



# Coordination and Communication in Healthcare Action Teams

## The Role of Expertise

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**Abstract:** Communication and coordination represent central processes in healthcare action teams. However, we have a limited understanding of how expertise affects these processes and to what extent these effects are shaped by interprofessional differences. The current study addresses these questions by jointly investigating the influence of different aspects of expertise – individual expertise, team familiarity, and expertise asymmetry – on coordination quality and communication openness. We tested our propositions in two hospitals: one in Switzerland (CH, Sample 1) and one in the United Kingdom (UK, Sample 2). Both samples included two-person anesthesia action teams consisting of a physician and a nurse ( $N_{CH} = 47$  teams,  $N_{UK} = 48$  teams). We used a correlational design with two measurement points (i.e., pre- and postoperation). To consider potential interprofessional differences, we analyzed our data with actor-partner interdependence models. Moreover, we explored differences in the effects of expertise between both hospitals. Our findings suggest that nurses' expertise is the most important predictor of coordination quality and communication openness. Overall, differences between the two hospitals were more prevalent than interprofessional differences between physicians and nurses. The current study provides a nuanced picture of the effects of expertise, and thereby extends our understanding of interprofessional teamwork.

**Keywords:** action team, expertise, coordination, communication, interprofessional

## Introduction

Teamwork is a major contributor to safe and efficient patient care (Dinh et al., 2020; Schmutz et al., 2019), particularly in dynamic settings such as operating rooms and intensive care units (e.g., Manser, 2009; Reader et al., 2009; Wilson et al., 2005). Most teams in these settings can be classified as action teams (Edmondson, 2003; Farh & Chen, 2018; Klein et al., 2006; Kolbe et al., 2014; Vashdi et al., 2013), that is, teams of highly skilled specialists cooperating for brief performance episodes in a challenging environment (Sundstrom et al., 2000). Because of the interdependence and the urgency of tasks, effective coordination and open communication of information are considered central determinants of team performance (Edmondson, 2003; Fernandez et al., 2008; Reader et al., 2009).

Research has sought to identify factors that positively affect coordination quality and communication openness.

Expertise represents a likely candidate: Research has emphasized the impact of both individual members' expertise (e.g., Patel et al., 2000) as well as team familiarity – the expertise of having worked together before (e.g., Kurmann et al., 2014) – on teamwork in healthcare. In addition, it has been suggested that other aspects of expertise also play an important role. Transactive memory systems (i.e., knowledge about “who knows what”) were positively related to perceived team effectiveness in anesthesia (Michinov et al., 2008). Moreover, differences in team members' perceptions of each other's expertise were shown to affect coordination and performance (Gardner & Kwan, 2012). Because healthcare teams are characterized by their interprofessional composition (Hughes et al., 2016; Kvarnström, 2008), whereby individual members possess distinctive sets of knowledge and skills, we regard the perception of differences in expertise as a particularly relevant predictor of teamwork. To conceptualize these differences, we introduce the construct of “expertise asymmetry”: the degree

to which team members perceive their own task-related expertise to differ from that of their teammates.

The current study simultaneously investigates three aspects of expertise – individual expertise, team familiarity, and expertise asymmetry – in two-person anesthesia action teams. Importantly, we quantify interprofessional differences in the effects of expertise by analyzing our data using actor-partner interdependence models (APIM; Kenny et al., 2006), a statistical technique that allows for modeling specific effects for physicians and nurses. Finally, we collected data in two different hospitals – one in Switzerland and one in the United Kingdom – which allowed for exploring interorganizational differences in the effects of expertise. The current research aims to improve our understanding of healthcare action teams by investigating how different aspects of expertise affect major team processes and whether the effects of expertise are shaped by interprofessional and interorganizational differences. Given the vital role of teamwork in healthcare, we regard this as an important contribution to the literature that also has practical implications.

## Theoretical Background

### Teamwork in Healthcare

Teamwork is particularly important in dynamic healthcare settings such as operating rooms and intensive care units (e.g., Manser, 2009; Reader et al., 2009; Wilson et al., 2005). Most teams in these settings can be classified as action teams (Edmondson, 2003; Farh & Chen, 2018; Klein et al., 2006; Kolbe et al., 2014; Vashdi et al., 2013). As an example, consider a trauma team of anesthesiologists, surgeons, and nurses who treat the victims of a car accident. Such teams typically have to “respond to unexpected events in a coordinated way, often requiring a free and open transfer of information to enable real-time, reciprocal coordination of action” (Edmondson, 2003, p. 1421). Action teams perform tasks in situations where poor teamwork can have serious consequences, including the loss of human life (e.g., Burtscher et al., 2018; Klein et al., 2006; Kolbe et al., 2014). Moreover, these teams are unstable: They are brought together for a single performance episode (e.g., surgical procedure), may change their composition depending on emergent task requirements, and disband upon completion (Ishak & Ballard, 2012; Tschan et al., 2006; Vashdi et al., 2013).

Another key characteristic of healthcare teams is that they are professionally diverse and often multidisciplinary (Edmondson, 2003; Hughes et al., 2016). They can include anesthesiologists, surgeons, emergency physicians, nurses, and paramedics. Thus, members of healthcare teams also

differ in their training, their professional cultures, and their perceptions regarding team members’ roles and responsibilities (Sexton et al., 2000; Thomas et al., 2003). A number of studies suggest that these interprofessional differences affect key team processes such as communication and coordination (e.g., Kvarnström, 2008; Lingard et al., 2002; Powell & Davies, 2012).

### Coordination Quality and Communication Openness

Effective coordination is a critical process in healthcare action teams because their tasks are highly interdependent: In the operating room, the actions of one team member may require an immediate reaction from another team member (Helmreich & Schaefer, 1994). The importance of coordination is amplified in interprofessional teams where activities must be coordinated among individual experts because certain tasks have to be completed by a specific member (e.g., Cannon-Bowers & Bowers, 2011; Hughes et al., 2016). Empirical research confirms the importance of coordination quality. A series of studies emphasized the importance of coordination to the performance of anesthesia teams (e.g., Burtscher, Manser, et al., 2011; Burtscher et al., 2010; Manser et al., 2009), and a review highlighted the importance of effective coordination for teams performing cardiopulmonary resuscitation (Fernandez Castela et al., 2013).

