Associations of form and function of speaking up in anaesthesia: a prospective observational study

Lemke, Rahel ; Burtscher, Michael J ; Seelandt, Julia C ; Grande, Bastian ; Kolbe, Michaela

DOI: https://doi.org/10.1016/j.bja.2021.08.014

BJA

British Journal of Anaesthesia, 127 (6): 971–980 (2021)

doi: 10.1016/j.bja.2021.08.014
Advance Access Publication Date: 10 September 2021
Quality and Patient Safety

Associations of form and function of speaking up in anaesthesia: a prospective observational study

Rahel Lemke[1,2], Michael J. Burtscher[3,4], Julia C. Seelandt[2], Bastian Grande[1,2,†] and Michaela Kolbe[2,5,*,†]

[1]Institute of Anaesthesiology, University Hospital Zurich, Zurich, Switzerland, [2]Simulation Centre, University Hospital Zurich, Zurich, Switzerland, [3]School of Applied Psychology, Zurich University of Applied Sciences, Switzerland, [4]Universtiy of Zurich, Switzerland and [5]ETH Zurich, Zurich, Switzerland

*Corresponding author. E-mail: michaela.kolbe@usz.ch

†Shared last authors.

Abstract

Background: Speaking up with concerns in the interest of patient safety has been identified as important for the quality and safety of patient care. The study objectives were to identify how anaesthesia care providers speak up, how their colleagues react to it, whether there is an association among speak up form and reaction, and how this reaction is associated with further speak up.

Methods: Data were collected over 3 months at a single centre in Switzerland by observing 49 anaesthesia care providers while performing induction of general anaesthesia in 53 anaesthesia teams. Speaking up and reactions to speaking up were measured by event-based behaviour coding.

Results: Instances of speaking up were classified as *opinion* (59.6%), *oblique hint* (37.2%), *inquiry* (30.7%), and *observation* (16.7%). Most speak up occurred as a combination of different forms. Reactions to speak up included *short approval* (36.5%), *elaboration* (35.9%), *no verbal reaction* (26.3%), or *rejection* (1.28%). Speaking up was *implemented* in 89.1% of cases. *Inquiry* was associated with an increased likelihood of recipients discussing the respective issue (odds ratio [OR]=13.6; 95% confidence interval [CI], 5.9–31.5; $P<0.0001$) and with a decreased likelihood of implementing the speak up during the same induction (OR=0.27; 95% CI, 0.08–0.88; $P=0.03$). Reacting with *elaboration* to the first speak up was associated with decreased further speak up during the same induction (relative risk [RR]=0.42; 95% CI, 0.21–0.83; $P=0.018$).

Conclusion: Our study provides insights into the form and function of speaking up in clinical environments and points to a perceived dilemma of speaking up via questions.

Keywords: assertiveness; group processes; interaction; patient safety; responding; speaking up

Editor's key points

- Speaking up in high-risk clinical situations is important for the quality and safety of patient care.
- Speaking up and reactions were observed and coded during induction of general anaesthesia by experienced clinicians in a single-centre *in situ* observational study.
- Speaking up resulted most frequently in either short approval or elaboration and occurred in 90% of the cases, and reactions were mostly of neutral affective character.
- Inquiry was associated with an increased likelihood of the recipient discussing the issue but with a decreased likelihood of implementing the issue.

Received: 14 December 2020; **Accepted:** 7 August 2021

Effective communication among anaesthesia providers is important for both teamwork and patient care.[1,2] In particular, challenging others by speaking up with concerns and questions in the interest of patient safety has been identified as important.[3] Speaking up, also called 'safety voice', is defined as 'informal and discretionary communication by an employee of ideas, suggestions, concerns, information about problems, or opinions about work-related issues'.[4,5] Conceptually, speaking up not only includes voicing issues across the authority gradient but also includes safety voices among peers and across interdisciplinary and interprofessional boundaries.[6,7]

Without speaking up, potential harm for patients will not be prevented.[8] However, in many instances, healthcare professionals face difficulties when attempting to speak up with patient safety concerns, in anaesthesia[2,6] and in other disciplines.[9–11] The widespread phenomenon of organisational disregard ('organisational deaf'; i.e. continually disregarding employees' concerns)[12] for voiced concerns contributes to healthcare workers' belief that their concerns will not be taken seriously and, as a consequence, to individual and organisational silence. A variety of barriers complicates challenging other workers: individual (e.g. fear, feeling uncertain about the issue, belonging to minority),[6,13–15] interpersonal (e.g. fear of damaging relationship, respect for experience/seniority/territory, sex differences),[6,15–18] and organisational factors (e.g. strong emphasis on hierarchy, lack of formal speaking up mechanism, lack of psychological safety)[6,16,19,20] interact in a way that frame speaking up as a potentially risky social endeavour. Strategies aiming to help healthcare professionals overcome barriers to speaking up focus on training,[1,6,21] formal reporting mechanisms,[22] and change from unsafe (e.g. intimidation, disruptive behaviour)[23] to psychologically safe working environments in which team members feel empowered to speak up (e.g. flatter hierarchy, open communication, invitations to voice opinions).[24,25] Although of critical importance, more specific insights into how to facilitate speaking up in the busy clinical environment are required to help successfully implement these strategies. Research on how healthcare providers speak up and react to it is largely missing or limited to self-reports and simulations.[5,26–29]

This study builds on communication and organisational behaviour science applied to healthcare, indicating the importance of explicitness and curiosity in workplace interactions, in particular the importance of leader inclusiveness (i.e. inviting and appreciating speaking up).[6,9,30–34] We also draw on recent research indicating that perceived positive reactions to speaking up may encourage further speaking up and *vice versa* that vague, 'unreadable', no or negative reactions may constitute a barrier to further speaking up.[9,35]

The primary aim of this study was to answer four research questions:

1. What forms do anaesthesia providers use to speak up (i.e. observation, opinion, inquiry, oblique hint)?
2. How do recipients of speaking up react (i.e. verbally: short approval, elaboration, rejection, no/non-verbal reaction; behavioural: implementation *vs* no implementation)?
3. Are the senders' forms of speak up associated with resulting recipients' reactions?
4. Do reactions to the first speaking up predict the occurrence of further speaking up during the same induction?

