Research
Date Submitted by the Author:	16-Oct-2013
Complete List of Authors:	Randmaa, Maria; Faculty of Health and Occupational Studies, Department of Health and Caring Sciences; County Council of Gävleborg, Department of Anaesthesia Mårtensson, Gunilla; University of Gävle, Faculty of Health and Occupational Studies; Uppsala University, Department of Public Health and Caring Sciences Leo Swenne, Christine; Uppsala University, Department of Public Health and Caring Sciences Engström, Maria; University of Gävle, Faculty of Health and Occupational Studies; Uppsala University, Department of Public Health and Caring Sciences
Primary Subject Heading:	Communication
Secondary Subject Heading:	Anaesthesia
Keywords:	Adult anaesthesia < ANAESTHETICS, Adult intensive & critical care < ANAESTHETICS, Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

SCHOLARONE™
Manuscripts

1
2
3 **SBAR improves communication and safety climate and decreases incident**
4
5 **reports due to communication errors in an anaesthetic clinic: a prospective**
6
7 **intervention study**
8
9

10
11
12 Maria Randmaa^{1,2,3*}, Gunilla Mårtensson^{1,3}, Christine Leo Swenne³, Maria Engström^{1,3}

13
14 1) Faculty of Health and Occupational Studies, University of Gävle, Gävle, Sweden

15
16 2) Department of Anaesthesia, County Council of Gävleborg, Sweden

17
18 3) Department of Public Health and Caring Sciences, Uppsala University, Uppsala, Sweden
19

20
21 *Corresponding author;

22
23 Maria Randmaa, Faculty of Health and Occupational Studies, University of Gävle, S-801 76

24
25 Gävle, Sweden

26
27 E-mail: maaraa@hig.se
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Word count: 3999 words including figure and tables

Keywords: Anaesthetic clinic, Communication, Incident reports, Safety attitudes, SBAR

ABSTRACT

Objectives: We aimed to examine staff members' perceptions of communication within and between different professions, safety attitudes and psychological empowerment, prior to and after implementation of the communication tool SBAR at an anaesthetic clinic. The aim was also to study whether there was any change in the proportion of incident reports caused by communication errors.

Design: A prospective intervention study with comparison group using pre- and post-assessments. Questionnaire data were collected from staff in an intervention (n=100) and a comparison group (n=69) at the anaesthetic clinic in two hospitals prior to (2011) and after (2012) implementation of SBAR. The proportion of incident reports due to communication errors was calculated during a 1-year period prior to and after implementation.

Setting: Anaesthetic clinics at two hospitals in Sweden.

Participants: All licensed practical nurses, registered nurses and physicians working in the operating theatres, intensive care units and post anaesthesia care units at anaesthetic clinics in two hospitals were invited to participate.

Intervention: Implementation of SBAR in an anaesthetic clinic.

Primary and secondary outcomes: The primary outcomes were staff members' perception of communication within and between different professions, as well as their perceptions of safety attitudes. Secondary outcomes were psychological empowerment and incident reports due to error of communication.

Results: In the intervention group, there were statistically significant improvements in the factors "Between-group communication accuracy" (p=0.039) and "Safety climate" (p=0.011). The total number of incident reports prior to implementation were 116 and after 208.

1
2
3 However, the proportion of incident reports due to communication errors decreased
4
5 significantly ($p < 0.0001$) in the intervention group, from 31% to 11%.
6

7 **Conclusions:** Implementing the communication tool SBAR in anaesthetic clinics can improve
8
9 communication between professionals, improve the safety climate and reduce incidents
10
11 caused by communication errors.
12

13
14
15
16 **Trial registration:** ISRCTN37251313
17

18 19 20 21 **Article summary**

22 23 24 **Strengths and limitations of this study**

- 25
26
27 • Despite recommendation of implementing SBAR in healthcare there are few
28
29 intervention studies with a comparison group, using pre- and post-assessments,
30
31 evaluating both staff and clinical outcome, thus the study add new knowledge to the
32
33 subject area.
34
 - 35
36 • The implementation was followed by the authors using manipulation check, involving
37
38 randomized structured telephone interviews. To monitor the implementation the local
39
40 inter-professional workgroup conducted observations of handovers.
41
 - 42
43 • The response rate was satisfying, exceeding 70% at both baseline and follow-up in the
44
45 two groups.
46
 - 47
48 • The very natures of the quasi-experimental design entail selection biases as the lack of
49
50 randomization.
51
- 52
53
54
55
56
57
58
59
60

INTRODUCTION

Teamwork in operating theatres and intensive care units requires straightforward, clear, and consistent communication as well as good collaboration. Nonetheless, communication breakdowns are frequent during the pre-, intra- and postoperative period.^{1 2} Communication and collaboration problems, in turn, have been shown to be the strongest predictors of health-related harm.²⁻⁴ The communication tool SBAR (Situation, Background, Assessment, Recommendations) is used in high-risk organizations to make communication more effective and consistent, and it has also been introduced in healthcare. SBAR is thought to create conditions for accurate information exchange and encourage dialogue, and the World Health Organization (WHO) recommends using it in healthcare to increase patient safety.⁵ Using the communication tool SBAR, important information can be transferred in a brief and concise manner, and in a predictable structure.⁶ In a review⁷ investigating studies on communication failures and how to avoid them, the authors suggested that one way to improve communication is to structure the information by employing tools such as SBAR.

Studies evaluating SBAR have been conducted in the US,⁸⁻¹⁰ Canada,^{11 12} Australia,^{13 14} the UK,¹⁵ Belgium¹⁶ and the Netherlands.¹⁷ The results have shown improved collaboration and nurse-physician communication, as perceived by nurses working in surgical and medical wards.¹⁶ Other studies have shown improvements in team communication and the safety culture, as assessed by rehabilitation staff.^{11 12} However, low adherence to SBAR was found in a simulation study among nurses working in surgical and medical wards one year after implementation.¹⁷ Still another study found, in contrast, that about 60% of nurses reported using SBAR.⁹ Findings from studies of simulated telephone referrals made by medical students and junior doctors have shown improved communication¹⁴ and improved call impact

1
2
3 as measured by an observer when SBAR was used.¹³ Studies measuring clinical outcomes
4
5 have found reduced unexpected death,¹⁶ decreased order entry errors¹⁰ and improvements in
6
7 safety reporting¹¹ after implementation of SBAR. Among the studies mentioned above, we
8
9 found only six that have used a comparison group,^{10-14 17} and of these, three were simulation
10
11 studies.^{13 14 17} One review¹⁸ studying interventions intended to facilitate teamwork and
12
13 communication in healthcare found that only 3 of 14 studies measured clinical outcomes and
14
15 that only 7 of 14 measured effects on the safety culture.¹⁸ Thus, there is a need to further
16
17 investigate staff and clinical outcomes with regard to use of the communication tool SBAR.
18
19

20
21
22
23
24 The aim of the present study was to examine staff members' perceptions of communication
25
26 within and between different professions, as well as their safety attitudes and psychological
27
28 empowerment, prior to and after implementation of the communication tool SBAR at an
29
30 anaesthetic clinic. A further aim was to investigate whether there were any differences in
31
32 change over time in these variables between an intervention group that was introduced to
33
34 SBAR and a comparison group. Still another aim was to study whether there was any change
35
36 in the proportion of incident reports due to communication errors. We hypothesized that
37
38 implementation of the communication tool SBAR would improve staff members' perception
39
40 of communication within and between different professions as well as their safety attitudes,
41
42 thereby decreasing reports of incidents caused by communication errors as well as increasing
43
44 staff members' perception of psychological empowerment.
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

METHOD

Design

A prospective intervention study with comparison group using pre- and post-assessments was used. The study involved one intervention group in which the SBAR was implemented (staff at an anaesthetic clinic at one hospital) and one comparison group (staff at another hospital's anaesthetic clinic). Questionnaires were delivered at baseline and at follow-up 6 months after implementation, and the proportion of incident reports at the two hospitals was measured during a 1-year period prior to and after implementation (Fig. 1).

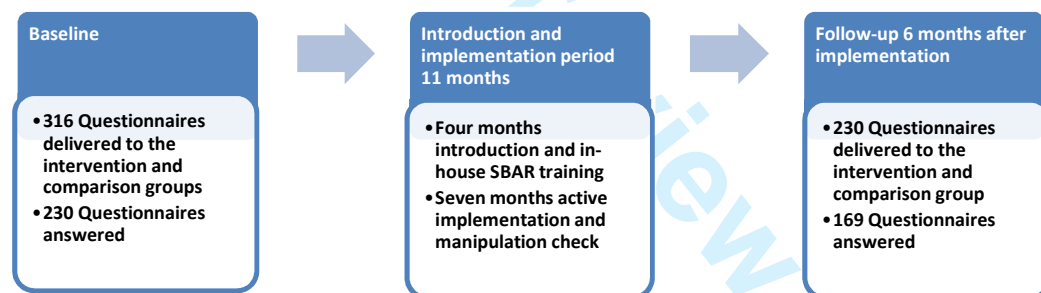


Fig. 1 Outline of design

Sample and procedures

A total of 316 questionnaires, and two reminders, were delivered to all staff (licensed practical nurses [LPNs], registered nurses [RNs] and physicians) working in the operating theatres, intensive care units and post anaesthesia care unit at anaesthetic clinics in the two

hospitals during spring 2011. The two hospitals were located in the same county council and thus the clinics shared the same top management. The response rate at baseline was 72% (n=139 of 194) in the intervention group and 75% (n=91 of 122) in the comparison group. The response rate at follow-up in 2012 was 72% (n=100 of 139) and 76% (n=69 of 91), respectively (Table 1). The drop-outs had fewer years working in the profession ($p=0.005$) fewer years working at the clinic ($p<0.001$) and statistically significant higher score on one factor measuring the variable safety attitudes and statistically significant lower score on one factor measuring the variable psychological empowerment (please see discussion section). There were no statistically significant differences between the intervention and comparison groups at baseline regarding age, sex, working years in the profession, working years at the clinic and working time (Table 2). However, at baseline there were statistically significant higher scores in the comparison group on four factors in the instrument measuring the variable safety attitudes and statistically significant higher scores on one factor in the instrument measuring the variable communication within and between different professions (please see discussion section).

Table 1. Reasons for non-participants/dropouts at baseline and follow-up

Dropout	Intervention group	Comparison group
<i>Baseline</i>	194	122
Refusal	3	24
No reason	52	7
Answered questionnaires	139	91
<i>Follow-up</i>	139	91
Parental leave	3	2
Changed workplace	3	1
Long-term illness	-	1
Retired	1	1
Quit work	3	6
Leave of absence	5	1
Education	2	1
Total unavailable staff	17	13
Eligible staff	122	78
Refusal	6	6
No reason	16	3
Answered questionnaires	100	69

Table 2. Demographic data on staff members in the intervention group and control group who participated at baseline and follow-up. Mean (m), Standard deviation (SD), numbers (n) and percent (%)

	Intervention group (n=100)	Comparison group (n=69)	P-value
Age, years, m (SD)	48.2 (8.7)	48.6 (9.0)	0.780
Sex male/female, n	15 (15%)/85 (85%)	11 (16%)/58 (84%)	1.000
Profession, n			0.945
- LPN	27 (27%)	18 (26%)	
- RN	63 (63%)	43 (62%)	
- Physician	10 (10%)	8 (12%)	
Years in the profession, m (SD)	17.5 (11.2)	19.5 (10.2)	0.257
Years at the clinic, m (SD)	15.2 (11.0)	15.4 (10.3)	0.883
Working full-time/part-time, n	60 (60%)/40 (40%)	48 (70%)/21 (30%)	0.254

Independent Samples T-test and Chi-square Test. The significant level is 0.05

LPN = Licensed Practical Nurse, RN = Registered Nurse

Intervention

The decision to implement the communication tool SBAR at the clinic was taken by the management. Strategies to facilitate the implementation were: modifying a SBAR card, in-house training course, information material and observations during 7 months of the implementation period. A pocket SBAR card was slightly modified prior to implementation by a local inter-professional workgroup to adapt it to needs at the clinic. The intervention included an in-house training course (2.5 hours of instruction and role-playing) and implementation of the communication tool SBAR. During the introduction period May to September 2011, 155 of 194 (80%) staff were trained and the rest were offered continuous training. Informational material describing SBAR was distributed to all staff in the intervention group, who received the pocket card describing the SBAR structure to be used. At the post anaesthesia care unit, the SBAR card was also attached to the patients' tables, where most handovers were conducted, and on the wall in the room where the physician's handovers were conducted. At the intensive care unit, a printed SBAR template was used for the receiver's notes during handovers. All staff members in the intervention group were encouraged to take part in the training course and to use the communication tool SBAR in their daily work. The period with an in-house training course was followed by a 7-month

1
2
3 monitoring period, which consisted of 168 structured observations of handovers carried out
4
5 by four members of the local inter-professional workgroup. The observations were used by
6
7 management to monitor the intervention process and as feedback to the intervention group. In
8
9 the comparison group, no structured communication system was used.
10

11 Manipulation check:

12
13 Careful control of the implementation is required for interpretation of the findings.¹⁹ To check
14
15 whether SBAR was implemented as intended, measures were made during a 7-month period
16
17 to follow the implementation. In the intervention group, structured telephone interviews were
18
19 conducted by one author (MR) with a random sample of 10 staff each month, except for one
20
21 month when only six staff members were reached. In total, 11 physicians, 17 intensive care
22
23 nurses, 10 anaesthesia nurse, 8 operating theatre nurses and 20 LPNs were interviewed.
24
25 Results showed that the majority of staff had taken the in-house training course and had used
26
27 the SBAR tool during the past seven working days.
28
29
30
31
32
33
34
35
36
37

38 Data collection

39
40 Questionnaire data were collected prior to implementation of SBAR in April 2011 and at
41
42 follow-up 6 months after completion of the implementation period in October 2012. To
43
44 measure communication within and between different professions, the ICU Nurse-Physician
45
46 Questionnaire²⁰ was used, and the Safety Attitudes Questionnaire (SAQ)²¹ was used to
47
48 measure staff members' attitudes toward six patient-safety-related domains. Spritzer's
49
50 empowerment scale²² was used to measure psychological empowerment. Incident reports
51
52 were collected from the hospitals' registration systems during a 1-year period prior to (1 April
53
54 2010 to 31 March 2011) and after implementation of SBAR (1 April 2012 to 31 March 2013).
55
56
57
58
59
60