Communication openness represents another central determinant of action team performance in healthcare (Manser, 2009; Reader et al., 2009; Tschan et al., 2015). Given the interdependence, urgency, and unpredictability of their tasks, the free and open transfer of information is considered vitally important (Edmondson, 2003). In support of this proposition, less intrateam information sharing during surgery was found to increase the likelihood of patient death or major complications (Mazzocco et al., 2009), and communication failures have frequently been linked to adverse events in the operating room (Greenberg et al., 2007; Lingard et al., 2004; Williams et al., 2010). In this context, interprofessional barriers can impede open communication and, thus, compromise patient safety and quality of care (Nagpal et al., 2010).

### The Role of Expertise

In general, expertise can be described as possessing expert skill or knowledge in a specific area. In the team context, expertise includes multiple aspects. For one, the expertise of individual members – the specialized skills and knowledge an individual brings to the team’s task – is one of the most important team resources (Bunderson, 2003; Faraj

& Sproull, 2000). Research demonstrated that members' task-related expertise is positively related to team processes and outcomes (e.g., Bonner et al., 2002; Littlepage et al., 1997). The role of expertise for teamwork has also been emphasized in healthcare (e.g., Oborn et al., 2019; Patel et al., 2000), whereas the role of expertise in interprofessional healthcare teams has received limited attention in the literature. Although their roles and responsibilities overlap to a certain degree (e.g., anesthesiologist and anesthesia nurse), team members receive different training (i.e., medical school vs. nursing school), so that their expertise in a specific area may vary considerably.

Besides individual expertise, the expertise of having worked together before is likely to affect the coordination quality and communication openness in healthcare action teams. This expertise is referred to as *team familiarity* (cf. Huckman et al., 2009). Higher team familiarity was proposed to have positive effects on team performance because it is beneficial to coordination, particularly during the early stages of a team's existence (Guzzo & Dickson, 1996). In line with this notion, team familiarity was related to team performance and patient outcomes in surgical teams (Kurmman et al., 2014; Xu et al., 2013).

Importantly, research indicates that not only the absolute amount of expertise within a team, but also other aspects of members' expertise play a critical role. Before a team can benefit from having expert members, their expertise has to be recognized: Teams perform better when their members know "who is good at what" (e.g., Ellwart et al., 2014; Faraj & Sproull, 2000; Littlepage et al., 1995). Knowledge about "who knows what" represents a component of transactive memory systems, which have been related to perceived team effectiveness in anesthesia (Michinov et al., 2008) and interprofessional team experience in geriatrics (Tan et al., 2014). Moreover, research suggested that differences in team members' perceptions of each other's expertise affect coordination (Gardner & Kwan, 2012).

Because interprofessional healthcare teams are characterized by individual differences in knowledge, skills, and attitudes, we propose that perceptions of these differences play an important role. In particular, we suggest that perceptions of one's own knowledge and skills compared to the perception the knowledge and skills of one's teammates affect team processes. We conceptualize this difference as expertise asymmetry: the degree to which team members perceive their own task-related expertise to differ from the expertise of their teammates. Importantly, expertise asymmetry is different from status or power (cf. Galinsky et al., 2015). Whereas the latter focuses on overall hierarchical differences (i.e., higher vs. lower status), expertise asymmetry captures qualitative differences in knowledge and skills between team members. Higher levels of asymmetry indicate that members perceive their own task-related

expertise to be qualitatively different, but not necessarily higher or lower, from that of their teammates.

As an example, consider a two-person team performing a task that requires two types of expertise. One team member may feel very experienced with respect to the first type of expertise ("100%") but less experienced with respect to the second type of expertise ("50%"). At the same time, this team member perceives the teammate to be less experienced in the first ("50%") and highly experienced in the second type of expertise ("100%"). Hence, overall, the team member perceives themselves as equally experienced as their teammate but they think that they differ *qualitatively* from each other in the distribution of their expertise.

## The Present Research

We simultaneously investigate the influence of three aspects of expertise – individual expertise, team familiarity, expertise asymmetry – on two key team processes: coordination quality and communication openness. We propose that expertise asymmetry explains differences in these processes above and beyond individual expertise and team familiarity. We expect, however, that expertise asymmetry exerts differential effects on both outcomes and hypothesize that expertise asymmetry positively affects coordination quality (Hypothesis 1). This is because in asymmetric teams, it is easier to determine which team members have the most expertise in specific areas ("who is good at what"), which in turn facilitates task allocation (e.g., Austin, 2003; Ellwart et al., 2014; Faraj & Sproull, 2000). For example, if Member A is very skilled in one area, while Member B is not skilled, clearly Member A should perform the tasks in this area. However, if Member A and B are both equally skilled, task coordination becomes more challenging as it must be made explicit and potentially negotiated.

By contrast, for communication openness, we hypothesize that expertise asymmetry has a negative effect (Hypothesis 2) because perceiving differences in expertise indicates an interprofessional gap, which in turn constitutes an impediment to open communication (Hughes et al., 2016; Lingard et al., 2002). For example, one team member may feel that the other team member does not have sufficient task-specific expertise to make a contribution and therefore sees no need to openly share information.

To explicitly address interprofessionalism, we investigated how the effects of expertise differ between physicians and nurses (Research question 1). Moreover, we collected data from two hospitals: one in Switzerland and one in the United Kingdom. We were interested in whether interorganizational differences between the two hospitals influences the effects of expertise (Research question 2). In the British sample, we also explored differences between teams

including a resident physician or an attending physician (Research question 3). Thus, the present study included three different sets of teams: (1) teams with a resident physician from a Swiss hospital, (2) teams with a resident physician from a British hospital, and (3) teams with an attending physician from a British hospital.

## General Method

### Design and Procedure

We tested our predictions in anesthesia teams because they represent a prototypical example of healthcare action teams (Kolbe et al., 2014), and they include members from different professions who possess specialized skills (i.e., physicians and nurses). We used an observational design with two measurement points: Individual expertise, team familiarity, and expertise asymmetry were measured before the start of the operation; coordination quality and communication openness were measured after the operation was completed. To ensure comparability between cases, we only considered elective operations.