We assessed speaking up behaviour via behaviour observation, *in situ* behaviour coding, and interaction analysis rather than relying on self-reports.[36–38]

Methods

Study design and inclusion/exclusion criteria

The study was granted exemption by the ethics committee of the canton of Zurich, Switzerland (Registry no. 2016-000341). Data collection for this prospective observational, interaction analysis study took place from January 2019 to March 2019 at the Institute of Anaesthesiology of a large urban academic medical hospital in Switzerland. The participants were 26 male and 23 female anaesthesia care providers. We observed 49 participants while they performed induction of general anaesthesia in 53 anaesthesia teams (29 teams consisting of three and 24 teams consisting of two members). Inductions were performed in the anaesthesia induction room located adjacent to the theatre.

Participants were recruited over 2 months during morning briefings in the operating environment for anaesthesia in cardiac, thoracic, and visceral surgery. The criterion for inclusion was employment as an anaesthesia care provider (i.e. senior consultant anaesthetist, consultant anaesthetist, anaesthesia registrar, anaesthesia nurse, anaesthesia nursing student). The criterion for exclusion was repetitive team constellations: teams were excluded if the whole team was the same, but there could be some pairs the same in three-member teams. We chose induction of general anaesthesia for elective, non-urgent cases as distinct performance episodes, during which communication is both frequent and critical for patient safety, especially during crisis situations such as deteriorating physiological conditions or airway problems.[2] Induction did not start until at least one physician (senior consultant, consultant, registrar) and one registered anaesthesia nurse were present. A nursing student would either be in the room as additional help or be delegated by the registered anaesthesia nurse based on their stage in anaesthesia nursing training.

Study procedures

Data were collected anonymously, and no inferences from the data about participating clinicians were possible. Written informed consent from participants was obtained before data collection. Before data collection, we informed participating clinicians in detail (verbally and by providing written documents) about the study. We did not collect any patient data or any data about the particular anaesthetic and surgical procedures. No inferences from the data about patients or procedures are possible. A trained doctoral student who also worked as an anaesthesia registrar (RL) performed behaviour observation and live coding of the anaesthesia teams. During induction, she stood 2–3 m next to the anaesthesia team, which allowed an unobstructed view of all team members to observe and code communication behaviour in real time. Anaesthesia induction was defined as the period beginning with administering the first anaesthetic drug intravenously and ending once the anaesthesia team verbally declared that the patient could be handed to the surgical staff for positioning.[39]

Table 1 Observation taxonomy and frequencies of codes. *f*, absolute frequencies; f_i, relative frequencies. Assigning multiple codes was possible, for example speaking up form and speaking up content. Examples were extracted from the raw data. *Speaking up content and speaking of form were overlapping sets of codes: a speak up event was assigned to both speaking up content and speaking up form code. Speaking up form codes were overlapping; a speak up event could be assigned to multiple form codes, for example if an observation preceded an inquiry. †Taskwork and teamwork were mutually exclusive sets of codes: a speak up event could either be assigned to taskwork or teamwork codes. ‡Verbal, behavioural and affect were overlapping sets of codes: a reaction to speaking up was assigned to all three sets of codes.

Code	Definition and example	*f* (f_i)
Speaking up Content: taskwork†*		
Anaesthesia procedure	Referring to medication, airway, and/or anaesthesia induction procedure; for example 'It's better to make a rapid sequence induction for this patient'.	108 (69.2%)
Hygiene	Referring to hand hygiene and aspects of asepsis; for example 'Please disinfect your hands after patient contact'.	4 (2.6%)
Patient position	Referring to specific positions for surgery; for example 'We must level the OR table before entering the operating room'.	10 (6.4%)
Devices	Referring to installation and position of devices such as catheters, drainages, and airway tools; for example 'The peripheral vein catheter in this position is inappropriate'.	18 (11.5%)
Technical issues	Referring to technical devices such as monitoring, perfusor, respirator, telephone; for example 'The perfusor does not seem to be working, we should replace it'.	2 (1.3%)
Speaking up Content: teamwork†*		
Information exchange	Referring to how team members exchange information by scrutinising its validity; for example 'Are you sure? I remember that I had read about a medication allergy'	3 (1.9%)
Action coordination	Referring to how team members coordination actions; for example '[…] Can you ask me before you put the patient in the operating position?' in response to the receiver having attached the patient's arms in the operating position.	11 (7%)
Speaking up Form†		
Opinion	Stating an opinion or point of view; for example 'I have doubts about a 200 mg bolus of Propofol, because the patient has a left ventricular ejection fraction of 30%'	93 (59.6%)
Inquiry	Inviting team members to share their thoughts; for example 'What's your reason for using Remifentanil instead of Fentanyl?'	48 (30.7%)
Oblique hint	Indirect and implicit remarks; for example 'Really?' 'Are you sure?'	58 (37.2%)
Observation	Describing what has been seen or heard; for example 'I saw that you preoxygenated the patient without a continuous positive airway pressure'.	26 (16.7%)
Reactions to speaking up Verbal‡		
Short approval	One-word sentences including a confirmation, for example 'Ok', 'Yes'.	57 (36.5%)
Elaboration	Detailed explanation of the issue; for example 'Oh yes, thank you. I didn't consider the reflux. You are right. It's better to intubate the patient because…'	56 (35.9%)
Rejection	Speaking up is rejected; for example 'Don't interrupt me'.	2 (1.3%)
No verbal or non-verbal reaction	Includes no visible/audible and non-verbal reactions; for example 'Nodding', 'Eye rolling'	41 (26.3%)
Reactions to speaking up Behavioural‡		
Content is implemented	The idea or concern is implemented, for example consultant anaesthetist nods and takes the tube in response to the registrar's suggestion to intubate the patient.	139 (89.1%)
Content is not implemented	The idea is not implemented; for example Consulting anaesthetist decides against a urinary catheter and does not install one in response to the nurse's suggestion to install a urinary catheter.	17 (10.9%)
Reactions to speaking up Affect‡		
Enthusiasm	Enthusiastic reaction, showing gladness, gratefulness or positive surprise; for example 'Oh, thank you so much. I didn't think of this'.	9 (5.8%)
Interest	Genuine interest about the concern through active elaboration or further open questions; for example 'That's interesting. What is your experience with…?'	2 (1.3%)