1
2
3 Primary outcome measures:

4
5 The *ICU Nurse-Physician Questionnaire* (short version, section one)²³ consists of five factors:

6
7 Within-group communication openness (4 items); Between-group communication openness
8 (4 items); Within-group communication accuracy (4 items); Between-group communication
9 accuracy (3 items); Communication timeliness (3 items). The original questionnaire was
10 created to address the relationship between nurses and physicians only. But because LPNs are
11 a common staff group in Sweden, the questionnaire was adapted for LPNs and thus to suite
12 Swedish working conditions. The items are answered in a 5-point Likert scale ranging from
13 “Strongly Disagree” to “Strongly Agree.” Negatively worded items are reversed before factor
14 scores are averaged. The ICU Nurse-Physician Questionnaire has shown satisfactory
15 psychometric properties. Cronbach’s alpha values (α) for the five factors have been 0.64 to
16 0.88.²⁰ Translation of the questionnaire was conducted forward by the research team and
17 back-translation was carried out by a bilingual translator.²⁴ In the present study, α -values were
18 between 0.69 and 0.83 at baseline and 0.68 and 0.85 at follow-up.
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35

36 The *Safety Attitudes Questionnaire* (SAQ, short form)²¹ consists of six factors: Teamwork
37 climate (6 items); Safety climate (7 items); Job satisfaction (5 items); Stress recognition (4
38 items); Perceptions of management (6 items); Working conditions (3 items). The items are
39 answered in a 5-point Likert scale ranging from “Disagree Strongly” to “Agree Strongly.”
40 The negatively worded items are reversed and the scale is converted to a 0 - 100% scale
41 where 0% = Disagree Strongly, 25% = Disagree Slightly, 50% = Neutral, 75% = Agree
42 Slightly and 100% = Agree Strongly. The SAQ has shown satisfactory psychometric
43 properties. Cronbach’s α -values have been between 0.70 and 0.85 for the factors.²¹
44
45
46
47
48
49
50
51
52
53

54 Translation of the questionnaire was conducted forward by the research team and back-
55
56
57
58
59
60

1
2
3 translation was carried out by a bilingual translator.²⁴ In the present study, α -values ranged
4
5 from 0.71 to 0.85 at baseline and from 0.71 to 0.86 at follow-up for the factors.
6
7

8
9
10 Secondary outcome measures:

11 *Spreitzer's empowerment scale*²⁵ consists of four factors: Meaning (3 items); Competence (3
12 items); Self-determination (3 items); Impact (3 items). The items are answered on a 7-point
13 Likert scale ranging from "Strongly Disagree" to "Strongly Agree." Factor scores and the
14 total scale are averaged. The Swedish version of the scale has shown satisfactory
15 psychometric properties, with α -values ranging from 0.77 to 0.90.²² In the present study, α -
16 values ranged from 0.86 to 0.88 at baseline and from 0.80 to 0.87 at follow-up for the factors.
17
18
19
20
21
22
23
24
25
26

27 The number of *incident reports* was measured during a 1-year period prior to (1 April 2010 to
28 31 March 2011) and after implementation of SBAR (1 April 2012 to 31 March 2013). In
29 accordance with WHO definitions,²⁶ we defined incident reports as "A process used to
30 document occurrences that are not consistent with routine hospital operation or patient care."
31 A communication error is defined as "Missing or wrong information exchange or
32 misinterpretation or misunderstanding."²⁶ In the county council where the present study was
33 conducted, the clinic administrator has overall responsibility for incident reports. The incident
34 reports are examined by an investigator who reviewed the cause of the incident and what
35 measures were taken. The result of the investigation then goes back to the clinic, where
36 possible follow-ups are carried out.
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52

53 **Data analysis**

54 The data were analysed using descriptive statistics such as means, standard deviations [SD],
55 absolute numbers and percentages. For within-group comparisons over time, the Wilcoxon
56
57
58
59
60

1
2
3 Signed Rank Test was used, and for between-group comparisons the Mann-Whitney U-test
4
5 was used. The Chi-square and Fisher's exact test were used to detect differences in the
6
7 frequency data. Factor scores in the three questionnaires were calculated if at least 66.7% of
8
9 the questions for each factor were answered. Internal consistency was calculated using
10
11 Cronbach's alpha. Non-parametric tests were used because the majority of factors did not
12
13 have a normal distribution. The level for statistical significance was set at $p < 0.05$ (two-tailed).
14
15
16
17

18 **Ethical considerations**

19
20 The study was approved (reg. no. 2011/061) by the Regional Ethical Review Board. All
21
22 participants received written information about the study aim and procedures and were told
23
24 that participation was strictly voluntary and could be discontinued at any time without
25
26 explanation.
27
28
29
30
31
32

33 **RESULTS**

34 **Primary outcome**

35
36
37 Of the five factors in the ICU Nurse-Physician Questionnaire, the factor Between-group
38
39 communication accuracy improved significantly ($p = 0.001$) over time in the intervention
40
41 group. For the factor Within-group communication accuracy, there was a tendency for
42
43 improvement over time in the intervention group, though it was not statistically significant
44
45 ($p = 0.076$). This finding required further investigation, and we proceeded by analyzing each
46
47 item. There was significant improvement over time for the item "It is often necessary for me
48
49 to go back and check the accuracy of information I have received from [physicians, nurses or
50
51 licensed practical nurses] in this unit" ($p = 0.025$). In the comparison group, the factor
52
53 Between-group openness improved significantly ($p = 0.039$) over time. When changes over
54
55
56
57
58
59
60

1
2
3 time were compared between the intervention group and comparison group, the results
4
5 showed no statistically significant differences (Table 3). Of the factors in the SAQ, the factor
6
7 Safety climate improved significantly ($p=0.011$) over time in the intervention group. For the
8
9 other factors in the SAQ, there were no statistically significant differences. In the comparison
10
11 group, the factor Perception of management at the unit showed a significant ($p<0.001$)
12
13 improvement over time, as did the factor Working condition ($p=0.029$). When changes over
14
15 time were compared between the intervention group and comparison group, the results
16
17 showed a significant difference ($p<0.001$) between groups for the factor Perception of
18
19 management at the unit. For the factor Safety climate, the p-value was 0.087 when change
20
21 over time between the groups was compared (Table 3).
22
23
24
25
26

27 **Secondary outcome**

28
29 In the intervention group, the number of incident reports during a 1-year period prior to
30
31 implementation was 116, whereof 36 (31%) were due to communication errors. The same
32
33 year, in the comparison group, 6 of the 24 (25%) registered incident reports were due to
34
35 communication errors. In the intervention group, during a 1-year period after implementation,
36
37 the incident reports due to communication errors had decreased to 23 of a total of 208 (11%).
38
39 During the same period in the comparison group, the number of incident reports due to
40
41 communication errors was 6 of 32 (19%). The decrease in the proportions of incident reports
42
43 due to communication errors in the intervention group was statistically significant ($p<0.0001$),
44
45 though it was not in the comparison group ($p=0.744$). Regarding psychological
46
47 empowerment, the results revealed no statistically significant changes over time in either the
48
49 intervention group or the comparison group (Table 3).
50
51
52
53
54
55
56
57
58
59
60

Table 3. Staff members' assessment of communication within and between groups, safety attitudes and empowerment in the intervention and comparison group at baseline and follow-up as change over time between groups. Mean and Standard deviation (SD), n = 169.

Measurement factors	Intervention group – Within group		Comparison group – Within group		Change over time between groups
	¹ Mean value (SD)	¹ p-value	¹ Mean value (SD)	¹ p-value	² p-value
ICU Nurse-Physician Questionnaire					
<i>Within-group communication openness</i>					
Baseline	4.3 (0.6)		4.4 (0.6)		
Follow-up	4.3 (0.5)	0.998	4.4 (0.5)	0.529	0.390
<i>Between-group communication openness</i>					
Baseline	4.3 (0.5)		4.2 (0.6)		
Follow-up	4.3 (0.5)	0.686	4.3 (0.6)	0.039	0.263
<i>Within-group communication accuracy</i>					
Baseline	3.3 (0.8)		3.7 (0.8)		
Follow-up	3.4 (0.8)	0.076	3.7 (0.9)	0.966	0.371
<i>Between-group communication accuracy</i>					
Baseline	3.3 (0.8)		3.5 (0.8)		
Follow-up	3.5 (0.8)	0.001	3.6 (0.8)	0.185	0.172
<i>Communication timeliness</i>					
Baseline	4.2 (0.7)		4.2 (0.7)		
Follow-up	4.3 (0.6)	0.612	4.3 (0.7)	0.650	0.958
Safety Attitudes Questionnaire					
<i>Teamwork climate</i>					
Baseline	72.2 (15.1)		76.9 (15.1)		
Follow-up	73.8 (14.4)	0.350	76.7 (15.8)	0.914	0.584
<i>Safety climate</i>					
Baseline	63.1 (15.8)		70.3 (14.3)		
Follow-up	66.4 (16.2)	0.011	70.2 (16.0)	0.949	0.087
<i>Job satisfaction</i>					
Baseline	75.3 (15.5)		81.5 (16.4)		
Follow-up	74.2 (15.4)	0.604	81.7 (15.0)	0.865	0.771
<i>Stress recognition</i>					
Baseline	68.0 (21.9)		65.8 (25.2)		
Follow-up	67.8 (20.8)	0.483	63.5 (24.9)	0.382	0.388

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49

<i>Perception of management unit</i>					
Baseline	60.2 (17.9)		59.2 (16.7)		
Follow-up	60.2 (18.6)	0.667	68.6 (16.7)	<0.001	<0.001
<i>Working condition</i>					
Baseline	63.9 (19.2)		73.3 (15.6)		
Follow-up	63.5 (18.8)	0.956	77.8 (16.2)	0.029	0.131
Spreitzer's Empowerment scale					
<i>Meaning</i>					
Baseline	6.2 (0.8)		6.3 (0.9)		
Follow-up	6.3 (0.7)	0.270	6.3 (0.8)	0.935	0.602
<i>Competence</i>					
Baseline	6.4 (0.7)		6.5 (0.6)		
Follow-up	6.4 (0.6)	0.985	6.5 (0.7)	0.877	0.818
<i>Self-determination</i>					
Baseline	4.3 (1.2)		4.4 (1.5)		
Follow-up	4.3 (1.3)	0.992	4.6 (1.3)	0.342	0.465
<i>Impact</i>					
Baseline	4.2 (1.3)		4.5 (1.4)		
Follow-up	4.2 (1.4)	0.639	4.5 (1.3)	0.867	0.857
<i>Empowerment total factors</i>					
Baseline	5.3 (0.7)		5.4 (0.8)		
Follow-up	5.3 (0.8)	0.474	5.5 (0.7)	0.444	0.916

¹Wilcoxon Signed Rank Test and ²Mann-Whitney U-test. The significant level is 0.05 and statistical significant results are marked with boldface text

DISCUSSION

SBAR is thought to facilitate communication between professions and increase safety as well as to decrease the negative effects the professional hierarchy may have on communication.

Our results showed that implementation of the communication tool SBAR resulted in significant improvement over time in staff members' perceptions of Between-group communication accuracy and Safety climate as well as a tendency toward improvement in Within-group communication accuracy. Furthermore, the proportion of incident reports due to communication errors decreased significantly, from 31% (36 of 116) to 11% (23 of 208), in the intervention group compared with a non-significant decrease, from 25% (6 of 24) to 19% (6 of 32), in the comparison group. Thus, in the intervention group safety reporting seemed to improve but the proportion of incident reports due to communication decreased significantly.

The improvement in staff members' perceptions of Between-group communication accuracy after implementation of the communication tool SBAR seen in the present study is similar to findings from a study by DeMeester¹⁶, where nurse-physician communication also improved. In a study by Manojlovich and DeCicco²⁷ Between-group communication was shown to be a significant predictor of perceived medication error²⁷. Nurses and physicians are trained to express themselves in different ways²⁸ and communication between different professions is known to be a contributing factor in surgical malpractice claims.¹ Because staff members' perceptions of Between-group communication accuracy improved, it would seem that SBAR was able to bridge differences in style of communication.

Safety climate also improved, and the proportion of incident reports due to communication errors decreased in the intervention group, which may indicate that safety performance

1
2
3 improved. One study²⁹ of 91 hospitals found that a higher level of safety climate was
4
5 associated with higher safety performance at the hospital level. Furthermore, Huang *et al.*
6
7 (2010)³⁰ studied 30 ICUs in the US using SAQ and found that lower Safety climate was
8
9 associated with patient outcomes such as increased hospital length of stay. However, another
10
11 study by Rosen *et al.* (2010)³¹ failed to show a relationship between safety climate and
12
13 hospital safety performance. As in the present study, improved perception of safety climate
14
15 has also been found in studies^{11 12} of rehabilitation settings in which SBAR had been
16
17 implemented. Verbal communication errors were found to be an important cause of severe
18
19 patient safety incidents.³² In the present study, there was a decrease in the proportion of
20
21 incident reports due to communication errors. According to the present results, one can
22
23 assume that SBAR made communication safer, resulting in a decrease in incident reports due
24
25 to communication errors. This interpretation is also in line with our hypothesis. We also
26
27 hypothesized that a secondary outcome of implementing SBAR could be an increase in staff
28
29 members' perception of psychological empowerment. In the present study, it would seem
30
31 reasonable to assume that SBAR training should have increased staff members'
32
33 empowerment, but no such effect was found during the study period.
34
35
36
37
38
39

40
41 In the comparison group, there were no significant changes in staff members' perceptions of
42
43 Communication accuracy or Safety climate. However, the factors Between-group openness,
44
45 Perception of management at the unit and Working condition improved significantly over
46
47 time. During the period between baseline and follow-up, there were work-related changes in
48
49 the comparison group that may have affected the results. The staff in the operating theatre had
50
51 increased in size, and there had been discussions of the importance of collaboration at the
52
53 intensive care unit. On the other hand, SBAR was not expected to affect these particular
54
55 factors.
56
57
58
59
60

Strengths and weaknesses of the study

The strengths of the present study were that measures of safety culture and clinical outcomes were included, as previously recommended,¹⁸ and that a comparison group was used.