The study as such and the data collection in Switzerland were approved by the Ethikkommission beider Basel (now: EK Nordwest- und Zentralschweiz), reference number: 21/12. Participants provided written informed consent prior to the data collection. The UK study was part of a wider research program on observational assessment of clinical teams and approved by the Imperial Centre for Patient Safety and Service Quality (“Teams, Skills and Safety Program,” led by NS at the time of the study, see [www.imperial.ac.uk/patient-safety-translational-research-centre/our-work/prior-to-august-2017/theme-4-teams-skills-and-safety/](http://www.imperial.ac.uk/patient-safety-translational-research-centre/our-work/prior-to-august-2017/theme-4-teams-skills-and-safety/)). Because the study was part of a larger study program and involved minimal risk to participants, participants were provided with information about the study and gave explicit oral consent before being handed the questionnaire. Moreover, the questionnaire itself included a description of the study (e.g., aim of the study, guarantee of anonymity, voluntary participation). Thus, filling in the questionnaire was considered as written consent.

## Measures

### Individual Expertise and Expertise Asymmetry

With guidance from subject matter experts from both organizations, we identified nine relevant areas of expertise for anesthesia. These include infection control, drug administration, and dealing with ventilation problems (see Appendix). Participants were asked to indicate (1) their personal level of expertise in each of these areas and (2) the

level of expertise of their teammate on a 7-point Likert-scale (1 = *very inexperienced* to 7 = *very experienced*). The scale for individual expertise had excellent reliability in both samples ( $\alpha_{\text{Sample1}} = .95$ ,  $\alpha_{\text{Sample2}} = .96$ ). Thus, items were averaged to obtain single scores for individual expertise.

Expertise asymmetry was calculated as the squared Euclidean distance between the participants’ ratings of their own expertise and their ratings of their teammate’s expertise separately for each of the nine items. Again, these scores were averaged to obtain a single measure of expertise asymmetry. Expertise asymmetry ranges from 0 to a potential maximum value of 36, with higher values indicating higher levels of asymmetry.

### Team Familiarity

We measured team familiarity with the item “How often have you worked with your teammate before?” (1 = *never* to 5 = *very often*). Physicians’ and nurses’ familiarity scores were highly correlated. We averaged them to form a single team-level rating in order to increase parsimony of the statistical analyses.

### Coordination Quality

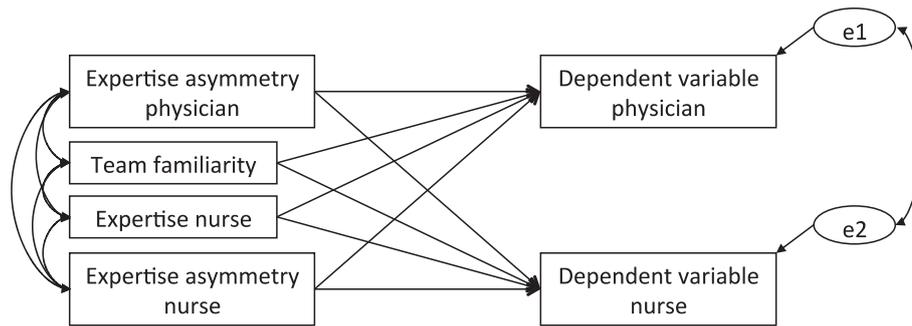
We used the 5-item scale developed by Lewis (2003) to operationalize the quality of team coordination. A sample item is “We worked together in a well-coordinated fashion.” Participants indicated their agreement using a 7-point Likert-scale (1 = *strongly disagree* to 7 = *strongly agree*;  $\alpha_{\text{Sample1}} = .81$ ,  $\alpha_{\text{Sample2}} = .71$ ).

### Communication Openness

We used O’Reilly and Roberts’ (1977) 5-item scale to measure communication openness. The wording was slightly adapted to the setting of the current study. A sample item is “It was easy to talk openly to my teammate.” Participants indicated their agreement using a 7-point Likert-scale ((1 = *strongly disagree* to 7 = *strongly agree*;  $\alpha_{\text{Sample1}} = .90$ ,  $\alpha_{\text{Sample2}} = .92$ ).

### Analytic Strategy: Actor-Partner Interdependence Models

We used actor-partner interdependence models (APIM, see Figure 1) to model the psychological and statistical nonindependence of the two team members’ variables (Kenny et al., 2006). Because of the interactive character of the common task for physicians and nurses, which is likely to influence individuals’ task-related cognitions and behaviors, but also because of the nested data structure (i.e., two persons form a team), APIM were deemed the most appropriate analytical strategy. In addition, the APIM allow for analyzing actor and partner effects: Actor effects are effects within an individual (e.g., effect of a nurse’s expertise asymmetry on a nurse’s coordination quality), whereas partner effects are



**Figure 1.** APIM predicting coordination quality or communication openness. Dependent variables for physician and nurse represent either communication openness or coordination quality. e1 and e2 represent regression residuals. Directed arrows represent directed effects (path coefficients). Double headed arrows represent correlations.

the effects of one team member on the other (e.g., a nurse's expertise asymmetry on a physician's coordination quality). In our model, there are two actor effects (i.e., one within nurses and one within physicians) and two partner effects (i.e., one running from nurse to physician and one the opposite way). These effects adequately reflect the interdependence of the two team members' views about coordination quality and communication openness. Please note that the definition of actor and partner effects is determined solely by the dependent variable (of nurses or physicians); it is not the role of an individual. APIM were calculated using Mplus 7.4 (Muthén & Muthén, 1998–2015).

Importantly, we included only the nurses' expertise scores, that is, their averaged self-ratings regarding the nine areas of expertise (see above), as a predictor. The physicians' expertise was not entered as predictor variable because it is confounded with the physician's level of seniority (i.e., resident vs. attending). In the first sample, all teams included a resident physician, whereas in the second study, about half of the teams included a resident and half of the teams an attending physician. Consequently, we analyzed these three sets of teams separately: (1) Teams consisting of a resident physician and a nurse from Sample 1 (CH), (2) teams consisting of a resident physician and a nurse from Sample 2 (UK), and (3) teams consisting of an attending physician and a nurse from Sample 2 (UK).