Continued

Table 1 Continued

Code	Definition and example	*f* (*f*$_i$)
Validation	Verbal or non-verbal confirmation of team member's concerns; for example 'Good idea', 'Nodding'	43 (27.6%)
Contempt	Disrespectful reactions, sarcasm and hostile humour; for example 'Oh, I had forgotten that you're an expert in this field'.	2 (1.3%)
Defensiveness	Refusing responsibility; for example 'That is not my job'.	2 (1.3%)
Fear/tension	Nervous, anxious reactions accompanied with discomfiture	0
Neutral	No specific affect; for example 'Well let's just go through the checklist before we start with induction'.	98 (62.8%)
Role of sender and receiver of speaking up		
Intubation	Performing airway management	Sender: 31 (19.9%) Recipient: 95 (60.9%)
Drug administration and support	Administering drugs and handing over airway equipment	Sender: 66 (42.3%) Recipient: 33 (21.2%)
Monitoring and documentation	Monitoring vital signs and logging anaesthesia protocol	Sender: 59 (37.8%) Recipient: 28 (17.9%)

Measurements and development of the observation system

We assessed speaking up behaviour and reactions to speaking up by behaviour observation: RL observed team communication and behaviour during induction.[38] We developed a behaviour observation system before data collection. The observation system was required to meet validity, feasibility, and reliability criteria. Following steps of observation system development, we aimed to achieve content validity by drawing from existing behaviour observation systems and adapting them to our specific research purpose.[40,41] In particular, RL and MK, a psychologist with a record in behaviour observation research, developed an initial list of codes based on social science and organisational behaviour and anaesthesia research.[9,21,35,40,42–52] Subsequently, RL used the initial list of codes to assess speaking up and reactions to speaking up during real anaesthesia inductions.[41] Based on her feedback, discussions of coding examples with MK, and consulting the literature, a final list of coded behaviours was agreed on. For ease of applicability, the final observation system was organised into three main categories (speaking up, reactions to speaking up, involved roles), which each included a list of thematically organised codes (Table 1).[53] *Speaking up behaviour*, which was defined as expressions of concerns about potentially risky or inappropriate actions that might be harmful for patients or expression of ideas about alternative actions,[9,47,54,55] was measured with 13 codes. Based on the literature, we differentiated content (e.g. anaesthesia procedure, team information coordination) from form (e.g. opinion, inquiry) of speaking up (Table 1). Mere feedback or instruction from a qualified consultant or nurse to a registrar or nursing student would not be counted as speaking up. Speaking up was exclusively coded if it included assertive communication in relevant clinical situations that required immediate action with respect to patient care and safety.[55] We expected that some speaking up content codes might occur more frequently (e.g. anaesthesia procedure/taskwork) than others (e.g. team information coordination/teamwork) but wanted to be able to detect even rarely occurring speaking up behaviours.[40] *Reactions to speaking* up were assessed with 13 codes, distinguishing verbal (e.g. short approval) from behavioural (e.g. implementation) and affective (e.g. neutral) reactions (Table 1). In addition, *functional role* during induction (e.g. intubation) was captured (Table 1).

Coding procedure

RL applied a method called event-based, live behaviour coding.[48] Rather than recording or transcribing what was said and done for the duration of the entire induction, she assigned and documented pre-defined codes of the behaviour observing taxonomy to the observed interaction.[53] She had been working as an anaesthesia registrar for 6 yr and accumulated significant subject matter expertise. A member of our study team, JCS, a psychologist with a significant track record in behaviour observation methodology in the operating theatre (OR), trained RL in applying codes by event-based, life behaviour coding. Training involved iterative cycles of applying the coding system and reflective discussions.

For data collection, RL classified each speaking up and each reaction according to its code and its timing (beginning, end, duration). First, she coded the person who spoke up (sender) or reacted (recipient) and their functional role during induction (intubation, drug administration & support, monitoring & documentation; Table 1). Subsequently, she applied specific codes for sender (i.e. speaking up content and form, Table 1) and recipient (i.e. reaction to speaking up, Table 1). She used a standard PC and The Observer XT 14.1, a specialised software for behaviour observation, for behaviour coding.[56] To determine interrater reliability, two anaesthesia inductions were also coded separately by JCS. We then compared the codings performed by RL and JCS by calculating Cohen's κ, which is a coefficient of interrater agreement for nominal scales, using IBM SPSS Statistics v. 26 (IBM Corp., Armonk, NY, USA).[57,58] Cohen's κ was 0.99, indicating very good interrater reliability.[59]

Statistical analysis

For research question 1, speaking up behaviour was treated as a focal variable. For research question 2, reactions to speaking up were treated as a focal variable. For research question 3, speaking up behaviour was treated as an independent variable, and reaction to speaking up was treated as a dependent

variable. For research question 4, reaction to initial speaking up was treated as an independent variable and further speaking up behaviour as a dependent variable. For each anaesthesia induction, we calculated the number of all speaking up behaviours with respect to content and form. For each behaviour, we specified content and form as well reactions to speaking up (i.e. verbal, behavioural, and affective reaction).

With respect to research question 1 (*How do anaesthesia care providers speak up?*), we included all speaking up behaviours and calculated absolute frequencies of speaking up content and form codes. Descriptive analyses were performed with IBM SPSS Statistics v. 25.[60] We report descriptive statistics in terms of both absolute and relative frequencies for each code. With respect to research question 2 (*How do anaesthesia care providers react to speaking up?*), we analysed all speaking up behaviours and calculated absolute frequencies of reaction codes. Again, we report descriptive statistics in terms of both absolute and relative frequencies for each reaction code.