Furthermore, during 7 months of the implementation period, we followed the implementation using a manipulation check involving randomized structured telephone interviews. An additional support in the implementation was observations of handovers conducted by the local inter-professional workgroup. In a simulation study, low adherence was found for use of SBAR during a 1-year period after implementation in a hospital.¹⁷ In the present study, the manipulation check and observations showed that SBAR was in use at the clinic. One other strength is that the questionnaires used have shown satisfactory psychometric properties, and Cronbach's Alpha values in the present study for all instruments, total scale and factors were over 0.68. Although the two groups were different in size, there were no significant differences in the demographic data. The response rate was satisfying, exceeding 70% at both baseline and follow-up in the two groups. When interpreting the present results, possible threats to internal validity should be considered. First, the very nature of the quasi-experimental design entailed selection biases: The participants were not randomly assigned and there were statistically significant differences between the intervention group and the comparison group at baseline. The comparison group had higher scores on the factors Teamwork climate ($p=0.045$), Safety climate ($p=0.002$), Job satisfaction ($p=0.004$), Working condition ($p=0.002$) and Within-group communication accuracy ($p=0.001$). Although the comparison group had higher baseline levels on the five factors that could have affected the results, there was still room for improvement. Second, the loss of subjects poses another threat to internal validity, in that the drop-outs had higher scores on the factor Teamwork climate ($p=0.017$) and lower scores on the factor Competence ($p=0.048$) than the participants did. On the other hand, the number of drop-outs was moderate. There were also differences in

1
2
3 incident reporting. The comparison group had overall lower frequency of registered incident
4 reports. There may be several reasons for this, e.g. that the frequency of incidents was
5 actually different or that there was a difference in the tendency to report incidents. Third, an
6 additional threat to internal validity was that there may have been some diffusion of the
7 intervention to the comparison group, which could have affected the results. Further research
8 dealing with these methodological issues is needed to confirm our results.
9
10
11
12
13
14
15
16
17
18

19 **Conclusion**

20 Implementing the communication tool SBAR in anaesthetic care can improve communication
21 between professionals, improve the safety climate and reduce incidents caused by
22 communication errors.
23
24
25
26
27
28
29

30 **Contributors** All authors (MR, GM, CLS and ME) contributed to the design, interpreted
31 data, drafted and revised the article critically. Data analysis was conducted by MR and ME.
32 MR collected data, conducted the manipulation check and wrote the manuscript under the
33 supervision of GM, CLS and ME. All authors read and approved the final version of the
34 paper.
35
36
37
38
39
40
41
42
43
44

45 **Funding** This work was supported by the Faculty of Health and Occupational Studies,
46 University of Gävle and by the County Council Gävleborg. It was also supported by the
47 Patient Insurance LÖF and the Swedish Society of Nursing, but these organizations had no
48 role in the design and running of the study.
49
50
51
52
53
54
55

56 **Competing Interests** None.
57
58
59
60

1
2
3
4
5 **Ethics approval** The Regional Ethical Review Board (reg. no. 2011/061).
6
7
8
9

10 **Data sharing statement** There is no additional data available for data sharing.
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

REFERENCES

1. Greenberg CC, Regenbogen SE, Studdert DM, *et al.* Patterns of communication breakdowns resulting in injury to surgical patients. *J Am Coll Surg* 2007;**204**:533-40.
2. Lingard L, Espin S, Whyte S, *et al.* Communication failures in the operating room: an observational classification of recurrent types and effects. *Qual Saf Health Care* 2004;**13**:330-4.
3. Wiegmann DA, ElBardissi AW, Dearani JA, *et al.* Disruptions in surgical flow and their relationship to surgical errors: an exploratory investigation. *Surgery* 2007; **142**:658-65.
4. White AA, Pichert JW, Bledsoe SH, *et al.* Cause and effect analysis of closed claims in obstetrics and gynecology. *Obstet Gynecol* 2005;**105**:1031-8.
5. WHO Patient Safety Solutions| volume 1, solution 3 | May 2007 Available at:
http://www.refworks.com/refgrabit/rw2linkpage.aspx?subscriber=6107&user=1209&_id=1344860455630.
Accessed 13/8/2012
6. Leonard M, Graham S, Bonacum D. The human factor: the critical importance of effective teamwork and communication in providing safe care. *Qual Saf Health Care* 2004;**13** Suppl 1:i85-90.
7. Flemming D, Hubner U. How to improve change of shift handovers and collaborative grounding and what role does the electronic patient record system play? Results of a systematic literature review. *Int J Med Inform* 2013;**82**:580-92.
8. Renz SM, Boltz MP, Wagner LM, *et al.* Examining the feasibility and utility of an SBAR protocol in long-term care. *Geriatr Nurs* 2013; **34**:295-301.
9. Compton J, Copeland K, Flanders S, *et al.* Implementing SBAR across a large multihospital health system. *Jt Comm J Qual Patient Saf* 2012;**38**:261-8.
10. Telem DA, Buch KE, Ellis S, *et al.* Integration of a formalized handoff system into the surgical curriculum: resident perspectives and early results. *Arch Surg* 2011; Jan;**146**:89-93.

- 1
2
3 11. Velji K, Baker GR, Fancott C, *et al.* Effectiveness of an Adapted SBAR Communication Tool for a
4 Rehabilitation Setting. *Healthc Q* 2008;**11**:72-9.
5
6
7 12. Andreoli A, Fancott C, Velji K, *et al.* Using SBAR to communicate falls risk and management in inter-
8 professional rehabilitation teams. *Healthc Q* 2010; **13**:94-101.
9
10
11 13. Cunningham NJ, Weiland TJ, van Dijk J, *et al.* Telephone referrals by junior doctors: a randomised
12 controlled trial assessing the impact of SBAR in a simulated setting. *Postgrad Med J* 2012; **88**:619-26.
13
14
15 14. Marshall S, Harrison J, Flanagan B. The teaching of a structured tool improves the clarity and content of
16 interprofessional clinical communication. *Qual Saf Health Care* 2009;**18**:137-40.
17
18
19 15. Christie P, Robinson H. Using a communication framework at handover to boost patient outcomes. *Nurs*
20 *Times* 2009; **105**:13-5.
21
22
23 16. De Meester K, Verspuy M, Monsieurs KG, *et al.* SBAR improves nurse-physician communication and
24 reduces unexpected death: A pre and post intervention study. *Resuscitation* 2013;**84**: 1192-6
25
26
27 17. Ludikhuizen J, de Jonge E, Goossens A. Measuring adherence among nurses one year after training in
28 applying the Modified Early Warning Score and Situation-Background-Assessment-Recommendation
29 instruments. *Resuscitation* 2011; **82**:1428-33.
30
31
32 18. McCulloch P, Rathbone J, Catchpole K. Interventions to improve teamwork and communications among
33 healthcare staff. *Br J Surg* 2011; **98**:469-79.
34
35
36 19. Kazdin AE. *Research design in clinical psychology*. 4. uppl. ed. Boston, MA: Allyn and Bacon; 2003.
37
38
39 20. Shortell SM, Rousseau DM, Gillies RR, *et al.* Organizational assessment in intensive care units (ICUs):
40 construct development, reliability, and validity of the ICU nurse-physician questionnaire. *Med Care* 1991;
41 **29**:709-26.
42
43
44 21. Sexton JB, Helmreich RL, Neilands TB, *et al.* The Safety Attitudes Questionnaire: psychometric properties,
45 benchmarking data, and emerging research. *BMC Health Serv Res* 2006; **6**:44.
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 22. Hochwalder J, Bergsten Brucefors A. A psychometric assessment of a Swedish translation of Spreitzer's
4 empowerment scale. *Scand J Psychol* 2005; **46**:521-9.
5
6
7
8 23. The organization and management of intensive care units. Copyright 1989. Available at:
9 <http://shortellresearch.berkeley.edu/ICU.htm>. Accessed 24/9/2013.
10
11
12 24. Maneesriwongul W, Dixon JK. Instrument translation process: a methods review. *J Adv Nurs* 2004; **48**:175-
13 86.
14
15
16
17 25. Spreitzer GM. Psychological empowerment in the workplace: Dimensions, measurement, and validation.
18 *Academy of Management Journal* 1995;**38**:1442-65.
19
20
21
22 26. WHO Conceptual framework for the international classification for patient safety. Januari 2009. Available
23 at: <http://www.who.int/patientsafety/implementation/taxonomy/publications/en/index.html>. Accessed 9/24/2013,
24 2013.
25
26
27
28
29 27. Manojlovich M, DeCicco B. Healthy work environments, nurse-physician communication, and patients'
30 outcomes. *Am J Crit Care* 2007; **16**:536-43.
31
32
33
34 28. Greenfield LJ. Doctors and nurses: a troubled partnership. *Ann Surg* 1999;**230**:279-88.
35
36
37 29. Singer S, Lin S, Falwell A, Gaba D, *et al*. Relationship of safety climate and safety performance in hospitals.
38 *Health Serv Res* 2009; **44**:399-421.
39
40
41 30. Huang DT, Clermont G, Kong L, *et al*. Intensive care unit safety culture and outcomes: a US multicenter
42 study. *Int J Qual Health Care* 2010; **22**:151-61.
43
44
45
46 31. Rosen AK, Singer S, Shibe Z, *et al*. Hospital safety climate and safety outcomes: is there a relationship in
47 the VA?. *Med Care Res Rev* 2010; **67**:590-608.
48
49
50
51 32. Rabol LI, Andersen ML, Ostergaard D, *et al*. Descriptions of verbal communication errors between staff. An
52 analysis of 84 root cause analysis-reports from Danish hospitals. *BMJ Qual Saf* 2011; **20**:268-74.
53
54
55
56
57
58
59
60



SBAR improves communication and safety climate and decreases incident reports due to communication errors in an anaesthetic clinic: a prospective intervention study

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2013-004268.R1
Article Type:	Research
Date Submitted by the Author:	06-Dec-2013
Complete List of Authors:	Randmaa, Maria; University of Gävle, Faculty of Health and Occupational Studies; Uppsala University, Department of Public Health and Caring Sciences Mårtensson, Gunilla; University of Gävle, Faculty of Health and Occupational Studies; Uppsala University, Department of Public Health and Caring Sciences Leo Swenne, Christine; Uppsala University, Department of Public Health and Caring Sciences Engström, Maria; University of Gävle, Faculty of Health and Occupational Studies; Uppsala University, Department of Public Health and Caring Sciences
Primary Subject Heading:	Communication
Secondary Subject Heading:	Anaesthesia
Keywords:	Adult anaesthesia < ANAESTHETICS, Adult intensive & critical care < ANAESTHETICS, Health & safety < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

SCHOLARONE™
Manuscripts

1
2
3 **SBAR improves communication and safety climate and decreases incident**
4
5 **reports due to communication errors in an anaesthetic clinic: a prospective**
6
7 **intervention study**
8
9

10
11
12 Maria Randmaa^{1,2,3*}, Gunilla Mårtensson^{1,3}, Christine Leo Swenne³, Maria Engström^{1,3}

13
14 1) Faculty of Health and Occupational Studies, University of Gävle, Gävle, Sweden

15
16 2) Department of Anaesthesia, County Council of Gävleborg, Sweden

17
18 3) Department of Public Health and Caring Sciences, Uppsala University, Uppsala, Sweden
19

20
21 *Corresponding author;

22
23 Maria Randmaa, Faculty of Health and Occupational Studies, University of Gävle, S-801 76

24
25 Gävle, Sweden

26
27 E-mail: maaraa@hig.se
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Word count: 3441 words excluding title page, abstract, references, figures and tables

Keywords: Anaesthetic clinic, Communication, Incident reports, Safety attitudes, SBAR

ABSTRACT

Objectives: We aimed to examine staff members' perceptions of communication within and between different professions, safety attitudes and psychological empowerment, prior to and after implementation of the communication tool SBAR (Situation-Background-Assessment-Recommendation) at an anaesthetic clinic. The aim was also to study whether there was any change in the proportion of incident reports caused by communication errors.

Design: A prospective intervention study with comparison group using pre- and post-assessments. Questionnaire data were collected from staff in an intervention (n=100) and a comparison group (n=69) at the anaesthetic clinic in two hospitals prior to (2011) and after (2012) implementation of SBAR. The proportion of incident reports due to communication errors was calculated during a 1-year period prior to and after implementation.

Setting: Anaesthetic clinics at two hospitals in Sweden.

Participants: All licensed practical nurses, registered nurses and physicians working in the operating theatres, intensive care units and post anaesthesia care units at anaesthetic clinics in two hospitals were invited to participate.

Intervention: Implementation of SBAR in an anaesthetic clinic.

Primary and secondary outcomes: The primary outcomes were staff members' perception of communication within and between different professions, as well as their perceptions of safety attitudes. Secondary outcomes were psychological empowerment and incident reports due to error of communication.

Results: In the intervention group, there were statistically significant improvements in the factors "Between-group communication accuracy" (p=0.039) and "Safety climate" (p=0.011). The proportion of incident reports due to communication errors decreased significantly (p<0.0001) in the intervention group, from 31% to 11%.

1
2
3 **Conclusions:** Implementing the communication tool SBAR in anaesthetic clinics was
4
5 associated with improvement in staff members' perception of communication between
6
7 professionals and their perception of the safety climate as well as with a decreased proportion
8
9 of incident reports related to communication errors.
10
11

12
13
14 **Trial registration:** ISRCTN37251313
15
16

17 **Article summary**

18 **Strengths and limitations of this study**

- 19
20
21
22
23
24
25 • Despite recommendation of implementing SBAR in healthcare there are few
26
27 intervention studies with a comparison group, using pre- and post-assessments,
28
29 evaluating both staff members' perception of communication and safety attitudes as
30
31 well as incident reports due to communication errors, thus the study add new
32
33 knowledge to the subject area.
34
35
- 36
37 • The implementation was followed by the authors using manipulation check, involving
38
39 randomized structured telephone interviews. To monitor the implementation the local
40
41 inter-professional workgroup conducted observations of handovers.
42
- 43
44 • The response rate was satisfying, exceeding 70% at both baseline and follow-up in the
45
46 two groups.
47
- 48
49 • The very natures of the quasi-experimental design entail selection biases as the lack of
50
51 randomization.
52
53
54
55
56
57
58
59
60

INTRODUCTION

Teamwork in operating theatres and intensive care units requires straightforward, clear, and consistent communication as well as good collaboration. Nonetheless, communication breakdowns are frequent during the pre-, intra- and postoperative period.^{1 2} Communication and collaboration problems, in turn, have been shown to be the strongest predictors of health-related harm.²⁻⁴ The communication tool SBAR (Situation, Background, Assessment, Recommendations) is used in high-risk organizations to make communication more effective and consistent, and it has also been introduced in healthcare. SBAR is thought to create conditions for accurate information exchange and encourage dialogue, and the World Health Organization (WHO) recommends using it in healthcare to increase patient safety.⁵ Using the communication tool SBAR, important information can be transferred in a brief and concise manner, and in a predictable structure.⁶ In a review⁷ investigating studies on communication failures and how to avoid them, the authors suggested that one way to improve communication is to structure the information by employing tools such as SBAR.