## Sample 1

### Participants and Setting

Data collection was conducted at a teaching hospital in Switzerland. Our sample included 47 2-person anesthesia teams consisting of a resident physician and a nurse who worked together over the course of one operation. Reflecting the reality of changing team composition within a restricted set of potential team members, a number of

participants included in this study were working in more than one team. However, we made sure that each team included in our sample had a unique composition, meaning that if a person was part of multiple teams, it was always with a different teammate. In total, 23 physicians and 25 nurses participated in the study. Physicians were on average 33.78 years old ( $SD = 4.06$ ) and had a work experience of 5.38 years ( $SD = 3.80$ ); nurses were on average 37.16 years old ( $SD = 8.96$ ) and had a work experience of 6.44 years ( $SD = 7.04$ ). For reasons of confidentiality, we did not collect data on participants' sex in either of the two samples.

## Results

Table 1 provides an overview of descriptive statistics. The relatively high mean scores indicate that physicians and nurses were equally positive in their assessment of their teams' communication and coordination. Zero-order correlations indicate that both team members agreed about expertise asymmetry in their team ( $r = .49$ ). Interestingly, in those teams with more experienced nurses, both team members perceived less asymmetry ( $r = -.30$  and  $r = -.61$ ). Not surprisingly, considering the action team's task, communication openness and coordination quality were correlated in one team member's view. These correlations exceeded the correlations of the team members when rating the same outcome (coordination or communication, see Table 1, shaded area).

The APIM (see Table 2, upper part) revealed that for physicians, *coordination quality* could be predicted by team familiarity ( $\beta = .29$ ), whereas for nurses, coordination quality could be predicted by their own self-rated expertise ( $\beta = .44$ ). Importantly, we found the expected positive effect of expertise asymmetry for both physicians ( $\beta = .27$ ; one-tailed  $p < .05$ ; two-tailed  $p = .09$ ) as well as for nurses ( $\beta = .40$ ). In support of Hypothesis 1, the more asymmetric physicians and nurses perceived their team, the better they judged the coordination quality during the operation. Taken

**Table 1.** Means (*M*), standard deviations (*SD*), and intercorrelations for variables of Sample 1 (CH)

a) Switzerland								
	ExAsP	ExAs_N	Com_P	Com_N	Coor_P	Coor_N	Exp_N	Fam
ExAs_N	.49*	–						
Com_P	–.07	–.03	–					
Com_N	–.08	.08	.55*	–				
Coor_P	.16	–.01	.71*	.44*	–			
Coor_N	–.01	.09	.48*	.82*	.50*	–		
Exp_N	–.30*	–.61*	.08	.00	.16	.22	–	
Fam	–.16	–.07	.20	.02	.28	.06	.19	–
Mean	2.15	2.73	5.83	5.83	5.93	5.93	5.13	2.50
SD	2.56	3.23	1.10	1.15	0.80	0.91	1.07	0.85

Note. ExAs\_P = expertise asymmetry physician, ExAs\_N = expertise asymmetry nurse, Com\_P = communication openness physician, Com\_N = communication openness nurse, Coor\_P = coordination quality physician, Coor\_N = coordination quality nurse, Exp\_N = expertise nurse, Fam = team familiarity. *N* = 47 teams; \**p* < .05; grey-shaded cells indicate correlations between communication and coordination within/between physicians and nurses.

**Table 2.** APIMs predicting coordination quality and communication openness in Sample 1 (CH)

Predictors	Coordination quality						Communication openness					
	Physician			Nurse			Physician			Nurse		
	<i>b</i>	$\beta$	<i>p</i>	<i>b</i>	$\beta$	<i>p</i>	<i>b</i>	$\beta$	<i>p</i>	<i>b</i>	$\beta$	<i>p</i>
Expertise asymmetry physician	0.08	.27	.09	–0.02	–.07	.66	–0.02	–.04	.81	–0.07	–.16	.35
Expertise asymmetry nurse	–0.00	–.00	.95	0.11	.40	.04	0.01	.04	.84	0.07	.21	.31
Team familiarity	0.27	.29	.04	–0.00	–.00	.98	0.24	.19	.20	–0.01	.00	.98
Expertise nurse	0.14	.18	.29	0.37	.44	.01	0.06	.06	.76	0.08	.08	.69

Note. *b* = unstandardized path coefficient;  $\beta$  = standardized path coefficient; *p* = *p*-value of the unstandardized path coefficient; grey-shaded cells indicate actor effects. *N* = 47 teams.

together the independent variables explained 15% of the variance of physicians' coordination quality ratings and 13% of the nurses' ratings.

With respect to *communication openness*, no predictor in the APIM proved significant. Thus, our second hypothesis was not supported in this sample. The proportions of explained variance were very low with 5% for physicians and 3% for nurses.

## Sample 2

### Participants and Setting

We collected data at a teaching hospital in the United Kingdom. Our sample included 48 2-person anesthesia teams consisting of a physician and a nurse.<sup>1</sup> Compared to Sample 1, teams tended to work together for multiple performance episodes (i.e., surgical procedures), and only a

few participants were part of more than one team. Again, we made sure that each team had a unique composition. In total, 42 physicians and 45 nurses participated in the study. Physicians were on average 38.10 years old (*SD* = 9.00) and had a work experience of 10.70 years (*SD* = 8.66); nurses were on average 39.56 years old (*SD* = 8.64) and had a work experience of 11.31 years (*SD* = 9.86).

Sample 2 provided the opportunity to explicitly consider the level of seniority of the physician because teams in the second sample included either a resident (*N* = 25) or an attending physician (*N* = 23). We were interested in potential differences regarding the effects of expertise between teams with a resident and teams with an attending physician. As expected, there was a significant difference regarding individual expertise between residents (*M* = 5.43, *SD* = 1.01) and attending physicians (*M* = 6.79, *SD* = 0.29), *t*(23.28) = –5.92, *p* < .001. Because we only had a few missing data points in our dependent variables and we could presume “missing at random,” we used the FIML (i.e., full information maximum likelihood) estimator implemented

<sup>1</sup> In the UK, instead of a nurse, anesthesia teams often include an operating department practitioner. However, because both have the same roles and responsibilities, we did not distinguish between them.