With respect to research question 3 (*associations between the sender's form of speak up and the resulting recipient's reactions*), we addressed the interdependence of reactions (*occurrences of speaking up being nested in inductions*) and used two generalised estimating equations (GEEs) using a multivariate binary logistic model to predict reactions to speaking up. For ease of interpretation, we report the exponentiated coefficients of these logistic models, which represent odds ratios (ORs), along with 95% confidence intervals (95% CIs) for these coefficients. With respect to research question 4 (*How are reactions to the first speaking up associated with potential further speaking up?*), we used multiple regression to predict the frequency of further speaking up behaviours from reactions to the first speaking up during the same induction. As the dependent variable further speaking up occurrences represents count data, we used a Poisson regression model. In this model, however, we encountered overdispersion (i.e. variance larger than the mean). Thus, we performed a quasi-Poisson model that adds a parameter to the respective Poisson regression to account for the overdispersion.[61] We report the exponentiated coefficients of this Poisson model, which represent relative risks (RR), along with 95% CIs for these coefficients. For the GEE, we used the package geepack[62] of the statistical software R, v. 3.6.1.[63] In addition, we used the package broom[64] to calculate 95% confidence intervals for all coefficients and the package qcc[65] to test for overdispersion. Throughout the analyses for research questions 3 and 4, we used the conventional statistical significance level of 0.05.

Results

The total observation times were 12 h, 29 min, and 52 s (M=14 min 09 s; Md=11 min 07 s). The mean age of the 49 participating anaesthesia care providers was 34 yr (standard deviation [SD]=5.7), and their mean work experience was 7.5 yr (SD=6.0). The sample included 1 senior anaesthesia consultant (2.0%), 7 anaesthesia consultants (14.3%), 23 anaesthesia registrars (46.9%), 7 anaesthesia nurses (14.3%), and 11 anaesthesia nursing students (22.4%). In 52 of the 53 observed inductions of anaesthesia, at least one speaking up occurred. In total, we coded 156 speak ups.

Characteristics of speak up

In research question 1, we were interested in how anaesthesia care providers speak up. More than half of all speaking up behaviours (n=80, 51.3%) occurred from anaesthesia consultants, 29 (18.6%) from anaesthesia nursing students, 23 from registrars (14.7%), 11 (7.1%) from other healthcare workers outside of the team, 9 (5.8%) from anaesthesia nurses, and 4 (2.6%) from the senior anaesthesia consultant. Recipients of speaking up were anaesthesia nursing students (n=59, 37.8%), registrars (n=46, 29.5%), consultants (n=30, 19.2%), anaesthesia nurses (n=10, 6.4%), healthcare workers outside of the team (n=8, 5.1%), and senior consultants (n=3, 1.9%).

In most speak up instances, senders of speak up had assumed the role of drug administration and support (n=66, 42.3%), in 59 (37.8%) instances the role of monitoring and documentation, and in 31 (19.9%) instances the role of tracheal intubation. Recipients of speaking up had assumed the role of intubation in 95 (60.9%) instances, drug administration and support in 33 (21.2%) instances, and monitoring and documentation in 28 (17.9%) instances.

With respect to content, 108 (69.2%) speak ups referred to anaesthesia procedure, 18 (11.5%) to devices, 10 (6.4%) to patient positioning, 11 (7%) to action coordination, 4 (2.6%) to hygiene, 3 (1.9%) to information exchange, and 2 (1.3%) to technical issues (Table 1).

With respect to form, 93 (59.6%) speak ups were classified as *opinion* (e.g. 'I think it would be better to intubate the patient, because he has oesophageal reflux disease'), 58 (37.2%) as *oblique hint* (e.g. 'Are you sure?'), 48 (30.7%) as *inquiry*, and 26 (16.7%) as *observation*. In some cases, speak up had more than only one form and occurred as a combination: opinions were more frequently shared without (n=62, 39.7%) than with (n=25, 16.0%) an accompanying *inquiry* (Table 2). *Oblique hints* occurred in most instances as stand-alone comments (n=36, 23.1%). Enquiries were mostly asked in combination with sharing an *opinion* (e.g. 'Did you notice that the patient is allergic to penicillin? I think we should use a different antibiotic prophylaxis'; n=25, 16.0%), an *observation* (n=7, 4.5%), or both. *Observations* were never shared solely but always combined with either/and an *opinion* (e.g. 'I notice you ventilate the patient without PEEP. I think using the PEEP would be good in terms of lung protection'; n=21, 13.5%), an *inquiry* (e.g. 'You want to use atracurium instead of rocuronium. Why?'; n=7, 4.5%) or an *oblique hint* (e.g. 'You want to do a rapid sequence induction. Really?'; n=4, 2.6%) (Table 2).

Reactions to speaking up

In research question 2, we were interested in how anaesthesia care providers react to speaking up. With respect to

Table 2 Examples for codes and absolute frequencies of combinations of speak up forms.

Observation	Opinion	Inquiry	Implicit hint	
			No	Yes
No	No	No	1	36
		Yes	9	13
	Yes	No	47	5
		Yes	19	0
Yes	No	No	0	3
		Yes	1	0
	Yes	No	15	1
		Yes	6	0

Table 3 Absolute frequencies of combinations of speak up reaction codes.

Behavioural	Verbal	Affect					
		Enthusiasm	Contempt	Defensiveness	Interest	Validation	Neutral
No implementation	No verbal reaction	0	0	0	0	3	0
	Rejection	0	0	0	0	1	1
	Elaboration	0	2	0	1	4	5
	Short approval	0	0	0	0	0	0
Implementation	No verbal reaction	0	0	0	0	21	17
	Rejection	0	0	0	0	0	0
	Elaboration	8	0	2	1	1	32
	Short approval	1	0	0	0	13	43

verbal reactions, speaking up resulted most frequently in either *short approval* (e.g. 'OK'; n=57, 36.5%) or *elaboration* (e.g. 'My thinking was that we place the arterial catheter before induction of anaesthesia to take a blood gas analysis under spontaneous breathing conditions'; n=56, 35.9%), particularly if speaking up was implemented (Table 3). It also resulted in *no verbal reaction* (n=41, 26.3%) or *rejection* (n=2, 1.28%). Speaking up was *implemented* in 139 instances (89.1%) *vs not implemented* in 17 (10.9%) instances. With respect to affect, noticeable affect occurred, particularly if speaking up was implemented (Table 3); reactions were mostly *neutral* (n=98, 62.8%) or a form of *validation* (n=43, 27.6%). In many instances they involved *affection/enthusiasm* (n=9; 5.8%), *contempt* (n=2, 1.3%), *defensiveness* (n=2, 1.3%), and *interest* (n=2, 1.3%).