Studies evaluating SBAR have been conducted in the US,⁸⁻¹⁰ Canada,^{11 12} Australia,^{13 14} the UK,¹⁵ Belgium¹⁶ and the Netherlands.¹⁷ The results have shown improved collaboration and nurse-physician communication, as perceived by nurses working in surgical and medical wards.¹⁶ Other studies have shown improvements in team communication and the safety culture, as assessed by rehabilitation staff.^{11 12} However, low adherence to SBAR was found in a simulation study among nurses working in surgical and medical wards one year after implementation.¹⁷ Still another study found, in contrast, that about 60% of nurses reported using SBAR.⁹ Findings from studies of simulated telephone referrals made by medical students and junior doctors have shown improved communication¹⁴ and improved call impact

1
2
3 as measured by an observer when SBAR was used.¹³ Studies measuring clinical outcomes
4
5 have found reduced unexpected death,¹⁶ decreased order entry errors¹⁰ and improvements in
6
7 safety reporting¹¹ after implementation of SBAR. Among the studies mentioned above, we
8
9 found only six that have used a comparison group,^{10-14 17} and of these, three were simulation
10
11 studies.^{13 14 17} One review¹⁸ studying interventions intended to facilitate teamwork and
12
13 communication in healthcare found that only 3 of 14 studies measured clinical outcomes and
14
15 that only 7 of 14 measured effects on the safety culture.¹⁸ Thus, there is a need to further
16
17 investigate staff and clinical outcomes with regard to use of the communication tool SBAR.
18
19

20
21
22
23
24 The aim of the present study was to examine staff members' perceptions of communication
25
26 within and between different professions, as well as their safety attitudes and psychological
27
28 empowerment, prior to and after implementation of the communication tool SBAR at an
29
30 anaesthetic clinic. A further aim was to investigate whether there were any differences in
31
32 change over time in these variables between an intervention group that was introduced to
33
34 SBAR and a comparison group. Still another aim was to study whether there was any change
35
36 in the proportion of incident reports due to communication errors. We hypothesized that
37
38 implementation of the communication tool SBAR would improve staff members' perception
39
40 of communication within and between different professions as well as their safety attitudes,
41
42 thereby decreasing reports of incidents caused by communication errors as well as increasing
43
44 staff members' perception of psychological empowerment.
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

METHOD

Design

A prospective intervention study with comparison group using pre- and post-assessments was used. The study involved one intervention group in which the SBAR was implemented (staff at an anaesthetic clinic at one hospital) and one comparison group (staff at another hospital's anaesthetic clinic). Questionnaires were delivered at baseline and at follow-up 6 months after implementation, and the proportion of incident reports at the two hospitals was measured during a 1-year period prior to and after implementation (Fig.1).

Sample and procedures

A total of 316 questionnaires, and two reminders, were delivered to all staff (licensed practical nurses [LPNs], registered nurses [RNs] and physicians) working in the operating theatres, intensive care units and post anaesthesia care unit at anaesthetic clinics in the two hospitals during spring 2011. The two hospitals were located in the same county council and thus the clinics shared the same top management.

Intervention

The decision to implement the communication tool SBAR at the clinic was taken by the management. Strategies to facilitate the implementation were: modifying a SBAR card, in-house training course, information material and observations during 7 months of the implementation period. A pocket SBAR card was slightly modified prior to implementation by a local inter-professional workgroup to adapt it to needs at the clinic. The intervention included an in-house training course (2.5 hours of instruction and role-playing) and implementation of the communication tool SBAR. During the introduction period May to

1
2
3 September 2011, 155 of 194 (80%) staff were trained and the rest were offered continuous
4
5 training. Informational material describing SBAR was distributed to all staff in the
6
7 intervention group, who received the pocket card describing the SBAR structure to be used.
8
9 At the post anaesthesia care unit, the SBAR card was also attached to the patients' tables,
10
11 where most handovers were conducted, and on the wall in the room where the physician's
12
13 handovers were conducted. At the intensive care unit, a printed SBAR template was used for
14
15 the receiver's notes during handovers. All staff members in the intervention group were
16
17 encouraged to take part in the training course and to use the communication tool SBAR in
18
19 their daily work. The period with an in-house training course was followed by a 7-month
20
21 monitoring period, which consisted of 168 structured observations of handovers carried out
22
23 by four members of the local inter-professional workgroup. The observations were used by
24
25 management to monitor the intervention process and as feedback to the intervention group. In
26
27 the comparison group, no structured communication system was used.
28
29
30
31
32
33
34

35 Manipulation check:

36
37 Careful control of the implementation is required for interpretation of the findings.¹⁹ To check
38
39 whether SBAR was implemented as intended, measures were made during a 7-month period
40
41 to follow the implementation. In the intervention group, structured telephone interviews were
42
43 conducted by one author (MR) with a random sample of 10 staff each month, except for one
44
45 month when only six staff members were reached. In total, 11 physicians, 17 intensive care
46
47 nurses, 10 anaesthesia nurse, 8 operating theatre nurses and 20 LPNs were interviewed.
48
49 Results showed that the majority of staff had taken the in-house training course and had used
50
51 the SBAR tool during the past seven working days.
52
53
54
55
56
57

58 Data collection

59
60

1
2
3 Questionnaire data were collected prior to implementation of SBAR in April 2011 and at
4
5 follow-up 6 months after completion of the implementation period in October 2012. To
6
7 measure communication within and between different professions, the ICU Nurse-Physician
8
9 Questionnaire²⁰ was used, and the Safety Attitudes Questionnaire (SAQ)²¹ was used to
10
11 measure staff members' attitudes toward six patient-safety-related domains. Spritzer's
12
13 empowerment scale²² was used to measure psychological empowerment. Incident reports
14
15 were collected from the hospitals' registration systems during a 1-year period prior to (1 April
16
17 2010 to 31 March 2011) and after implementation of SBAR (1 April 2012 to 31 March 2013).
18
19
20

21
22
23 Primary outcome measures:

24
25 The *ICU Nurse-Physician Questionnaire* (short version, section one)²³ consists of five factors:

26
27 Within-group communication openness (4 items); Between-group communication openness
28
29 (4 items); Within-group communication accuracy (4 items); Between-group communication
30
31 accuracy (3 items); Communication timeliness (3 items). The original questionnaire was
32
33 created to address the relationship between nurses and physicians only. But because LPNs are
34
35 a common staff group in Sweden, the questionnaire was adapted for LPNs and thus to suite
36
37 Swedish working conditions. The term within-group communication means communication
38
39 within the same profession (e.g. physician's perception of communicating with physician's)
40
41 and the term between-group communication mean e.g. physician's perception of
42
43 communicating with nurses and physician's perception of communicating with LPNs and so
44
45 on. The items are answered in a 5-point Likert scale ranging from "Strongly Disagree" to
46
47 "Strongly Agree." Negatively worded items are reversed before factor scores are averaged.
48
49

50
51 The ICU Nurse-Physician Questionnaire has shown satisfactory psychometric properties.

52
53 Cronbach's alpha values (α) for the five factors have been 0.64 to 0.88.²⁰ Translation of the
54
55 questionnaire was conducted forward by the research team and back-translation was carried
56
57
58
59
60

1
2
3 out by a bilingual translator.²⁴ In the present study, α -values were between 0.68 and 0.88 at
4
5 baseline and 0.68 and 0.85 at follow-up (Table 3).
6
7

8
9 The *Safety Attitudes Questionnaire* (SAQ, short form)²¹ consists of six factors: Teamwork
10 climate (6 items); Safety climate (7 items); Job satisfaction (5 items); Stress recognition (4
11 items); Perceptions of management (6 items); Working conditions (3 items). The items are
12 answered in a 5-point Likert scale ranging from “Disagree Strongly” to “Agree Strongly.”
13
14 The negatively worded items are reversed and the scale is converted to a 0 - 100% scale
15 where 0% = Disagree Strongly, 25% = Disagree Slightly, 50% = Neutral, 75% = Agree
16 Slightly and 100% = Agree Strongly. The SAQ has shown satisfactory psychometric
17 properties. Cronbach’s α -values have been between 0.70 and 0.85 for the factors.²¹
18
19

20 Translation of the questionnaire was conducted forward by the research team and back-
21 translation was carried out by a bilingual translator.²⁴ In the present study, α -values ranged
22 from 0.71 to 0.85 at baseline and from 0.71 to 0.86 at follow-up for the factors (Table 3).
23
24

25 Secondary outcome measures:

26
27 *Spreitzer’s empowerment scale*²⁵ consists of four factors: Meaning (3 items); Competence (3
28 items); Self-determination (3 items); Impact (3 items). The items are answered on a 7-point
29 Likert scale ranging from “Strongly Disagree” to “Strongly Agree.” Factor scores and the
30 total scale are averaged. The Swedish version of the scale has shown satisfactory
31 psychometric properties, with α -values ranging from 0.77 to 0.90.²² In the present study, α -
32 values ranged from 0.85 to 0.88 at baseline and from 0.80 to 0.87 at follow-up for the factors
33 (Table 3).
34
35

36
37 The number of *incident reports* was measured during a 1-year period prior to (1 April 2010 to
38
39 31 March 2011) and after implementation of SBAR (1 April 2012 to 31 March 2013). In
40
41
42
43
44
45
46
47
48
49
50
51
52
53

1
2
3 accordance with WHO definitions,²⁶ we defined incident reports as “A process used to
4 document occurrences that are not consistent with routine hospital operation or patient care.”
5
6 A communication error is defined as “Missing or wrong information exchange or
7 misinterpretation or misunderstanding.”²⁶ In the county council where the present study was
8 conducted, the clinic administrator has overall responsibility for incident reports. The incident
9 reports are examined by an investigator who reviewed the cause of the incident and what
10 measures were taken. The result of the investigation then goes back to the clinic, where
11 possible follow-ups are carried out.
12
13
14
15
16
17
18
19
20
21
22
23

24 **Data analysis**

25
26 The data were analysed using descriptive statistics such as means, standard deviations [SD],
27 absolute numbers and percentages. For within-group comparisons over time, the Wilcoxon
28 Signed Rank Test was used, and for between-group comparisons the Mann-Whitney U-test
29 was used. The Chi-square and Fisher’s exact test were used to detect differences in the
30 frequency data. Factor scores in the three questionnaires were calculated if at least 66.7% of
31 the questions for each factor were answered. Internal consistency was calculated using
32 Cronbach’s alpha. Non-parametric tests were used because the majority of factors did not
33 have a normal distribution. The level for statistical significance was set at $p < 0.05$ (two-tailed).
34
35
36
37
38
39
40
41
42
43
44
45

46 **Ethical considerations**

47
48 The study was approved (reg. no. 2011/061) by the Regional Ethical Review Board. All
49 participants received written information about the study aim and procedures and were told
50 that participation was strictly voluntary and could be discontinued at any time without
51 explanation.
52
53
54
55
56
57
58
59
60

RESULTS

Sample characteristics

The response rate at baseline was 72% (n=139 of 194) in the intervention group and 75% (n=91 of 122) in the comparison group. The response rate at follow-up in 2012 was 72% (n=100 of 139) and 76% (n=69 of 91), respectively (Table 1). The drop-outs had fewer years working in the profession (p=0.005) fewer years working at the clinic (p<0.001) and higher scores on the factor Teamwork climate (p=0.017) and lower scores on the factor Competence (p=0.048) than the participants did. There were no statistically significant differences between the intervention and comparison groups at baseline regarding age, sex, working years in the profession, working years at the clinic and working time (Table 2). However, at baseline there were statistically significant higher scores in the comparison group on five factors; Teamwork climate (p=0.045), Safety climate (p=0.002), Job satisfaction (p=0.004), Working condition (p=0.002) and Within-group communication accuracy (p=0.001).