**Table 3.** Means (*M*), standard deviations (*SD*), and intercorrelations for variables in Sample 2 for teams with resident physicians (upper part) and teams with attending physicians (lower part)

	Resident physicians							
	ExAsP	ExAs_N	Com_P	Com_N	Coor_P	Coor_N	Exp_N	Fam
ExAs_N	-.13	-						
Com_P	-.29	-.17	-					
Com_N	-.04	-.29	-.05	-				
Coor_P	-.29	-.23	.81*	-.17	-			
Coor_N	.04	.05	-.09	.08	-.21	-		
Exp_N	-.04	-.53*	.33	-.29	.50*	-.19	-	
Fam	.14	-.03	-.02	-.04	.06	-.23	-.05	-
<i>N</i>	25	25	24	25	24	25	25	25
Mean	2.37	1.83	5.45	6.06	5.68	5.72	5.91	2.52
<i>SD</i>	3.17	2.50	0.95	0.66	0.88	0.54	1.10	0.94
	Attending physicians							
	ExAsP	ExAs_N	Com_P	Com_N	Coor_P	Coor_N	Exp_N	Fam
ExAs_N	-.14	-						
Com_P	-.70*	.11	-					
Com_N	-.27	.29	.24	-				
Coor_P	-.51*	.08	.90*	.24	-			
Coor_N	-.07	.28	-.14	.79*	-.08	-		
Exp_N	.05	-.65*	.20	-.01	.25	-.10	-	
Fam	-.23	-.05	.44*	-.21	.37	-.34	.03	-
<i>N</i>	23	23	20	19	22	21	23	22
Mean	4.36	1.96	5.95	6.00	5.94	5.90	5.67	3.75
<i>SD</i>	5.44	1.79	1.27	0.85	1.10	0.76	0.96	0.86

Note. ExAs\_P = expertise asymmetry physician, ExAs\_N = expertise asymmetry nurse, Com\_P = communication openness physician, Com\_N = communication openness nurse, Coor\_P = coordination quality physician, Coor\_N = coordination quality nurse, Exp\_N = expertise nurse, Fam = team familiarity. \* $p < .05$ ; grey-shaded cells indicate correlations between communication and coordination within/between physicians and nurses.

in Mplus 7.4 (Muthén & Muthén, 1998–2015). This allowed us to make full use of the data at the team-level.

## Results

Table 3 depicts the descriptive statistics. Regarding mean scores, we found a similar pattern as in Sample 1, in that physicians and nurses were both positive in their assessment of coordination quality and communication openness. Exceptions are resident physicians who seemed to have on average lower ratings of communication openness compared to both nurses as well as attending physicians. Notably, in teams with resident physicians, nurses' ratings of coordination quality and communication openness were strongly associated, whereas these ratings were uncorrelated in teams with attending physicians.

### Coordination Quality

With respect to the APIM (Table 4), we found that, in *teams with resident physicians*, the most important factor was nurses' self-rated expertise ( $\beta = .49$ ), which predicted

physicians' ratings of coordination quality. No other predictor turned significant. Thus, Hypothesis 1 was not supported. The model explained 34% of the variance in physicians' coordination quality ratings, but only 10% of the variance in nurses' ratings.

For *teams with attending physicians*, physicians' coordination quality ratings could again be predicted by nurses' expertise ( $\beta = .50$ ). As expected, physicians' expertise asymmetry ( $\beta = -.42$ ) predicted variance coordination quality as rated by physicians above and beyond the other aspects of expertise. Contrary to our expectations, the effect was negative, indicating that higher ratings of expertise asymmetry were related to lower coordination quality. No predictor for nurses' ratings of coordination quality proved significant. In total, the model explained 48% of the variance in attending physicians' coordination quality, and 18% of nurses' coordination quality.

### Communication Openness

Concerning communication openness, we found that for *teams with resident physicians*, nurses' ratings of communication openness could be predicted by their own expertise

**Table 4.** APIMs predicting coordination quality and communication openness for teams with resident physicians (upper part) and teams with attending physicians (lower part) in Sample 2 (UK)

Predictors	Coordination quality						Communication openness					
	Physician			Nurse			Physician			Nurse		
	<i>b</i>	$\beta$	<i>p</i>	<i>b</i>	$\beta$	<i>p</i>	<i>b</i>	$\beta$	<i>p</i>	<i>b</i>	$\beta$	<i>p</i>
Expertise asymmetry resident	-0.08	-.28	0.09	0.01	.06	.78	-0.09	-.29	.12	-0.03	-.15	.37
Expertise asymmetry nurse	-0.00	-.01	0.98	-0.02	-.07	.75	-0.02	-.05	.81	-0.17	-.65	.00
Team familiarity	0.12	.12	0.45	-0.14	-.25	.20	0.04	.04	.84	-0.05	-.07	.65
Expertise nurse	0.39	.49	0.01	-0.12	-.23	.30	0.25	.29	.18	-0.38	-.64	.00
Expertise asymmetry attending	-0.08	-.42	0.01	-0.02	-.10	.60	-0.15	-.64	.00	-0.05	-.32	.12
Expertise asymmetry nurse	0.22	.36	0.12	0.14	.33	.25	0.16	.22	.22	0.18	.38	.20
Team familiarity	0.36	.29	0.10	-0.28	-.31	.26	0.53	.35	.01	-0.21	-.21	.40
Expertise nurse	0.57	.50	0.01	0.09	.11	.66	0.49	.37	.01	0.24	.27	.29

Note. *b* = unstandardized path coefficient;  $\beta$  = standardized path coefficient; *p* = *p*-value of the unstandardized path coefficient; gray-shaded cells indicate actor effects.  $N_{\text{Resident}} = 25$  teams,  $N_{\text{Attending}} = 23$  teams; grey-shaded cells indicate actor effects.