Associations of senders' speak-up form and recipients' reactions

In research question 3, we were interested in associations of how the sender speaks up with how the recipient reacts to it. In the first step, we focused on verbal reactions and in the second step on behavioural reactions. For both steps, we used the four different binary codes to specify the form of speaking up (i.e. observation, opinion, inquiry, oblique hint). The codes could occur independently of each other, and combinations were possible.

To analyse verbal reactions, we were particularly interested in which form of speaking up would lead to a discussion of the respective issue with the recipient. For that purpose, we combined the codes *no verbal reaction*, *short approval*, and *rejection* to transform verbal reaction into a binary variable (*no elaboration vs elaboration*). We regressed this variable on the four forms of speaking up. We utilised GEEs using a binary logistic model. The GEE showed that only *inquiry* was significantly related to elaboration (OR=13.6; 95% CI, 5.9–31.5; P<0.0001; Fig. 1, upper half): *inquiry* was associated with an increased likelihood of the recipient discussing the respective issue.

To analyse the behavioural reactions, we performed a second GEE and regressed the binary dependent variable *implementation* (yes, no) on the four forms of speaking up. Similar to the first model, this GEE analysis revealed that only *inquiry* was significantly related to implementation of speaking up (OR=0.27; 95% CI, 0.08–0.88; P=0.03; Fig. 1, lower half): *implementation* was about four times less likely if participants spoke up via inquiry than if they did not use inquiry.

Relationship of reaction to first speaking up with occurrence of further speaking up

In research question 4, we were interested in potential relationships of reactions to an initial speak up with the occurrence of further speak up. Although in one of the 53 cases no speaking up occurred, in 11 of the 53 cases (20.8%), only 1 speaking up occurred. The total number of further speaking up occurrences was 104, ranging from 0 to 8 per induction (M=2.04, Mdn=2). As described above, we applied a quasi-Poisson model with implementation (yes, no) and verbal reaction (no verbal reaction, rejection, short approval, elaboration) as predictors. The results indicate that if the reaction to the first voice included *elaboration*, as compared with *no verbal reaction,* the number of further speaking up events decreased by a factor of 0.42 (95% CI, 0.21–0.83; P=0.018). Neither rejection nor short approval of the first speaking up had any comparable effect (Table 4). The occurrence of further speaking up events was unrelated to whether the first speaking up was implemented (RR=1.94; 95% CI, 0.61–10.88; P=0.35).

Discussion

Observations of speaking up behaviour and the respective reactions during inductions of anaesthesia provided insights into how anaesthesia care providers speak up and what follows a speaking up. We found that in most cases, speaking up referred to clinical issues such as anaesthesia procedures or devices rather than to teamwork issues. In most cases, participants spoke up rather vaguely by opinions and oblique hints. Although oblique hints occurred in most instances as individual comments, other forms occurred as hybrids. For example observations were always combined with either/and an opinion, an inquiry, or an oblique hint. Although enquiries were mostly asked in combination with sharing an opinion, observation, or both, opinions were more frequently shared without an accompanying inquiry.

Speaking up resulted most frequently in either short approvals or elaborations and was implemented in almost 90% of the cases. Reactions were mostly of neutral affective character. Interestingly, inquiry was associated with an increased likelihood of the recipient discussing the respective issue but with a decreased likelihood of implementing the respective issue. Reacting to speaking up by elaborating the respective issue was associated with fewer further speaking up behaviours during the respective induction. This is a highly relevant finding as it illustrates the complexity of speaking up. Previous research has suggested an 'ideal' form

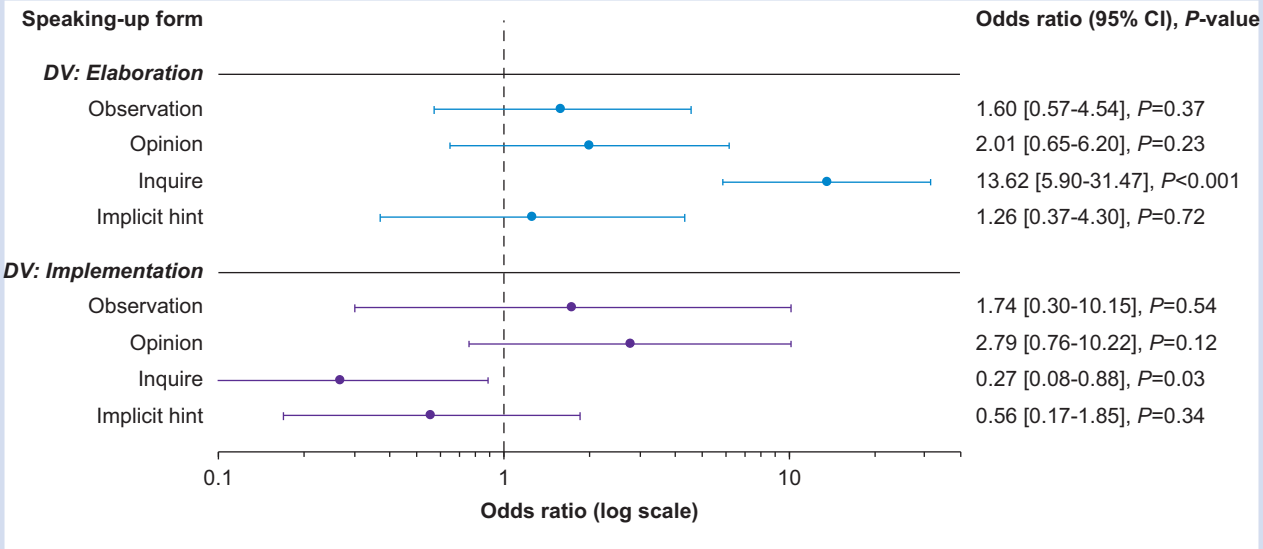

Fig 1. Forest plot visualising the association of speaking up form with recipients' reactions. ORs obtained from two multivariate logistic GEEs: the upper half refers to the GEE with elaboration as dependent variable (blue dots); the lower half refers to the GEE with implementation as dependent variable (green dots). ORs are drawn on a logarithmic scale (base 10). 'No' served as the reference category for each predictor, this form did not occur. DV, dependent variable; ORs, odds ratios; GEEs, generalised estimating equations; CI, confidence interval.