Table 1. Reasons for non-participants/dropouts at baseline and follow-up

Dropout	Intervention group	Comparison group
<i>Baseline</i>	194	122
Refusal	3	24
No reason	52	7
Answered questionnaires	139	91
<i>Follow-up</i>	139	91
Parental leave	3	2
Changed workplace	3	1
Long-term illness	-	1
Retired	1	1
Quit work	3	6
Leave of absence	5	1
Education	2	1
Total unavailable staff	17	13
Eligible staff	122	78
Refusal	6	6
No reason	16	3
Answered questionnaires	100	69

Table 2. Demographic data on staff members in the intervention group and control group who participated at baseline and follow-up. Mean (m), Standard deviation (SD), numbers (n) and percent (%)

	Intervention group (n=100)	Comparison group (n=69)	P-value
Age, years, m (SD)	48.2 (8.7)	48.6 (9.0)	0.780
Sex male/female, n	15 (15%)/85 (85%)	11 (16%)/58 (84%)	1.000
Profession, n			0.945
- LPN	27 (27%)	18 (26%)	
- RN	63 (63%)	43 (62%)	
- Physician	10 (10%)	8 (12%)	
Years in the profession, m (SD)	17.5 (11.2)	19.5 (10.2)	0.257
Years at the clinic, m (SD)	15.2 (11.0)	15.4 (10.3)	0.883
Working full-time/part-time, n	60 (60%)/40 (40%)	48 (70%)/21 (30%)	0.254

Independent Samples T-test and Chi-square Test. The significant level is 0.05

LPN = Licensed Practical Nurse, RN = Registered Nurse

Primary outcome

Of the five factors in the ICU Nurse-Physician Questionnaire, the factor Between-group communication accuracy improved significantly ($p=0.001$) over time in the intervention group. For the factor Within-group communication accuracy, there was a tendency for improvement over time in the intervention group, though it was not statistically significant ($p=0.076$). This finding required further investigation, and we proceeded by analyzing each item. There was significant improvement over time for the item “It is often necessary for me to go back and check the accuracy of information I have received from [physicians, nurses or licensed practical nurses] in this unit” ($p=0.025$). In the comparison group, the factor Between-group openness improved significantly ($p=0.039$) over time. When changes over time were compared between the intervention group and comparison group, the results showed no statistically significant differences (Table 3). Of the factors in the SAQ, the factor Safety climate improved significantly ($p=0.011$) over time in the intervention group. For the other factors in the SAQ, there were no statistically significant differences. In the comparison group, the factor Perception of management at the unit showed a significant ($p<0.001$) improvement over time, as did the factor Working condition ($p=0.029$). When changes over

1
2
3 time were compared between the intervention group and comparison group, the results
4
5 showed a significant difference ($p < 0.001$) between groups for the factor Perception of
6
7 management at the unit. For the factor Safety climate, the p-value was 0.087 when change
8
9 over time between the groups was compared (Table 3).
10

11 12 13 14 **Secondary outcome**

15
16 In the intervention group, the number of incident reports during a 1-year period prior to
17
18 implementation was 116, whereof 36 (31%) were due to communication errors. The same
19
20 year, in the comparison group, 6 of the 24 (25%) registered incident reports were due to
21
22 communication errors. In the intervention group, during a 1-year period after implementation,
23
24 the incident reports due to communication errors had decreased to 23 of a total of 208 (11%).
25
26 During the same period in the comparison group, the number of incident reports due to
27
28 communication errors was 6 of 32 (19%). The decrease in the proportions of incident reports
29
30 due to communication errors in the intervention group was statistically significant ($p < 0.0001$),
31
32 though it was not in the comparison group ($p = 0.744$). Regarding psychological
33
34 empowerment, the results revealed no statistically significant changes over time in either the
35
36 intervention group or the comparison group (Table 3).
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 3. Staff members' assessment of communication within and between groups, safety attitudes and empowerment in the intervention and comparison group at baseline and follow-up as change over time between groups. Mean and Standard deviation (SD), n = 169.

Measurement factors	Cronbach's alpha	Intervention group - Within group		Comparison group - Within group		Change over time between groups
		¹ Mean value (SD)	¹ p-value	¹ Mean value (SD)	¹ p-value	² p-value
ICU Nurse-Physician Questionnaire						
<i>Within-group communication openness</i>						
Baseline	0.80	4.3 (0.6)		4.4 (0.6)		
Follow-up	0.78	4.3 (0.5)	0.998	4.4 (0.5)	0.529	0.390
<i>Between-group communication openness</i>						
Baseline						
Physician↔RN; LPN↔Physician; RN↔LPN	0.82; 0.88; 0.84	4.3 (0.5)		4.2 (0.6)		
Follow-up						
Physician↔RN; LPN↔Physician; RN↔LPN	0.85; 0.84; 0.82	4.3 (0.5)	0.686	4.3 (0.6)	0.039	0.263
<i>Within-group communication accuracy</i>						
Baseline	0.73	3.3 (0.8)		3.7 (0.8)		
Follow-up	0.75	3.4 (0.8)	0.076	3.7 (0.9)	0.966	0.371
<i>Between-group communication accuracy</i>						
Baseline						
Physician↔RN; LPN↔Physician; RN↔LPN	0.69; 0.68; 0.77	3.3 (0.8)		3.5 (0.8)		
Follow-up						
Physician↔RN; LPN↔Physician; RN↔LPN	0.77; 0.69; 0.76	3.5 (0.8)	0.001	3.6 (0.8)	0.185	0.172
<i>Communication timeliness</i>						
Baseline	0.74	4.2 (0.7)		4.2 (0.7)		
Follow-up	0.68	4.3 (0.6)	0.612	4.3 (0.7)	0.650	0.958
Safety Attitudes Questionnaire						
<i>Teamwork climate</i>						
Baseline	0.73	72.2 (15.1)		76.9 (15.1)		
Follow-up	0.74	73.8 (14.4)	0.350	76.7 (15.8)	0.914	0.584
<i>Safety climate</i>						
Baseline	0.76	63.1 (15.8)		70.3 (14.3)		
Follow-up	0.78	66.4 (16.2)	0.011	70.2 (16.0)	0.949	0.087
<i>Job satisfaction</i>						

Baseline	0.85	75.3 (15.5)		81.5 (16.4)		
Follow-up	0.86	74.2 (15.4)	0.604	81.7 (15.0)	0.865	0.771
<i>Stress recognition</i>						
Baseline	0.85	68.0 (21.9)		65.8 (25.2)		
Follow-up	0.82	67.8 (20.8)	0.483	63.5 (24.9)	0.382	0.388
<i>Perception of management unit</i>						
Baseline	0.76	60.2 (17.9)		59.2 (16.7)		
Follow-up	0.80	60.2 (18.6)	0.667	68.6 (16.7)	<0.001	<0.001
<i>Working condition</i>						
Baseline	0.71	63.9 (19.2)		73.3 (15.6)		
Follow-up	0.71	63.5 (18.8)	0.956	77.8 (16.2)	0.029	0.131
Spreitzer's Empowerment scale						
<i>Meaning</i>						
Baseline	0.86	6.2 (0.8)		6.3 (0.9)		
Follow-up	0.86	6.3 (0.7)	0.270	6.3 (0.8)	0.935	0.602
<i>Competence</i>						
Baseline	0.86	6.4 (0.7)		6.5 (0.6)		
Follow-up	0.80	6.4 (0.6)	0.985	6.5 (0.7)	0.877	0.818
<i>Self-determination</i>						
Baseline	0.86	4.3 (1.2)		4.4 (1.5)		
Follow-up	0.86	4.3 (1.3)	0.992	4.6 (1.3)	0.342	0.465
<i>Impact</i>						
Baseline	0.88	4.2 (1.3)		4.5 (1.4)		
Follow-up	0.87	4.2 (1.4)	0.639	4.5 (1.3)	0.867	0.857
<i>Empowerment total factors</i>						
Baseline	0.85	5.3 (0.7)		5.4 (0.8)		
Follow-up	0.86	5.3 (0.8)	0.474	5.5 (0.7)	0.444	0.916

¹Wilcoxon Signed Rank Test and ²Mann-Whitney U-test. The significant level is 0.05 and statistical significant results are marked with boldface text
 LPN = Licensed Practical Nurse, RN = Registered Nurse

DISCUSSION

SBAR is thought to facilitate communication between professions and increase safety as well as to decrease the negative effects the professional hierarchy may have on communication.

Our results showed that implementation of the communication tool SBAR resulted in significant improvement over time in staff members' perceptions of Between-group communication accuracy and Safety climate as well as a tendency toward improvement in Within-group communication accuracy. Furthermore, the proportion of incident reports due to communication errors decreased significantly, from 31% (36 of 116) to 11% (23 of 208), in the intervention group compared with a non-significant decrease, from 25% (6 of 24) to 19% (6 of 32), in the comparison group. Thus, in the intervention group safety reporting seemed to improve but the proportion of incident reports due to communication decreased significantly.

The improvement in staff members' perceptions of Between-group communication accuracy after implementation of the communication tool SBAR seen in the present study is similar to findings from a study by DeMeester¹⁶, where nurse-physician communication also improved. In a study by Manojlovich and DeCicco²⁷ Between-group communication was shown to be a significant predictor of perceived medication error²⁷. Nurses and physicians are trained to express themselves in different ways²⁸ and communication between different professions is known to be a contributing factor in surgical malpractice claims.¹ Because staff members' perceptions of Between-group communication accuracy improved, it would seem that SBAR was able to bridge differences in style of communication.

Safety climate also improved, and the proportion of incident reports due to communication errors decreased in the intervention group, which may indicate that safety performance

1
2
3 improved. One study²⁹ of 91 hospitals found that a higher level of safety climate was
4
5 associated with higher safety performance at the hospital level. Furthermore, Huang *et al.*
6
7 (2010)³⁰ studied 30 ICUs in the US using SAQ and found that lower Safety climate was
8
9 associated with patient outcomes such as increased hospital length of stay. However, another
10
11 study by Rosen *et al.* (2010)³¹ failed to show a relationship between safety climate and
12
13 hospital safety performance. As in the present study, improved perception of safety climate
14
15 has also been found in studies^{11 12} of rehabilitation settings in which SBAR had been
16
17 implemented. Verbal communication errors were found to be an important cause of severe
18
19 patient safety incidents.³² In the present study, there was a decrease in the proportion of
20
21 incident reports due to communication errors. According to the present results, one can
22
23 assume that SBAR made communication safer, resulting in a decrease in incident reports due
24
25 to communication errors. This interpretation is also in line with our hypothesis. We also
26
27 hypothesized that a secondary outcome of implementing SBAR could be an increase in staff
28
29 members' perception of psychological empowerment. In the present study, it would seem
30
31 reasonable to assume that SBAR training should have increased staff members'
32
33 empowerment, but no such effect was found during the study period.
34
35
36
37
38
39
40

41 In the comparison group, there were no significant changes in staff members' perceptions of
42
43 Communication accuracy or Safety climate. However, the factors Between-group
44
45 communication openness, Perception of management at the unit and Working condition
46
47 improved significantly over time. During the period between baseline and follow-up, there
48
49 were work-related changes in the comparison group that may have affected the results. The
50
51 staff in the operating theatre had increased in size, and there had been discussions of the
52
53 importance of collaboration at the intensive care unit. When working condition is improved
54
55 one can expect that also communication improves.
56
57
58
59
60

Strengths and weaknesses of the study

The strengths of the present study were that measures of both safety culture and the number of incident reports related to communication were included, as previously recommended,¹⁸ and that a comparison group was used. Furthermore, during 7 months of the implementation period, we followed the implementation using a manipulation check involving randomized structured telephone interviews. An additional support in the implementation was observations of handovers conducted by the local inter-professional workgroup. In a simulation study, low adherence was found for use of SBAR during a 1-year period after implementation in a hospital.¹⁷ In the present study, the manipulation check and observations showed that SBAR was in use at the clinic. One other strength is that the questionnaires used have shown satisfactory psychometric properties, and Cronbach's Alpha values in the present study for all instruments, total scale and factors were over 0.68. Although the two groups were different in size, there were no significant differences in the demographic data. The distribution was not normal and a limitation was that it was not possible to do multivariate analysis to correct for the differences at baseline in some variables as "Between-group communication openness", Perception of management unit" and "Working conditions". The response rate was satisfying, exceeding 70% at both baseline and follow-up in the two groups. When interpreting the present results, possible threats to internal validity should be considered. First, the very nature of the quasi-experimental design entailed selection biases: The participants were not randomly assigned and there were statistically significant differences between the intervention group and the comparison group at baseline. Although the comparison group had higher baseline levels on the five factors that could have affected the results, there was still room for improvement. Second, the loss of subjects poses another threat to internal validity, in that the drop-outs had statistically higher scores on the factor Teamwork climate and statistically lower scores on the factor Competence than the

1
2
3 participants did. On the other hand, the number of drop-outs was moderate. There were also
4
5 differences in incident reporting. The comparison group had overall lower frequency of
6
7 registered incident reports. There may be several reasons for this, e.g. that the frequency of
8
9 incidents was actually different or that there was a difference in the tendency to report
10
11 incidents. Third, an additional threat to internal validity was that there may have been some
12
13 diffusion of the intervention to the comparison group, which could have affected the results.
14
15 Further research dealing with these methodological issues is needed to confirm our results.
16
17
18
19

20 21 **Conclusion**

22
23 Implementing the communication tool SBAR in anaesthetic care can improve communication
24
25 between professionals, improve the safety climate and reduce incidents caused by
26
27 communication errors.
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Figure legend

Fig. 1 Outline of design

Contributors All authors (MR, GM, CLS and ME) contributed to the design, interpreted data, drafted and revised the article critically. Data analysis was conducted by MR and ME. MR collected data, conducted the manipulation check and wrote the manuscript under the supervision of GM, CLS and ME. All authors read and approved the final version of the paper.

Funding This work was supported by the Faculty of Health and Occupational Studies, University of Gävle and by the County Council Gävleborg. It was also supported by the Patient Insurance LÖF and the Swedish Society of Nursing, but these organizations had no role in the design and running of the study.

Competing Interests None.

Ethics approval The Regional Ethical Review Board (reg. no. 2011/061).

Data sharing statement No additional data available.

REFERENCES

1. Greenberg CC, Regenbogen SE, Studdert DM, *et al.* Patterns of communication breakdowns resulting in injury to surgical patients. *J Am Coll Surg* 2007;**204**:533-40.
2. Lingard L, Espin S, Whyte S, *et al.* Communication failures in the operating room: an observational classification of recurrent types and effects. *Qual Saf Health Care* 2004;**13**:330-4.
3. Wiegmann DA, ElBardissi AW, Dearani JA, *et al.* Disruptions in surgical flow and their relationship to surgical errors: an exploratory investigation. *Surgery* 2007; **142**:658-65.
4. White AA, Pichert JW, Bledsoe SH, *et al.* Cause and effect analysis of closed claims in obstetrics and gynecology. *Obstet Gynecol* 2005;**105**:1031-8.