( $\beta = -.64$ ). In support of Hypothesis 2, higher levels expertise asymmetry perceived by nurses were related to less communication openness as perceived by nurses ( $\beta = -.65$ ). The model explained 18% of the variance in resident physicians' communication openness ratings and 38% of the nurses' variance.

For teams with attending physicians, our analysis revealed a different pattern. Physicians perceived communication to be open, when the team is familiar ( $\beta = .35$ ), and the nurse is experienced ( $\beta = .37$ ). In support of Hypothesis 2, higher levels of expertise asymmetry perceived by physicians were related to less communication openness as perceived by physician ( $\beta = -.64$ ). However, no predictor for nurses' communication openness ratings turned significant. In teams with attending physicians, the model explained 73% of the physicians' communication openness ratings and 23% of the of nurses' ratings.

## Overview of Main Findings

Table 5 provides an overview of the main findings from the six APIMs. The table indicates the presence of a positive or negative effect for each combination of predictors and outcomes for the three types of team in our study. For ease of illustration, we do not distinguish between actor and partner effects.

## Discussion

The current study specifies the effects of expertise on coordination quality and communication openness in healthcare action teams. All three aspects of expertise (individual expertise, expertise asymmetry, and team familiarity) contributed to explaining the team processes we

evaluated: up to 48% of the variance in coordination quality and up to 73% in communication openness. The significance of each aspect, however, varied between professions (i.e., physicians and nurses) and across the three types of teams found in the two participating organizations.

Overall, nurses' expertise seems to be the most important predictor of coordination quality and communication openness: Five of the six APIMs revealed significant effects (Table 5). In particular regarding coordination quality, we found positive effects for all three team types: Having a nurse with a high task-related expertise facilitates team coordination. In partial support of our hypotheses, expertise asymmetry did explain variance above and beyond individual expertise and team familiarity in four models. Team familiarity seems to have the least explanatory power: Only two models revealed significant effects.

## Research Implications

The current research suggests that perceptions of differences in expertise (i.e., expertise asymmetry) explains variance above and beyond the known effects of individual expertise and team familiarity. This finding is in line with previous research showing that not only the absolute amount of expertise within a team but also other aspects of members' expertise affect team processes and outcomes (e.g., Burtscher & Oostlander, 2019; Ellwart et al., 2014; Faraj & Sproull, 2000). Specifically, findings from Sample 2 suggest that perceptions of differences in expertise impede open communication under some conditions. This finding has potential implications for research on speaking up (e.g., openly voicing concerns to senior team members), which represents an important factor for performance and safety in both healthcare (Edmondson, 2003; Noort et al., 2019) as well as in other action team settings (Krenz & Burtscher, 2020). Given that team members are reluctant

**Table 5.** Summary of effects across all six APIMs

	Coordination quality			Communication openness		
	CH	UK resident	UK attending	CH	UK resident	UK attending
Expertise nurse	+	+	+		-	+
Expertise asymmetry	+		-		-	-
Team familiarity	+					+

Note. "+" = positive effect, "-" = negative effect.

to speak up (e.g., Raemer et al., 2016; Weiss et al., 2017), focusing on expertise perceptions could represent a fruitful avenue for future research.

Regarding potential interprofessional differences, physicians and nurses were similarly positive in their assessment of coordination quality and communication openness. Moreover, the APIMs predict similar effects for physicians and nurses in Sample 1. In this sample, we found positive effects of expertise asymmetry on coordination quality for both physicians and nurses. Regarding communication openness, findings for physicians and nurses were identical in that no aspect of expertise had a significant effect. In Sample 2, however, we found some evidence for interprofessional differences. For physicians, working with an experienced nurse was positively associated with coordination quality and communication openness. In addition, team familiarity seems to be beneficial in teams with attending physicians. For nurses, by contrast, these factors did not have any positive effect on either team process. In fact, for nurses who worked with a resident physician, having high expertise was negatively related to perceptions of communication openness. This finding is in line with recent research showing that junior physicians and nurses significantly differ in their assessment of the causes of poor teamwork (O'Connor et al., 2016). Importantly, we would like to emphasize that, although expertise seems to have worked differently for physicians versus nurses in Sample 2, we did not find any opposite effects: In each of the four models (Table 4), if a predictor had a positive effect for physicians, it never had a negative effect for nurses and vice versa. In sum, although we found some interprofessional differences in Sample 2, we believe that these differences should not be overrated given the general similarities between physicians' and nurses' ratings.

Finally, our findings suggest interorganizational differences between the two hospitals: In Sample 1, expertise asymmetry was positively related to coordination quality and unrelated to communication openness. By contrast, in Sample 2, we find negative effects of expertise asymmetry, not only on communication openness, but also on coordination quality. How to explain this pattern? Although task and team composition are equal in both samples, the teams differ with regard to their stability (e.g., Hollenbeck et al., 2012): Whereas in the Swiss hospital, teams often disband

upon completion of one operation and new teams are formed ad-hoc, teams in the British hospital tend to work together over the course of an operating list, which includes several operations. More fluid action teams, such as in the first sample, must often coordinate tasks and solve problems immediately upon formation, even though they have limited experience working together (Klein et al., 2006; Vashdi et al., 2013; Wildman et al., 2012). Having hardly any time for team building, members of these teams have to rely on their initial assessment of their teammate's expertise. Consequently, expertise asymmetry becomes an important factor for coordinating tasks: Higher asymmetry indicates a clear differentiation of knowledge and skills within the team, and thus, facilitates coordination. By contrast, in action teams that work together over the course of multiple performance episodes, coordination does not have to be based on initial perceptions. Instead, team members might have developed routines for coordinating tasks, clarifying roles, and establishing a shared mental model, which represents an important factor for teamwork in healthcare (Burtscher, Kolbe, et al., 2011; Burtscher & Manser, 2012). It should be noted that our conclusion that team stability is the underlying factor explaining the interorganizational differences is at this point speculative. Consequently, future research should address this issue by comparing a larger set of organizations.