of speaking up: combining advocacy (i.e. sharing a specific observation and one's own point of view) with inquiry (i.e. asking the recipient to share his/her point of view).[46,66] This combination, particularly the inquiry, allows for scrutinising the reasoning behind actions.[67] In line with previous studies, our results indicate that people rarely speak up this way.[26,46] Our study extends this finding by showing that if employees use a question to speak up, this is associated with further discussion rather than with an immediate change of action and with reduced further speaking up in the short term. This may point to a potential dilemma that anaesthesia care providers face when using enquiries to speak up: on the one hand, enquiries help explore, scrutinise and understand current action, support team mental models and manage patient safety risks.[68] They are essential for learning. On the other hand, questions seem to come with potentially undesired 'side-effects' in the short term: if a question is likely to trigger an explanation, this can be perceived as adding workload or distracting in the context of anaesthesia induction.

Table 4 Quasi-Poisson regression to analyse associations of recipients' reactions of first speaking up and further speaking up. 'No' served as the reference category for implementation; 'no verbal reaction' served as the reference category for verbal reaction. RR, relative risk; CI, confidence intervals.

Predictors	RR	95% CI	P value
Verbal reaction			
Rejection	2.64	0.57–17.40	0.25
Elaboration	0.42	0.21–0.83	0.018
Short approval	1.03	0.61–1.82	0.91
Implementation	1.94	0.61–10.88	0.35

Our study sample included experienced anaesthesia healthcare providers who may likely have acted and reacted in the context of their previous experiences. They may have learned that when they ask questions, they might receive answers that they either may not truly want to hear at that moment or that uncomfortably enhance uncertainty in the short term.[69] That is whereas the potential benefits of enquiries may likely become apparent in the long term (e.g. errors prevented, organisational learning), their perceived potential disadvantages may be more salient in the short term (e.g. distraction from immediate procedure).[70] This may indicate a potential bias when deciding how to speak up.[20,71] It may also explain our findings that elaborations were associated with reduced further speaking up during the particular induction and that oblique hints were frequently used to speak up. Oblique hints do not result in further discussion of the issue, that is, they are not associated with the 'negative side-effects' of asking questions (i.e. distraction from immediate procedure). Oblique hints may be perceived as having at least taken some action to indicate concern. This is problematic because they are not effective: oblique hints are neither associated with discussing a concerning issue nor with any respective action[33]; they are not a recommended way to speak up.

This study has several limitations. We did not manipulate speaking up events and thus cannot conclude if or how concerned participants should have been before speaking up.[72] We can also not conclude the degree of silence, that is the degree to which participants were concerned but did not speak up.[72] Other limitations are the relatively small sample size of anaesthesia teams in non-urgent heart, thoracic, and visceral surgery, the limited live coding options and resulting potential lack of variance in the data, a potential effect of the observers on the behaviour of the participants, and the correlational and short-term nature of the data. Speaking up results may have

differed if induction of anaesthesia had been performed on an emergency basis.

Strengths of our study include the setting and methodology: compared with most studies on speaking up,[5] we studied experienced anaesthesia personnel while performing their actual work and measured actual speaking up behaviour rather than choosing a laboratory or simulated setting and relying on self-reported behaviour.

Future studies exploring the less immediate, longer-term individual and social decision-making processes of speaking up would be interesting. It is possible that 'inquiry' and 'elaboration' are associated with different or even contrary consequences in the long term compared with the short term, as studied here. In addition, research on alternatives to oblique hints that are both subjectively and objectively effective is required. This research should include organisational science because leadership and responsibility are likely to be factors influencing the speaking up dilemma.[20,69] It should also be linked to research on variations in reacting to speaking up (e.g. listening, appreciating, discussing, no reaction).[27]

In summary, our study provides insights into the form and short-term function of speaking up in the clinical environment and highlights its complexity. Our findings should not condemn 'elaboration' and 'asking a question', and help to further uncover the social dynamics of effective speaking up and to stimulate further research on this important phenomenon in the interest of patient safety.

Authors' contributions

Conceptualisation: RL, MK, BG
Data collection: RL, JCS, BG
Data analysis: RL, JCS, MJB, MK
Project administration: MK
Study supervision: MK, BG
Writing original draft: RL, MK, MJB, BG
Review/editing of manuscript: all authors

Acknowledgements

The authors thank Andrina Nef, Barbara Fratangeli, Alfons Scherrer, and Gabriel Friedli for their operational support, and the anaesthesia physicians and nurses for participating in this study.

Declarations of interest

The authors declare that they have no conflicts of interest.

Funding

Swiss National Science Foundation (10001C_169785).