- 1
2
3 5. WHO Patient Safety Solutions| volume 1, solution 3 | May 2007 Available at:
4
5 http://www.refworks.com/refgrabit/rw2linkpage.aspx?subscriber=6107&user=1209&_id=1344860455630.
6
7 Accessed 13/8/2012
8
9
10 6. Leonard M, Graham S, Bonacum D. The human factor: the critical importance of effective teamwork and
11 communication in providing safe care. *Qual Saf Health Care* 2004;**13** Suppl 1:i85-90.
12
13
14 7. Flemming D, Hubner U. How to improve change of shift handovers and collaborative grounding and what
15 role does the electronic patient record system play? Results of a systematic literature review. *Int J Med Inform*
16 2013;**82**:580-92.
17
18
19
20 8. Renz SM, Boltz MP, Wagner LM, *et al*. Examining the feasibility and utility of an SBAR protocol in long-
21 term care. *Geriatr Nurs* 2013; **34**:295-301.
22
23
24 9. Compton J, Copeland K, Flanders S, *et al*. Implementing SBAR across a large multihospital health system. *Jt*
25 *Comm J Qual Patient Saf* 2012;**38**:261-8.
26
27
28
29 10. Telem DA, Buch KE, Ellis S, *et al*. Integration of a formalized handoff system into the surgical curriculum:
30 resident perspectives and early results. *Arch Surg* 2011; Jan;**146**:89-93.
31
32
33
34 11. Velji K, Baker GR, Fancott C, *et al*. Effectiveness of an Adapted SBAR Communication Tool for a
35 Rehabilitation Setting. *Healthc Q* 2008;**11**:72-9.
36
37
38
39 12. Andreoli A, Fancott C, Velji K, *et al*. Using SBAR to communicate falls risk and management in inter-
40 professional rehabilitation teams. *Healthc Q* 2010; **13**:94-101.
41
42
43
44 13. Cunningham NJ, Weiland TJ, van Dijk J, *et al*. Telephone referrals by junior doctors: a randomised
45 controlled trial assessing the impact of SBAR in a simulated setting. *Postgrad Med J* 2012; **88**:619-26.
46
47
48
49 14. Marshall S, Harrison J, Flanagan B. The teaching of a structured tool improves the clarity and content of
50 interprofessional clinical communication. *Qual Saf Health Care* 2009;**18**:137-40.
51
52
53
54 15. Christie P, Robinson H. Using a communication framework at handover to boost patient outcomes. *Nurs*
55 *Times* 2009; **105**:13-5.
56
57
58
59
60

- 1
2
3 16. De Meester K, Verspuy M, Monsieurs KG, *et al.* SBAR improves nurse-physician communication and
4 reduces unexpected death: A pre and post intervention study. *Resuscitation* 2013;**84**: 1192-6
5
6
7
8 17. Ludikhuizen J, de Jonge E, Goossens A. Measuring adherence among nurses one year after training in
9 applying the Modified Early Warning Score and Situation-Background-Assessment-Recommendation
10 instruments. *Resuscitation* 2011; **82**:1428-33.
11
12
13
14 18. McCulloch P, Rathbone J, Catchpole K. Interventions to improve teamwork and communications among
15 healthcare staff. *Br J Surg* 2011; **98**:469-79.
16
17
18
19 19. Kazdin AE. *Research design in clinical psychology*. 4. uppl. ed. Boston, MA: Allyn and Bacon; 2003.
20
21
22 20. Shortell SM, Rousseau DM, Gillies RR, *et al.* Organizational assessment in intensive care units (ICUs):
23 construct development, reliability, and validity of the ICU nurse-physician questionnaire. *Med Care* 1991;
24 **29**:709-26.
25
26
27
28
29 21. Sexton JB, Helmreich RL, Neilands TB, *et al.* The Safety Attitudes Questionnaire: psychometric properties,
30 benchmarking data, and emerging research. *BMC Health Serv Res* 2006; **6**:44.
31
32
33
34 22. Hochwalder J, Bergsten Brucefors A. A psychometric assessment of a Swedish translation of Spreitzer's
35 empowerment scale. *Scand J Psychol* 2005; **46**:521-9.
36
37
38
39 23. The organization and management of intensive care units. Copyright 1989. Available at:
40 <http://shortellresearch.berkeley.edu/ICU.htm>. Accessed 24/9/2013.
41
42
43
44 24. Manesriwongul W, Dixon JK. Instrument translation process: a methods review. *J Adv Nurs* 2004; 48:175-
45 86.
46
47
48
49 25. Spreitzer GM. Psychological empowerment in the workplace: Dimensions, measurement, and validation.
50 *Academy of Management Journal* 1995;**38**:1442-65.
51
52
53
54 26. WHO Conceptual framework for the international classification for patient safety. Januari 2009. Available
55 at: <http://www.who.int/patientsafety/implementation/taxonomy/publications/en/index.html>. Accessed 9/24/2013,
56
57 2013.
58
59
60

- 1
2
3 27. Manojlovich M, DeCicco B. Healthy work environments, nurse-physician communication, and patients'
4 outcomes. *Am J Crit Care* 2007; **16**:536-43.
5
6
7 28. Greenfield LJ. Doctors and nurses: a troubled partnership. *Ann Surg* 1999;**230**:279-88.
8
9
10 29. Singer S, Lin S, Falwell A, Gaba D, *et al*. Relationship of safety climate and safety performance in hospitals.
11 *Health Serv Res* 2009; **44**:399-421.
12
13
14 30. Huang DT, Clermont G, Kong L, *et al*. Intensive care unit safety culture and outcomes: a US multicenter
15 study. *Int J Qual Health Care* 2010; **22**:151-61.
16
17
18 31. Rosen AK, Singer S, Shibe Z, *et al*. Hospital safety climate and safety outcomes: is there a relationship in
19 the VA?. *Med Care Res Rev* 2010; **67**:590-608.
20
21
22 32. Rabol LI, Andersen ML, Ostergaard D, *et al*. Descriptions of verbal communication errors between staff. An
23 analysis of 84 root cause analysis-reports from Danish hospitals. *BMJ Qual Saf* 2011; **20**:268-74.
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 **SBAR improves communication and safety climate and decreases incident**
4
5 **reports due to communication errors in an anaesthetic clinic: a prospective**
6
7
8 **intervention study**
9

10
11
12 Maria Randmaa^{1,2,3*}, Gunilla Mårtensson^{1,3}, Christine Leo Swenne³, Maria Engström^{1,3}

13
14 1) Faculty of Health and Occupational Studies, University of Gävle, Gävle, Sweden

15
16 2) Department of Anaesthesia, County Council of Gävleborg, Sweden

17
18 3) Department of Public Health and Caring Sciences, Uppsala University, Uppsala, Sweden
19

20
21 *Corresponding author;

22 Maria Randmaa, Faculty of Health and Occupational Studies, University of Gävle, S-801 76

23
24 Gävle, Sweden

25
26 E-mail: maaraa@hig.se
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Word count: 3441 words excluding title page, abstract, references, figures and tables

Keywords: Anaesthetic clinic, Communication, Incident reports, Safety attitudes, SBAR

ABSTRACT

Objectives: We aimed to examine staff members' perceptions of communication within and between different professions, safety attitudes and psychological empowerment, prior to and after implementation of the communication tool SBAR (**Situation-Background-Assessment-Recommendation**) at an anaesthetic clinic. The aim was also to study whether there was any change in the proportion of incident reports caused by communication errors.

Design: A prospective intervention study with comparison group using pre- and post-assessments. Questionnaire data were collected from staff in an intervention (n=100) and a comparison group (n=69) at the anaesthetic clinic in two hospitals prior to (2011) and after (2012) implementation of SBAR. The proportion of incident reports due to communication errors was calculated during a 1-year period prior to and after implementation.

Setting: Anaesthetic clinics at two hospitals in Sweden.

Participants: All licensed practical nurses, registered nurses and physicians working in the operating theatres, intensive care units and post anaesthesia care units at anaesthetic clinics in two hospitals were invited to participate.

Intervention: Implementation of SBAR in an anaesthetic clinic.

Primary and secondary outcomes: The primary outcomes were staff members' perception of communication within and between different professions, as well as their perceptions of safety attitudes. Secondary outcomes were psychological empowerment and incident reports due to error of communication.

Results: In the intervention group, there were statistically significant improvements in the factors "Between-group communication accuracy" (p=0.039) and "Safety climate" (p=0.011). The proportion of incident reports due to communication errors decreased significantly (p<0.0001) in the intervention group, from 31% to 11%.

1
2
3 **Conclusions:** Implementing the communication tool SBAR in anaesthetic clinics was
4 associated with improvement in staff members' perception of communication between
5 professionals and their perception of the safety climate as well as with a decreased proportion
6 of incident reports related to communication errors.
7
8
9
10

11
12
13
14 **Trial registration:** ISRCTN37251313
15

16 17 18 **Article summary** 19

20 21 **Strengths and limitations of this study** 22

- 23
24 • Despite recommendation of implementing SBAR in healthcare there are few
25 intervention studies with a comparison group, using pre- and post-assessments,
26 evaluating both staff members' perception of communication and safety attitudes as
27 well as incident reports due to communication errors, thus the study add new
28 knowledge to the subject area.
29
30
31
32
- 33
34 • The implementation was followed by the authors using manipulation check, involving
35 randomized structured telephone interviews. To monitor the implementation the local
36 inter-professional workgroup conducted observations of handovers.
37
38
39
- 40
41 • The response rate was satisfying, exceeding 70% at both baseline and follow-up in the
42 two groups.
43
44
45
- 46
47 • The very natures of the quasi-experimental design entail selection biases as the lack of
48 randomization.
49
50
51
52
53
54
55
56
57
58
59
60

INTRODUCTION

Teamwork in operating theatres and intensive care units requires straightforward, clear, and consistent communication as well as good collaboration. Nonetheless, communication breakdowns are frequent during the pre-, intra- and postoperative period.^{1 2} Communication and collaboration problems, in turn, have been shown to be the strongest predictors of health-related harm.²⁻⁴ The communication tool SBAR (Situation, Background, Assessment, Recommendations) is used in high-risk organizations to make communication more effective and consistent, and it has also been introduced in healthcare. SBAR is thought to create conditions for accurate information exchange and encourage dialogue, and the World Health Organization (WHO) recommends using it in healthcare to increase patient safety.⁵ Using the communication tool SBAR, important information can be transferred in a brief and concise manner, and in a predictable structure.⁶ In a review⁷ investigating studies on communication failures and how to avoid them, the authors suggested that one way to improve communication is to structure the information by employing tools such as SBAR.

Studies evaluating SBAR have been conducted in the US,⁸⁻¹⁰ Canada,^{11 12} Australia,^{13 14} the UK,¹⁵ Belgium¹⁶ and the Netherlands.¹⁷ The results have shown improved collaboration and nurse-physician communication, as perceived by nurses working in surgical and medical wards.¹⁶ Other studies have shown improvements in team communication and the safety culture, as assessed by rehabilitation staff.^{11 12} However, low adherence to SBAR was found in a simulation study among nurses working in surgical and medical wards one year after implementation.¹⁷ Still another study found, in contrast, that about 60% of nurses reported using SBAR.⁹ Findings from studies of simulated telephone referrals made by medical students and junior doctors have shown improved communication¹⁴ and improved call impact

1
2
3 as measured by an observer when SBAR was used.¹³ Studies measuring clinical outcomes
4
5 have found reduced unexpected death,¹⁶ decreased order entry errors¹⁰ and improvements in
6
7 safety reporting¹¹ after implementation of SBAR. Among the studies mentioned above, we
8
9 found only six that have used a comparison group,^{10-14 17} and of these, three were simulation
10
11 studies.^{13 14 17} One review¹⁸ studying interventions intended to facilitate teamwork and
12
13 communication in healthcare found that only 3 of 14 studies measured clinical outcomes and
14
15 that only 7 of 14 measured effects on the safety culture.¹⁸ Thus, there is a need to further
16
17 investigate staff and clinical outcomes with regard to use of the communication tool SBAR.
18
19

20
21
22
23
24 The aim of the present study was to examine staff members' perceptions of communication
25
26 within and between different professions, as well as their safety attitudes and psychological
27
28 empowerment, prior to and after implementation of the communication tool SBAR at an
29
30 anaesthetic clinic. A further aim was to investigate whether there were any differences in
31
32 change over time in these variables between an intervention group that was introduced to
33
34 SBAR and a comparison group. Still another aim was to study whether there was any change
35
36 in the proportion of incident reports due to communication errors. We hypothesized that
37
38 implementation of the communication tool SBAR would improve staff members' perception
39
40 of communication within and between different professions as well as their safety attitudes,
41
42 thereby decreasing reports of incidents caused by communication errors as well as increasing
43
44 staff members' perception of psychological empowerment.
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

METHOD

Design

A prospective intervention study with comparison group using pre- and post-assessments was used. The study involved one intervention group in which the SBAR was implemented (staff at an anaesthetic clinic at one hospital) and one comparison group (staff at another hospital's anaesthetic clinic). Questionnaires were delivered at baseline and at follow-up 6 months after implementation, and the proportion of incident reports at the two hospitals was measured during a 1-year period prior to and after implementation (Fig. 1).

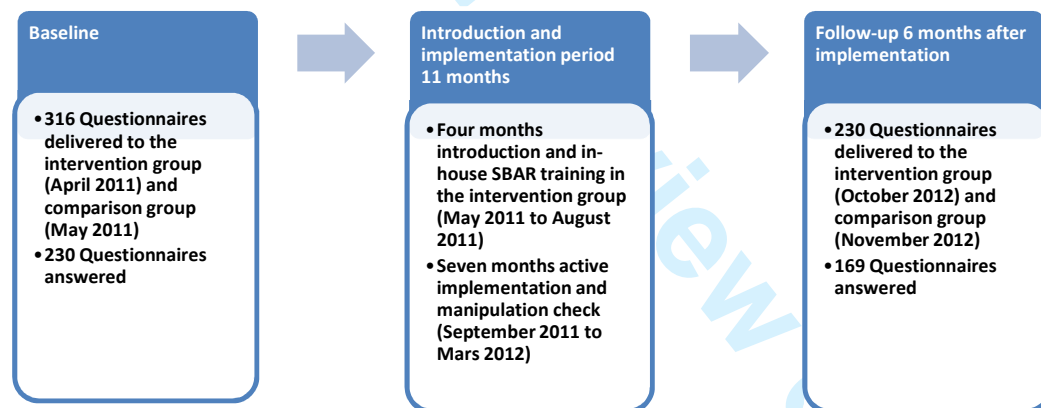


Fig. 1 Outline of design

Sample and procedures

A total of 316 questionnaires, and two reminders, were delivered to all staff (licensed practical nurses [LPNs], registered nurses [RNs] and physicians) working in the operating theatres, intensive care units and post anaesthesia care unit at anaesthetic clinics in the two

1
2
3 hospitals during spring 2011. The two hospitals were located in the same county council and
4
5 thus the clinics shared the same top management.
6
7
8
9