## Practical Implications

Our findings indicate that the presence of nurses with high expertise facilitates coordination quality and communication openness. This suggests that healthcare teams should indeed be interprofessional, and that the role of nurses be further recognized. Consequently, we state a need to plan interprofessional job roles and to allow for the necessary interprofessional training. Ideally, training interprofessional teamwork should start from medical and nursing schools: We cannot simply throw people into a team and expect them to work well together (e.g. Paige et al., 2017).

The need for early interprofessional training is further emphasized by our finding that nurses' expertise had fewer positive effects in teams with resident physicians. In the absence of respective training, physicians are forced to

learn working interprofessionally on the job. Apparently, senior physicians were able to acquire interprofessional teamwork skills over the course of their career, whereas junior physicians were not. Thus, specific training measures for developing interprofessional skills such as cross-training (e.g., Wilson et al., 2005) might be particularly beneficial for junior physicians.

Finally, our findings indicate that differences between the two hospitals – rather than differences between physicians and nurses – affect teamwork in healthcare. This should be considered when designing training and interventions: What works well in one hospital, might not have a positive effect in another, depending on the way in which teams are organized.

## Limitations and Future Research

The statistical analyses were conducted relying on APIM. Yet, as several physicians and nurses were part of different teams, although each team had a unique composition, our analyses do not respect the nested data structure completely (e.g., teams nested in nurses or physicians). We were unable to respect this data structure completely because of the relatively small number of physicians and nurses. This limitation reflects the reality of conducting field studies in hospitals with a restricted pool of potential participants. Still, in future studies, sample sizes should be larger to consider every individual only once or to respect the cross-nesting adequately.

Further, all our measures were self-report, which introduces the possibility of common-method bias (Podsakoff et al., 2012). We tried to decrease potential confounding effects by collecting predictor and outcomes variables at two different points in time. Moreover, the APIM accounts for correlations between predictors. Nonetheless, future research should aim to use alternative methods such as behavioral observation to assess the effects of expertise in healthcare action teams.

Our study was also limited in that it focused on anesthesiologists and nurse anesthetists. As they work within the same discipline, differences in expertise are relatively modest within these teams, at least compared to multidisciplinary teams. Future research therefore should try to consider the wider operating-room team, which also comprises surgeons and perioperative nurses, and commonly includes both senior members and trainees. Analyzing expertise asymmetry and its effects in such a complex dynamic team was beyond the scope of the current study, but we believe our study offers a foundation for such larger studies to be undertaken.

Moreover, future research should investigate additional aspects of expertise. While we think individual expertise,

team familiarity, and expertise asymmetry represent key aspects of expertise in healthcare teams, other aspects of expertise likely also play a role. For example, research has highlighted the importance of leadership in healthcare teams (Hu et al., 2016; Künzle et al., 2010; Tschan et al., 2006). Thus, leadership expertise would be another aspect worth considering.

## Conclusion

Our study showed that individual expertise, expertise asymmetry, and team familiarity all contribute to predicting both communication openness and coordination quality in healthcare action teams. Importantly, differences in the effects of expertise between the two hospitals in our study were more prevalent than interprofessional differences between physicians and nurses. In addition, the current research suggest that that expertise asymmetry explains variance above and beyond the other the variables. Overall, our findings provide a nuanced picture of the effects of expertise and thereby extend our understanding of interprofessional healthcare action teams, with potential implications for other action team settings.

## References

- Austin, J. R. (2003). Transactive memory in organizational groups: The effects of content, consensus, specialization, and accuracy on group performance. *Journal of Applied Psychology, 88*(5), 866–878. <https://doi.org/10.1037/0021-9010.88.5.866>
- Bonner, B. L., Baumann, M. R., & Dalal, R. S. (2002). The effects of member expertise on group decision-making and performance. *Organizational Behavior and Human Decision Processes, 88*(2), 719–736. [https://doi.org/10.1016/S0749-5978\(02\)00010-9](https://doi.org/10.1016/S0749-5978(02)00010-9)
- Bunderson, J. S. (2003). Recognizing and utilizing expertise in work groups: A status characteristics perspective. *Administrative Science Quarterly, 48*(4), 557–591. <https://doi.org/10.2307/3556637>
- Burtscher, M. J., Kolbe, M., Wacker, J., & Manser, T. (2011). Interactions of team mental models and monitoring behaviors predict team performance in simulated anesthesia inductions. *Journal of Experimental Psychology: Applied, 17*(3), 257–269. <https://doi.org/10.1037/a0025148>
- Burtscher, M. J., & Manser, T. (2012). Team mental models and their potential to improve teamwork and safety: A review and implications for future research in healthcare. *Safety Science, 50*(5), 1344–1354. <https://doi.org/10.1016/j.ssci.2011.12.033>
- Burtscher, M. J., Manser, T., Kolbe, M., Grote, G., Grande, B., Spahn, D. R., & Wacker, J. (2011). Adaptation in anaesthesia team coordination in response to a simulated critical event and its relationship to clinical performance. *British Journal of Anaesthesia, 106*(6), 801–806. <https://doi.org/10.1093/bja/aer039>
- Burtscher, M. J., Meyer, B., Jonas, K., Feese, S., & Tröster, G. (2018). A time to trust? The buffering effect of trust and its temporal variations in the context of high-reliability teams. *Journal of Organizational Behavior, 39*(9), 1099–1112. <https://doi.org/10.1002/job.2271>