References

1. Daly Guris RJ, Duarte SS, Miller CR, et al. Training novice anaesthesiology trainees to speak up for patient safety. *Br J Anaesth* 2019; **122**: 767–75
2. Pattni N, Arzola C, Malavade A, et al. Challenging authority and speaking up in the operating room environment: a narrative synthesis. *Br J Anaesth* 2019; **122**: 233–44
3. Kolbe M, Burtscher MJ, Wacker J, et al. Speaking-up is related to better team performance in simulated anesthesia inductions: an observational study. *Anesth Analg* 2012; **115**: 1099–108
4. Morrison EW. Employee voice and silence. *Annu Rev Organ Psychol Organ Behav* 2014; **1**: 173–97
5. Noort MC, Reader TW, Gillespie A. Speaking up to prevent harm: a systematic review of the safety voice literature. *Saf Sci* 2019; **117**: 375–87
6. Raemer DB, Kolbe M, Minehart RD, et al. Improving anesthesiologists' ability to speak up in the operating room: a randomized controlled experiment of a simulation-based intervention and a qualitative analysis of hurdles and enablers. *Acad Med* 2016; **91**: 530–9
7. Bienefeld-Seall N, Grote G. Silence that may kill: when aircrew members don't speak up and why. *Aviat Psychol Appl Hum Factor* 2012; **2**: 1–10
8. Edmondson AC. Speaking up in the operating room: how team leaders promote learning in interdisciplinary action teams. *J Manag Stud* 2003; **40**: 1419–52
9. Okuyama A, Wagner C, Bijnen B. Speaking up for patient safety by hospital-based health care professionals: a literature review. *BMC Health Serv Res* 2014; **14**: 61–9
10. Bell SK, Roche SD, Mueller A, et al. Speaking up about care concerns in the ICU: patient and family experiences, attitudes and perceived barriers. *BMJ Qual Saf* 2018; **27**: 928–36
11. Schwappach DLB, Gehring K. Frequency of and predictors for withholding patient safety concerns among oncology staff: a survey study. *Eur J Cancer Care* 2015; **24**: 395–403
12. Jones A, Kelly D. Deafening silence? Time to reconsider whether organisations are silent or deaf when things go wrong. *BMJ Qual Saf* 2014; **23**: 709–13
13. Detert JR, Burris ER. Leadership behavior and employee voice: is the door really open? *Acad Manage J* 2007; **50**: 869–84
14. Kish-Gephart JJ, Detert JR, Treviño LK, et al. Silenced by fear: the nature, sources, and consequences of fear at work. *Res Organ Behav* 2009; **29**: 163–93
15. Beament T, Mercer S. Speak up! Barriers to challenging erroneous decisions of seniors in anaesthesia. *Anaesthesia* 2016; **71**: 1332–40
16. Kobayashi H, Pian-Smith M, Sato M, et al. A cross-cultural survey of residents' perceived barriers in questioning/challenging authority. *Qual Saf Health Care* 2006; **15**: 277–83
17. Pattni N, Bould MD, Hayter MA, et al. Gender, power and leadership: the effect of a superior's gender on respiratory therapists' ability to challenge leadership during a life-threatening emergency. *Br J Anaesth* 2017; **119**: 697–702
18. Garden AL, Weller JM. Speaking up: does anaesthetist gender influence teamwork and collaboration? *Br J Anaesth* 2017; **119**: 571–2
19. Green B, Oeppen R, Smith D, et al. Challenging hierarchy in healthcare teams—ways to flatten gradients to improve teamwork and patient care. *Br J Oral Maxillofac Surg* 2017; **55**: 449–53
20. Krenz H, Burtscher MJ, Grande B, et al. Nurses' voice: the role of hierarchy and leadership. *Leadersh Health Serv* 2020; **33**: 12–26
21. Weiss M, Kolbe M, Grote G, et al. Why didn't you say something? Using after-event reviews to affect voice behavior and hierarchy beliefs in multi-professional action teams. *Eur J Work Organ Psychol* 2017; **26**: 66–80