10 **Intervention**

11
12 The decision to implement the communication tool SBAR at the clinic was taken by the
13 management. Strategies to facilitate the implementation were: modifying a SBAR card, in-
14 house training course, information material and observations during 7 months of the
15 implementation period. A pocket SBAR card was slightly modified prior to implementation
16 by a local inter-professional workgroup to adapt it to needs at the clinic. The intervention
17 included an in-house training course (2.5 hours of instruction and role-playing) and
18 implementation of the communication tool SBAR. During the introduction period May to
19 September 2011, 155 of 194 (80%) staff were trained and the rest were offered continuous
20 training. Informational material describing SBAR was distributed to all staff in the
21 intervention group, who received the pocket card describing the SBAR structure to be used.
22
23 At the post anaesthesia care unit, the SBAR card was also attached to the patients' tables,
24 where most handovers were conducted, and on the wall in the room where the physician's
25 handovers were conducted. At the intensive care unit, a printed SBAR template was used for
26 the receiver's notes during handovers. All staff members in the intervention group were
27 encouraged to take part in the training course and to use the communication tool SBAR in
28 their daily work. The period with an in-house training course was followed by a 7-month
29 monitoring period, which consisted of 168 structured observations of handovers carried out
30 by four members of the local inter-professional workgroup. The observations were used by
31 management to monitor the intervention process and as feedback to the intervention group. In
32 the comparison group, no structured communication system was used.
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Manipulation check:

4
5 Careful control of the implementation is required for interpretation of the findings.¹⁹ To check
6
7 whether SBAR was implemented as intended, measures were made during a 7-month period
8
9 to follow the implementation. In the intervention group, structured telephone interviews were
10
11 conducted by one author (MR) with a random sample of 10 staff each month, except for one
12
13 month when only six staff members were reached. In total, 11 physicians, 17 intensive care
14
15 nurses, 10 anaesthesia nurse, 8 operating theatre nurses and 20 LPNs were interviewed.
16
17 Results showed that the majority of staff had taken the in-house training course and had used
18
19 the SBAR tool during the past seven working days.
20
21
22
23
24
25

26 **Data collection**

27
28 Questionnaire data were collected prior to implementation of SBAR in April 2011 and at
29
30 follow-up 6 months after completion of the implementation period in October 2012. To
31
32 measure communication within and between different professions, the ICU Nurse-Physician
33
34 Questionnaire²⁰ was used, and the Safety Attitudes Questionnaire (SAQ)²¹ was used to
35
36 measure staff members' attitudes toward six patient-safety-related domains. Spritzer's
37
38 empowerment scale²² was used to measure psychological empowerment. Incident reports
39
40 were collected from the hospitals' registration systems during a 1-year period prior to (1 April
41
42 2010 to 31 March 2011) and after implementation of SBAR (1 April 2012 to 31 March 2013).
43
44
45
46
47

48 Primary outcome measures:

49
50 The *ICU Nurse-Physician Questionnaire* (short version, section one)²³ consists of five factors:
51
52 Within-group communication openness (4 items); Between-group communication openness
53
54 (4 items); Within-group communication accuracy (4 items); Between-group communication
55
56 accuracy (3 items); Communication timeliness (3 items). The original questionnaire was
57
58
59
60

1
2
3 created to address the relationship between nurses and physicians only. But because LPNs are
4 a common staff group in Sweden, the questionnaire was adapted for LPNs and thus to suite
5 Swedish working conditions. The term within-group communication means communication
6 within the same profession (e.g. physician's perception of communicating with physician's)
7 and the term between-group communication mean e.g. physician's perception of
8 communicating with nurses and physician's perception of communicating with LPNs and so
9 on. The items are answered in a 5-point Likert scale ranging from "Strongly Disagree" to
10 "Strongly Agree." Negatively worded items are reversed before factor scores are averaged.
11
12 The ICU Nurse-Physician Questionnaire has shown satisfactory psychometric properties.
13
14 Cronbach's alpha values (α) for the five factors have been 0.64 to 0.88.²⁰ Translation of the
15 questionnaire was conducted forward by the research team and back-translation was carried
16 out by a bilingual translator.²⁴ In the present study, α -values were between 0.68 and 0.88 at
17 baseline and 0.68 and 0.85 at follow-up (Table 3).
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33

34 The *Safety Attitudes Questionnaire* (SAQ, short form)²¹ consists of six factors: Teamwork
35 climate (6 items); Safety climate (7 items); Job satisfaction (5 items); Stress recognition (4
36 items); Perceptions of management (6 items); Working conditions (3 items). The items are
37 answered in a 5-point Likert scale ranging from "Disagree Strongly" to "Agree Strongly."
38
39 The negatively worded items are reversed and the scale is converted to a 0 - 100% scale
40 where 0% = Disagree Strongly, 25% = Disagree Slightly, 50% = Neutral, 75% = Agree
41 Slightly and 100% = Agree Strongly. The SAQ has shown satisfactory psychometric
42 properties. Cronbach's α -values have been between 0.70 and 0.85 for the factors.²¹
43
44 Translation of the questionnaire was conducted forward by the research team and back-
45 translation was carried out by a bilingual translator.²⁴ In the present study, α -values ranged
46 from 0.71 to 0.85 at baseline and from 0.71 to 0.86 at follow-up for the factors (Table 3).
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Secondary outcome measures:

4
5 *Spreitzer's empowerment scale*²⁵ consists of four factors: Meaning (3 items); Competence (3
6 items); Self-determination (3 items); Impact (3 items). The items are answered on a 7-point
7 Likert scale ranging from "Strongly Disagree" to "Strongly Agree." Factor scores and the
8 total scale are averaged. The Swedish version of the scale has shown satisfactory
9 psychometric properties, with α -values ranging from 0.77 to 0.90.²² In the present study, α -
10 values ranged from 0.85 to 0.88 at baseline and from 0.80 to 0.87 at follow-up for the factors
11 (Table 3).
12
13
14
15
16
17
18
19
20
21
22

23 The number of *incident reports* was measured during a 1-year period prior to (1 April 2010 to
24 31 March 2011) and after implementation of SBAR (1 April 2012 to 31 March 2013). In
25 accordance with WHO definitions,²⁶ we defined incident reports as "A process used to
26 document occurrences that are not consistent with routine hospital operation or patient care."
27 A communication error is defined as "Missing or wrong information exchange or
28 misinterpretation or misunderstanding."²⁶ In the county council where the present study was
29 conducted, the clinic administrator has overall responsibility for incident reports. The incident
30 reports are examined by an investigator who reviewed the cause of the incident and what
31 measures were taken. The result of the investigation then goes back to the clinic, where
32 possible follow-ups are carried out.
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

48 **Data analysis**

49 The data were analysed using descriptive statistics such as means, standard deviations [SD],
50 absolute numbers and percentages. For within-group comparisons over time, the Wilcoxon
51 Signed Rank Test was used, and for between-group comparisons the Mann-Whitney U-test
52 was used. The Chi-square and Fisher's exact test were used to detect differences in the
53
54
55
56
57
58
59
60

1
2
3 frequency data. Factor scores in the three questionnaires were calculated if at least 66.7% of
4
5 the questions for each factor were answered. Internal consistency was calculated using
6
7 Cronbach's alpha. Non-parametric tests were used because the majority of factors did not
8
9 have a normal distribution. The level for statistical significance was set at $p < 0.05$ (two-tailed).
10
11

12 13 14 **Ethical considerations**

15
16 The study was approved (reg. no. 2011/061) by the Regional Ethical Review Board. All
17
18 participants received written information about the study aim and procedures and were told
19
20 that participation was strictly voluntary and could be discontinued at any time without
21
22 explanation.
23
24

25 26 27 28 29 **RESULTS**

30 31 32 **Sample characteristics**

33
34 The response rate at baseline was 72% (n=139 of 194) in the intervention group and 75%
35
36 (n=91 of 122) in the comparison group. The response rate at follow-up in 2012 was 72%
37
38 (n=100 of 139) and 76% (n=69 of 91), respectively (Table 1). The drop-outs had fewer years
39
40 working in the profession ($p=0.005$) fewer years working at the clinic ($p < 0.001$) and higher
41
42 scores on the factor Teamwork climate ($p=0.017$) and lower scores on the factor Competence
43
44 ($p=0.048$) than the participants did. There were no statistically significant differences between
45
46 the intervention and comparison groups at baseline regarding age, sex, working years in the
47
48 profession, working years at the clinic and working time (Table 2). However, at baseline there
49
50 were statistically significant higher scores in the comparison group on five factors; Teamwork
51
52 climate ($p=0.045$), Safety climate ($p=0.002$), Job satisfaction ($p=0.004$), Working condition
53
54 ($p=0.002$) and Within-group communication accuracy ($p=0.001$).
55
56
57
58
59
60

Table 1. Reasons for non-participants/dropouts at baseline and follow-up

Dropout	Intervention group	Comparison group
<i>Baseline</i>	194	122
Refusal	3	24
No reason	52	7
Answered questionnaires	139	91
<i>Follow-up</i>	139	91
Parental leave	3	2
Changed workplace	3	1
Long-term illness	-	1
Retired	1	1
Quit work	3	6
Leave of absence	5	1
Education	2	1
Total unavailable staff	17	13
Eligible staff	122	78
Refusal	6	6
No reason	16	3
Answered questionnaires	100	69

Table 2. Demographic data on staff members in the intervention group and control group who participated at baseline and follow-up. Mean (m), Standard deviation (SD), numbers (n) and percent (%)

	Intervention group (n=100)	Comparison group (n=69)	P-value
Age, years, m (SD)	48.2 (8.7)	48.6 (9.0)	0.780
Sex male/female, n	15 (15%)/85 (85%)	11 (16%)/58 (84%)	1.000
Profession, n			0.945
- LPN	27 (27%)	18 (26%)	
- RN	63 (63%)	43 (62%)	
- Physician	10 (10%)	8 (12%)	
Years in the profession, m (SD)	17.5 (11.2)	19.5 (10.2)	0.257
Years at the clinic, m (SD)	15.2 (11.0)	15.4 (10.3)	0.883
Working full-time/part-time, n	60 (60%)/40 (40%)	48 (70%)/21 (30%)	0.254

Independent Samples T-test and Chi-square Test. The significant level is 0.05

LPN = Licensed Practical Nurse, RN = Registered Nurse

Primary outcome

Of the five factors in the ICU Nurse-Physician Questionnaire, the factor Between-group communication accuracy improved significantly ($p=0.001$) over time in the intervention group. For the factor Within-group communication accuracy, there was a tendency for improvement over time in the intervention group, though it was not statistically significant ($p=0.076$). This finding required further investigation, and we proceeded by analyzing each

1
2
3 item. There was significant improvement over time for the item “It is often necessary for me
4 to go back and check the accuracy of information I have received from [physicians, nurses or
5 licensed practical nurses] in this unit” ($p=0.025$). In the comparison group, the factor
6
7
8
9
10 Between-group openness improved significantly ($p=0.039$) over time. When changes over
11 time were compared between the intervention group and comparison group, the results
12 showed no statistically significant differences (Table 3). Of the factors in the SAQ, the factor
13
14 Safety climate improved significantly ($p=0.011$) over time in the intervention group. For the
15
16 other factors in the SAQ, there were no statistically significant differences. In the comparison
17
18
19 group, the factor Perception of management at the unit showed a significant ($p<0.001$)
20
21 improvement over time, as did the factor Working condition ($p=0.029$). When changes over
22
23 time were compared between the intervention group and comparison group, the results
24
25 showed a significant difference ($p<0.001$) between groups for the factor Perception of
26
27 management at the unit. For the factor Safety climate, the p-value was 0.087 when change
28
29 over time between the groups was compared (Table 3).
30
31
32
33
34
35

36 **Secondary outcome**

37
38 In the intervention group, the number of incident reports during a 1-year period prior to
39
40 implementation was 116, whereof 36 (31%) were due to communication errors. The same
41
42 year, in the comparison group, 6 of the 24 (25%) registered incident reports were due to
43
44 communication errors. In the intervention group, during a 1-year period after implementation,
45
46 the incident reports due to communication errors had decreased to 23 of a total of 208 (11%).
47
48 During the same period in the comparison group, the number of incident reports due to
49
50 communication errors was 6 of 32 (19%). The decrease in the proportions of incident reports
51
52 due to communication errors in the intervention group was statistically significant ($p<0.0001$),
53
54 though it was not in the comparison group ($p=0.744$). Regarding psychological
55
56
57
58
59
60

1
2
3 empowerment, the results revealed no statistically significant changes over time in either the
4
5 intervention group or the comparison group (Table 3).
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Table 3. Staff members' assessment of communication within and between groups, safety attitudes and empowerment in the intervention and comparison group at baseline and follow-up as change over time between groups. Mean and Standard deviation (SD), n = 169.

Measurement factors	Cronbach's alpha	Intervention group - Within group		Comparison group - Within group		Change over time between groups ² p-value
		¹ Mean value (SD)	¹ p-value	¹ Mean value (SD)	¹ p-value	
ICU Nurse-Physician Questionnaire						
<i>Within-group communication openness</i>						
Baseline	0.80	4.3 (0.6)		4.4 (0.6)		
Follow-up	0.78	4.3 (0.5)	0.998	4.4 (0.5)	0.529	0.390
<i>Between-group communication openness</i>						
Baseline						
Physician↔RN; LPN↔Physician; RN↔LPN	0.82; 0.88; 0.84	4.3 (0.5)		4.2 (0.6)		
Follow-up						
Physician↔RN; LPN↔Physician; RN↔LPN	0.85; 0.84; 0.82	4.3 (0.5)	0.686	4.3 (0.6)	0.039	0.263
<i>Within-group communication accuracy</i>						
Baseline	0.73	3.3 (0.8)		3.7 (0.8)		
Follow-up	0.75	3.4 (0.8)	0.076	3.7 (0.9)	0.966	0.371
<i>Between-group communication accuracy</i>						
Baseline						
Physician↔RN; LPN↔Physician; RN↔LPN	0.69; 0.68; 0.77	3.3 (0.8)		3.5 (0.8)		
Follow-up						
Physician↔RN; LPN↔Physician; RN↔LPN	0.77; 0.69; 0.76	3.5 (0.8)	0.001	3.6 (0.8)	0.185	0.172
<i>Communication timeliness</i>						
Baseline	0.74	4.2 (0.7)		4.2 (0.7)		
Follow-up	0.68	4.3 (0.6)	0.612	4.3 (0.7)	0.650	0.958
Safety Attitudes Questionnaire						
<i>Teamwork climate</i>						
Baseline	0.73	72.2 (15.1)		76.9 (15.1)		
Follow-up	0.74	73.8 (14.4)	0.350	76.7 (15.8)	0.914	0.584
<i>Safety climate</i>						
Baseline	0.76	63.1 (15.8)		70.3 (14.3)		
Follow-up	0.78	66.4 (16.2)	0.011	70.2 (16.0)	0.949	0.087
<i>Job satisfaction</i>						

Baseline	0.85	75.3 (15.5)		81.5 (16.4)		
Follow-up	0.86	74.2 (15.4)	0.604	81.7 (15.0)	0.865	0.771
<i>Stress recognition</i>						
Baseline	0.85	68.0 (21.9)		65.8 (25.2)		
Follow-up	0.82	67.8 (20.8)	0.483	63.5 (24.9)	0.382	0.388
<i>Perception of management unit</i>						
Baseline	0.76	60.2 (17.9)		59.2 (16.7)		
Follow-up	0.80	60.2 (18.6)	0.667	68.6 (16.7)	<0.001	<0.001
<i>Working condition</i>						
Baseline	0.71	63.9 (19.2)		73.3 (15.6)		
Follow-up	0.71	63.5 (18.8)	0.956	77.8 (16.2)	0.029	0.131
Spreitzer's Empowerment scale						
<i>Meaning</i>						
Baseline	0.86	6.2 (0.8)		6.3 (0.9)		
Follow-up	0.86	6.3 (0.7)	0.270	6.3 (0.8)	0.935	0.602
<i>Competence</i>						
Baseline	0.86	6.4 (0.7)		6.5 (0.6)		
Follow-up	0.80	6.4 (0.6)	0.985	6.5 (0.7)	0.877	0.818
<i>Self-determination</i>						
Baseline	0.86	4.3 (1.2)		4.4 (1.5)		
Follow-up	0.86	4.3 (1.3)	0.992	4.6 (1.3)	0.342	0.465
<i>Impact</i>						
Baseline	0.88	4.2 (1.3)		4.5 (1.4)		
Follow-up	0.87	4.2 (1.4)	0.639	4.5 (1.3)	0.867	0.857
<i>Empowerment total factors</i>						
Baseline	0.85	5.3 (0.7)		5.4 (0.8)		
Follow-up	0.86	5.3 (0.8)	0.474	5.5 (0.7)	0.444	0.916

¹Wilcoxon Signed Rank Test and ²Mann-Whitney U-test. The significant level is 0.05 and statistical significant results are marked with boldface text
 LPN = Licensed Practical Nurse, RN = Registered Nurse

DISCUSSION

SBAR is thought to facilitate communication between professions and increase safety as well as to decrease the negative effects the professional hierarchy may have on communication.

Our results showed that implementation of the communication tool SBAR resulted in significant improvement over time in staff members' perceptions of Between-group communication accuracy and Safety climate as well as a tendency toward improvement in Within-group communication accuracy. Furthermore, the proportion of incident reports due to communication errors decreased significantly, from 31% (36 of 116) to 11% (23 of 208), in the intervention group compared with a non-significant decrease, from 25% (6 of 24) to 19% (6 of 32), in the comparison group. Thus, in the intervention group safety reporting seemed to improve but the proportion of incident reports due to communication decreased significantly.

The improvement in staff members' perceptions of Between-group communication accuracy after implementation of the communication tool SBAR seen in the present study is similar to findings from a study by DeMeester¹⁶, where nurse-physician communication also improved. In a study by Manojlovich and DeCicco²⁷ Between-group communication was shown to be a significant predictor of perceived medication error²⁷. Nurses and physicians are trained to express themselves in different ways²⁸ and communication between different professions is known to be a contributing factor in surgical malpractice claims.¹ Because staff members' perceptions of Between-group communication accuracy improved, it would seem that SBAR was able to bridge differences in style of communication.

Safety climate also improved, and the proportion of incident reports due to communication errors decreased in the intervention group, which may indicate that safety performance

1
2
3 improved. One study²⁹ of 91 hospitals found that a higher level of safety climate was
4
5 associated with higher safety performance at the hospital level. Furthermore, Huang *et al.*
6
7 (2010)³⁰ studied 30 ICUs in the US using SAQ and found that lower Safety climate was
8
9 associated with patient outcomes such as increased hospital length of stay. However, another
10
11 study by Rosen *et al.* (2010)³¹ failed to show a relationship between safety climate and
12
13 hospital safety performance. As in the present study, improved perception of safety climate
14
15 has also been found in studies^{11 12} of rehabilitation settings in which SBAR had been
16
17 implemented. Verbal communication errors were found to be an important cause of severe
18
19 patient safety incidents.³² In the present study, there was a decrease in the proportion of
20
21 incident reports due to communication errors. According to the present results, one can
22
23 assume that SBAR made communication safer, resulting in a decrease in incident reports due
24
25 to communication errors. This interpretation is also in line with our hypothesis. We also
26
27 hypothesized that a secondary outcome of implementing SBAR could be an increase in staff
28
29 members' perception of psychological empowerment. In the present study, it would seem
30
31 reasonable to assume that SBAR training should have increased staff members'
32
33 empowerment, but no such effect was found during the study period.
34
35
36
37
38
39
40

41 In the comparison group, there were no significant changes in staff members' perceptions of
42
43 Communication accuracy or Safety climate. However, the factors Between-group
44
45 communication openness, Perception of management at the unit and Working condition
46
47 improved significantly over time. During the period between baseline and follow-up, there
48
49 were work-related changes in the comparison group that may have affected the results. The
50
51 staff in the operating theatre had increased in size, and there had been discussions of the
52
53 importance of collaboration at the intensive care unit. **When working condition is improved
54
55 one can expect that also communication improves.**
56
57
58
59
60

Strengths and weaknesses of the study

The strengths of the present study were that measures of both safety culture and the number of incident reports related to communication were included, as previously recommended,¹⁸ and that a comparison group was used. Furthermore, during 7 months of the implementation period, we followed the implementation using a manipulation check involving randomized structured telephone interviews. An additional support in the implementation was observations of handovers conducted by the local inter-professional workgroup. In a simulation study, low adherence was found for use of SBAR during a 1-year period after implementation in a hospital.¹⁷ In the present study, the manipulation check and observations showed that SBAR was in use at the clinic. One other strength is that the questionnaires used have shown satisfactory psychometric properties, and Cronbach's Alpha values in the present study for all instruments, total scale and factors were over 0.68. Although the two groups were different in size, there were no significant differences in the demographic data. The distribution was not normal and a limitation was that it was not possible to do multivariate analysis to correct for the differences at baseline in some variables as "Between-group communication openness", Perception of management unit" and "Working conditions". The response rate was satisfying, exceeding 70% at both baseline and follow-up in the two groups. When interpreting the present results, possible threats to internal validity should be considered. First, the very nature of the quasi-experimental design entailed selection biases: The participants were not randomly assigned and there were statistically significant differences between the intervention group and the comparison group at baseline. Although the comparison group had higher baseline levels on the five factors that could have affected the results, there was still room for improvement. Second, the loss of subjects poses another threat to internal validity, in that the drop-outs had statistically higher scores on the factor Teamwork climate and statistically lower scores on the factor Competence than the

1
2
3 participants did. On the other hand, the number of drop-outs was moderate. There were also
4
5 differences in incident reporting. The comparison group had overall lower frequency of
6
7 registered incident reports. There may be several reasons for this, e.g. that the frequency of
8
9 incidents was actually different or that there was a difference in the tendency to report
10
11 incidents. Third, an additional threat to internal validity was that there may have been some
12
13 diffusion of the intervention to the comparison group, which could have affected the results.
14
15 Further research dealing with these methodological issues is needed to confirm our results.
16
17
18
19

20 21 **Conclusion**

22
23 Implementing the communication tool SBAR in anaesthetic care can improve communication
24
25 between professionals, improve the safety climate and reduce incidents caused by
26
27 communication errors.
28
29
30
31

32
33 **Contributors** All authors (MR, GM, CLS and ME) contributed to the design, interpreted
34
35 data, drafted and revised the article critically. Data analysis was conducted by MR and ME.
36
37 MR collected data, conducted the manipulation check and wrote the manuscript under the
38
39 supervision of GM, CLS and ME. All authors read and approved the final version of the
40
41 paper.
42
43

44
45 **Funding** This work was supported by the Faculty of Health and Occupational Studies,
46
47 University of Gävle and by the County Council Gävleborg. It was also supported by the
48
49 Patient Insurance LÖF and the Swedish Society of Nursing, but these organizations had no
50
51 role in the design and running of the study.
52

53
54 **Competing Interests** None declared.
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Ethics approval The Regional Ethical Review Board (reg. no. 2011/061).

Data sharing statement There is no additional data available for data sharing.

For peer review only

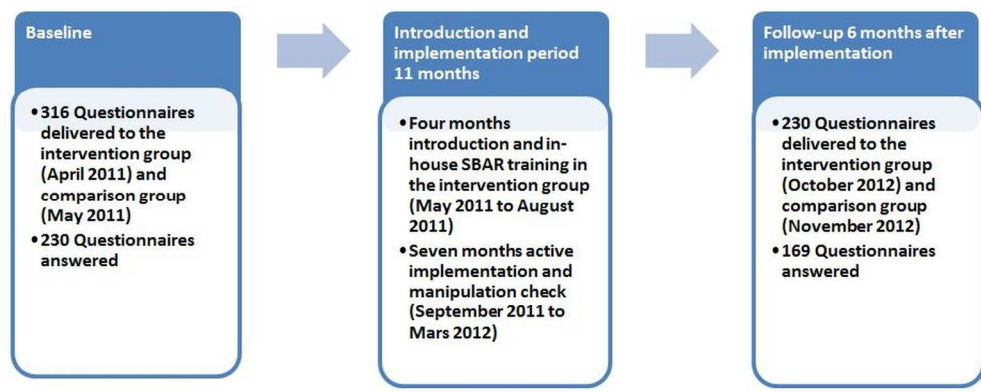
REFERENCES

1. Greenberg CC, Regenbogen SE, Studdert DM, *et al.* Patterns of communication breakdowns resulting in injury to surgical patients. *J Am Coll Surg* 2007;**204**:533-40.
2. Lingard L, Espin S, Whyte S, *et al.* Communication failures in the operating room: an observational classification of recurrent types and effects. *Qual Saf Health Care* 2004;**13**:330-4.
3. Wiegmann DA, ElBardissi AW, Dearani JA, *et al.* Disruptions in surgical flow and their relationship to surgical errors: an exploratory investigation. *Surgery* 2007; **142**:658-65.
4. White AA, Pichert JW, Bledsoe SH, *et al.* Cause and effect analysis of closed claims in obstetrics and gynecology. *Obstet Gynecol* 2005;**105**:1031-8.
5. WHO Patient Safety Solutions| volume 1, solution 3 | May 2007 Available at:
http://www.refworks.com/refgrabit/rw2linkpage.aspx?subscriber=6107&user=1209&_id=1344860455630.
Accessed 13/8/2012
6. Leonard M, Graham S, Bonacum D. The human factor: the critical importance of effective teamwork and communication in providing safe care. *Qual Saf Health Care* 2004;**13** Suppl 1:i85-90.
7. Flemming D, Hubner U. How to improve change of shift handovers and collaborative grounding and what role does the electronic patient record system play? Results of a systematic literature review. *Int J Med Inform* 2013;**82**:580-92.
8. Renz SM, Boltz MP, Wagner LM, *et al.* Examining the feasibility and utility of an SBAR protocol in long-term care. *Geriatr Nurs* 2013; **34**:295-301.
9. Compton J, Copeland K, Flanders S, *et al.* Implementing SBAR across a large multihospital health system. *Jt Comm J Qual Patient Saf* 2012;**38**:261-8.
10. Telem DA, Buch KE, Ellis S, *et al.* Integration of a formalized handoff system into the surgical curriculum: resident perspectives and early results. *Arch Surg* 2011; Jan;**146**:89-93.

- 1
2
3 11. Velji K, Baker GR, Fancott C, *et al.* Effectiveness of an Adapted SBAR Communication Tool for a
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
21. Sexton JB, Helmreich RL, Neilands TB, *et al.* The Safety Attitudes Questionnaire: psychometric properties,
benchmarking data, and emerging research. *BMC Health Serv Res* 2006; **6**:44.

- 1
2
3 22. Hochwalder J, Bergsten Brucefors A. A psychometric assessment of a Swedish translation of Spreitzer's
4 empowerment scale. *Scand J Psychol* 2005; **46**:521-9.
5
6
7
8 23. The organization and management of intensive care units. Copyright 1989. Available at:
9 <http://shortellresearch.berkeley.edu/ICU.htm>. Accessed 24/9/2013.
10
11
12 24. Maneesriwongul W, Dixon JK. Instrument translation process: a methods review. *J Adv Nurs* 2004; **48**:175-
13 86.
14
15
16
17 25. Spreitzer GM. Psychological empowerment in the workplace: Dimensions, measurement, and validation.
18 *Academy of Management Journal* 1995;**38**:1442-65.
19
20
21
22 26. WHO Conceptual framework for the international classification for patient safety. Januari 2009. Available
23 at: <http://www.who.int/patientsafety/implementation/taxonomy/publications/en/index.html>. Accessed 9/24/2013,
24 2013.
25
26
27
28
29 27. Manojlovich M, DeCicco B. Healthy work environments, nurse-physician communication, and patients'
30 outcomes. *Am J Crit Care* 2007; **16**:536-43.
31
32
33
34 28. Greenfield LJ. Doctors and nurses: a troubled partnership. *Ann Surg* 1999;**230**:279-88.
35
36
37 29. Singer S, Lin S, Falwell A, Gaba D, *et al*. Relationship of safety climate and safety performance in hospitals.
38 *Health Serv Res* 2009; **44**:399-421.
39
40
41 30. Huang DT, Clermont G, Kong L, *et al*. Intensive care unit safety culture and outcomes: a US multicenter
42 study. *Int J Qual Health Care* 2010; **22**:151-61.
43
44
45
46 31. Rosen AK, Singer S, Shibe Z, *et al*. Hospital safety climate and safety outcomes: is there a relationship in
47 the VA?. *Med Care Res Rev* 2010; **67**:590-608.
48
49
50
51 32. Rabol LI, Andersen ML, Ostergaard D, *et al*. Descriptions of verbal communication errors between staff. An
52 analysis of 84 root cause analysis-reports from Danish hospitals. *BMJ Qual Saf* 2011; **20**:268-74.
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



211x90mm (300 x 300 DPI)

Peer review only