22. Martin GP, Aveling E-L, Campbell A, et al. Making soft intelligence hard: a multi-site qualitative study of challenges relating to voice about safety concerns. *BMJ Qual Saf* 2018; **27**: 710–7
23. Rosenstein AH, O'Daniel M. Impact and implications of disruptive behavior in the perioperative arena. *J Am Coll Surg* 2006; **203**: 96–105
24. Friedman Z, Hayter M, Everett T, et al. Power and conflict: the effect of a superior's interpersonal behaviour on trainees' ability to challenge authority during a simulated airway emergency. *Anaesthesia* 2015; **70**: 1119–29
25. Kwon B, Farndale E. Employee voice viewed through a cross-cultural lens. *Hum Resour Manag Rev* 2020; **30**: 100653
26. Minehart RD, Pian-Smith MCM, Walzer TB, et al. Speaking across the drapes: communication strategies of anesthesiologists and obstetricians during a simulated maternal crisis. *Simul Healthc* 2012; **7**: 166–70
27. Long J, Jowsey T, Garden A, et al. The flip side of speaking up: a new model to facilitate positive responses to speaking up in the operating theatre. *Br J Anaesth* 2020; **125**: 1099–106
28. Noort MC, Reader TW, Gillespie A. Safety voice and safety listening during aviation accidents: cockpit voice recordings reveal that speaking-up to power is not enough. *Saf Sci* 2021; **139**: 105260
29. Krenz HL, Burtscher MJ. Investigating voice in action teams: a critical review. *Cogn Technol Work* 2021; **23**: 605–24
30. Minehart RD, Foldy EG, Long JA, et al. Challenging gender stereotypes and advancing inclusive leadership in the operating theatre. *Br J Anaesth* 2020; **124**: e148–54
31. Nembhard IM, Edmondson AC. Making it safe: the effects of leader inclusiveness and professional status on psychological safety and improvement efforts in health care teams. *J Organ Behav* 2006; **27**: 941–66
32. Morrison EW, Wheeler-Smith S, Kamdar D. Speaking up in groups: a cross-level study of group voice climate and voice. *J Appl Psychol* 2011; **96**: 183–91
33. Krenz HL, Burtscher MJ, Kolbe M. "Not only hard to make but also hard to take:" Team leaders' reactions to voice. *Z Angew Organisationspsychol* 2019; **50**: 3–13
34. Stone D, Patton B, Heen S. *Difficult conversations*. New York: Penguin Books; 1999
35. Martinez W, Lehmann LS, Thomas EJ, et al. Speaking up about traditional and professionalism-related patient safety threats: a national survey of interns and residents. *BMJ Qual Saf* 2017; **26**: 869–80
36. Kolbe M, Boos M. Laborious but elaborate: the benefits of really studying team dynamics. *Front Psychol* 2019; **10**: 1478
37. Gerpott FH, Lehmann-Willenbrock N, Scheibe S. Is work and aging research a science of questionnaires? Moving the field forward by considering perceived versus actual behaviors. *Work Aging Retire* 2020; **6**: 65–70
38. Brauner E, Boos M, Kolbe M, editors. *The Cambridge Handbook of Group interaction analysis*. Cambridge: Cambridge University Press; 2018
39. Künzle B, Zala-Mezö E, Wacker J, et al. Leadership in anaesthesia teams: the most effective leadership is shared. *Qual Saf Health Care* 2010; **19**: 1–6
40. Tschan F, Zimmermann J, Semmer NK. Rules for coding scheme development. In: Brauner E, Boos M, Kolbe M, editors. *The Cambridge Handbook of Group interaction analysis*. Cambridge: Cambridge University Press; 2018. p. 191–207
41. Weingart LR. How did they do that? The ways and means of studying group process. In: Staw B, editor. *Research in organizational behavior*vol. 19. Greenwich, CT: JAI; 1997. p. 189–239
42. Weinger MB, Herndon OW, Zornow MH, et al. An objective methodology for task analysis and workload assessment in anesthesia providers. *Anesthesiology* 1994; **80**: 77–92
43. Salas E, Sims DE, Burke CS. Is there a "big five" in teamwork? *Small Group Res* 2005; **36**: 555–99
44. Kolbe M, Künzle B, Zala-Mezö E, et al. Measuring coordination behaviour in anaesthesia teams during induction of general anaesthetics. In: Flin R, Mitchell L, editors. *Safer surgery analysing behaviour in the operating theatre*. Aldershot: Ashgate; 2009. p. 203–21
45. Kolbe M, Burtscher M, Manser T. Co-ACT—a framework for observing coordination behavior in acute care teams. *BMJ Qual Saf* 2013; **22**: 596–605
46. Pian-Smith MCM, Simon R, Minehart RD, et al. Teaching residents the Two-Challenge Rule: a simulation-based approach to improve education and patient safety. *Simul Healthc* 2009; **4**: 84–91
47. Weiss M, Kolbe M, Grote G, et al. We can do it! Inclusive leader language promotes voice behavior in multiprofessional teams. *Leadersh Q* 2018; **29**: 389–402
48. Seelandt JC, Grande B, Kriech S, et al. DE-CODE: a coding scheme for assessing debriefing interactions. *BMJ STEL* 2018; **4**: 51–8
49. Isen AM. Positive affect, cognitive processes, and social behavior. In: *Advances in experimental social psychology*. Elsevier; 1987. p. 203–53
50. Burris ER. The risks and rewards of speaking up: managerial responses to employee voice. *Acad Manage J* 2012; **55**: 851–7
51. Coan JA, Gottman JM. The Specific Affect Coding System (SPAFF). In: Coan JA, Allen JJB, editors. *Handbook of emotion elicitation and assessment*. Oxford: Oxford University Press; 2007. p. 267–85
52. Marks MA, Mathieu JE, Zaccaro SJ. A temporally based framework and taxonomy of team processes. *Acad Manage Rev* 2001; **26**: 356–76
53. Brauner E. Coding Interaction. In: Brauner E, Boos M, Kolbe M, editors. *The Cambridge Handbook of Group interaction analysis*. Cambridge: Cambridge University Press; 2018. p. 165–90
54. Lyndon A, Sexton JB, Simpson KR, et al. Predictors of likelihood of speaking up about safety concerns in labour and delivery. *BMJ Qual Saf* 2012; **21**: 791–9
55. Schwappach DLB, Gehring K. 'Saying it without words': a qualitative study of oncology staff's experiences with speaking up about safety concerns. *BMJ Open* 2014; **4**, e004740
56. *Noldus observer XT 14 [program]*. The Netherlands: Waningen; 2017
57. *IBM SPSS statistics for windows, Version 26.0 [program]*. Armonk, NY: IBM Corp; 2019
58. Seelandt JC. Quality control. In: Brauner E, Boos M, Kolbe M, editors. *The Cambridge Handbook of Group interaction analysis*. Cambridge: Cambridge University Press; 2018. p. 227–44
59. Landis JR, Koch GG. The measurement of observers agreement for categorial data. *Biometrics* 1977; **33**: 159–74

60. *IBM SPSS statistics for windows, Version 25.0 [program]*. Armonk, NY: IBM Corp; 2017
61. Kabacoff RI. *R in action*. 2nd edn. Shelter Island, NY: Manning Publications; 2015
62. Halekoh U, Højsgaard S, Yan J. The R package geepack for generalized estimating equations. *J Stat Softw* 2006; **15**: 1–11
63. R Core Team. *R: a language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing; 2013
64. *broom: convert statistical analysis objects into tidy tibbles* 2019 [program], R package version 0.5.2.
65. Scrucca L. qcc: an r package for quality control charting and statistical process control. *R News* 2004; **4**: 11–7
66. Rudolph JW, Simon R, Rivard P, et al. Debriefing with good judgment: combining rigorous feedback with genuine inquiry. *Anesthesiol Clin* 2007; **25**: 361–76
67. Rutherford J, Flin R, Mitchell L. Teamwork, communication, and anaesthetic assistance in Scotland. *Br J Anaesth* 2012; **109**: 21–6
68. Schein EH. *Humbly inquiry. The gentle art of asking instead of telling*. San Francisco, CA: Berrett-Koehler; 2013
69. Grote G. Promoting safety by increasing uncertainty – implications for risk management. *Saf Sci* 2015; **71**: 71–9
70. Tucker AL, Edmondson AC. Why hospitals don't learn from failures: organizational and psychological dynamics that inhibit system change. *Calif Manage Rev* 2003; **45**: 55–72
71. Kahneman D, Tversky A. Prospect theory: an analysis of decision under risk. *Econometrica* 1979; **47**: 263–91
72. Noort MC, Reader TW, Gillespie A. Walking the plank: an experimental paradigm to investigate safety voice. *Front Psychol* 2019; **10**. https://doi.org/10.3389/fpsyg.2019.00668

Handling editor: Hugh C Hemmings Jr