- Burtscher, M. J., & Oostlander, J. (2019). Perceived mutual understanding (PMU). *European Journal of Psychological Assessment*, 35(1), 98–108. <https://doi.org/10.1027/1015-5759/a000360>
- Burtscher, M. J., Wacker, J., Grote, G., & Manser, T. (2010). Managing nonroutine events in anesthesia: The role of adaptive coordination. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 52(2), 282–294. <https://doi.org/10.1177/0018720809359178>
- Cannon-Bowers, J. A., & Bowers, C. (2011). Team development and functioning. In *APA handbook of industrial and organizational psychology* (Vol. 1, pp. 597–650). American Psychological Association
- Dinh, J. V., Traylor, A. M., Kilcullen, M. P., Perez, J. A., Schweissing, E. J., Venkatesh, A., & Salas, E. (2020). Cross-disciplinary care: A systematic review on teamwork processes in health care. *Small Group Research*, 51(1), 125–166. <https://doi.org/10.1177/1046496419872002>
- Edmondson, A. C. (2003). Speaking up in the operating room: How team leaders promote learning in interdisciplinary action teams. *Journal of Management Studies*, 40(6), 1419–1452. <https://doi.org/10.1111/1467-6486.00386>
- Ellwart, T., Konradt, U., & Rack, O. (2014). Team mental models of expertise location: Validation of a field survey measure. *Small Group Research*, 45(2), 119–153. <https://doi.org/10.1177/1046496414521303>
- Faraj, S., & Sproull, L. (2000). Coordinating expertise in software development teams. *Management Science*, 46(12), 1554–1568. <https://doi.org/10.1287/mnsc.46.12.1554.12072>
- Farh, C. I. C., & Chen, G. (2018). Leadership and member voice in action teams: Test of a dynamic phase model. *Journal of Applied Psychology*, 103(1), 97–110. <https://doi.org/10.1037/apl0000256>
- Fernandez Castela, E., Russo, S. G., Riethmüller, M., & Boos, M. (2013). Effects of team coordination during cardiopulmonary resuscitation: A systematic review of the literature. *Journal of Critical Care*, 28(4), 504–521. <https://doi.org/10.1016/j.jcrc.2013.01.005>
- Fernandez, R., Kozlowski, S. W. J., Shapiro, M. J., & Salas, E. (2008). Toward a definition of teamwork in emergency medicine. *Academic Emergency Medicine*, 15(11), 1104–1112. <https://doi.org/10.1111/j.1553-2712.2008.00250.x>
- Galinsky, A. D., Rucker, D. D., & Magee, J. C. (2015). Power: Past findings, present considerations, and future directions. In *APA handbook of personality and social psychology, Volume 3: Interpersonal relations* (pp. 421–460). American Psychological Association. <https://doi.org/10.1037/14344-016>
- Gardner, H. K., & Kwan, L. (2012). Expertise dissensus: A multi-level model of teams' differing perceptions about member expertise. *Harvard Business School Working Paper, Nr. 12-070*. [http://www.hbs.edu/faculty/Publication%20Files/12-070\\_3ac36b43-cafc-4831-a82c-9ff874cca074.pdf](http://www.hbs.edu/faculty/Publication%20Files/12-070_3ac36b43-cafc-4831-a82c-9ff874cca074.pdf)
- Greenberg, C. C., Regenbogen, S. E., Studdert, D. M., Lipsitz, S. R., Rogers, S. O., Zinner, M. J., & Gawande, A. A. (2007). Patterns of communication breakdowns resulting in injury to surgical patients. *Journal of the American College of Surgeons*, 204(4), 533–540. <https://doi.org/10.1016/j.jamcollsurg.2007.01.010>
- Guzzo, R. A., & Dickson, M. W. (1996). Teams in organizations: Recent research on performance and effectiveness. *Annual Review of Psychology*, 47(1), 307–338. <https://doi.org/10.1146/annurev.psych.47.1.307>
- Helmreich, R. L., & Schaefer, H.-G. (1994). Team performance in the operating room. In M. S. Bogner (Ed.), *Human error in medicine* (pp. 225–253). Erlbaum.
- Hollenbeck, J. R., Beersma, B., & Schouten, M. E. (2012). Beyond team types and taxonomies: A dimensional scaling conceptualization for team description. *Academy of Management Review*, 37(1), 82–106. <https://doi.org/10.5465/amr.2010.0181>
- Hu, Y.-Y., Parker, S. H., Lipsitz, S. R., Arriaga, A. F., Peyre, S. E., Corso, K. A., Roth, E. M., Yule, S. J., & Greenberg, C. C. (2016). Surgeons' leadership styles and team behavior in the operating room. *Journal of the American College of Surgeons*, 222(1), 41–51. <https://doi.org/10.1016/j.jamcollsurg.2015.09.013>
- Huckman, R. S., Staats, B. R., & Upton, D. M. (2009). Team familiarity, role experience, and performance: Evidence from Indian software services. *Management Science*, 55(1), 85–100. <https://doi.org/10.1287/mnsc.1080.0921>
- Hughes, A. M., Gregory, M. E., Joseph, D. L., Sonesh, S. C., Marlow, S. L., Lacerenza, C. N., Benishek, L. E., King, H. B., & Salas, E. (2016). Saving lives: A meta-analysis of team training in healthcare. *Journal of Applied Psychology*, 101(9), 1266–1304. <https://doi.org/10.1037/apl0000120>
- Ishak, A. W., & Ballard, D. I. (2012). Time to re-group: A typology and nested phase model for action teams. *Small Group Research*, 43(1), 3–29. <https://doi.org/10.1177/1046496411425250>
- Kenny, D., Kashy, D., & Cook, W. (2006). *Dyadic data analysis*. Guilford.
- Klein, K. J., Ziegert, J. C., Knight, A. P., & Xiao, Y. (2006). Dynamic delegation: Shared, hierarchical, and deindividualized leadership in extreme action teams. *Administrative Science Quarterly*, 51(4), 590–621. <https://doi.org/10.2189/asqu.51.4.590>
- Kolbe, M., Grote, G., Waller, M. J., Wacker, J., Grande, B., Burtscher, M. J., & Spahn, D. R. (2014). Monitoring and talking to the room: Autochthonous coordination patterns in team interaction and performance. *Journal of Applied Psychology*, 99(6), 1254–1267. <https://doi.org/10.1037/a0037877>
- Krenz, H. L., & Burtscher, M. J. (2020). Investigating voice in action teams: A critical review. *Cognition, Technology & Work*. <https://doi.org/10.1007/s10111-020-00646-9>
- Künzle, B., Kolbe, M., & Grote, G. (2010). Ensuring patient safety through effective leadership behaviour: A literature review. *Safety Science*, 48(1), 1–17. <https://doi.org/10.1016/j.ssci.2009.06.004>
- Kurmann, A., Keller, S., Tschan-Semmer, F., Seelandt, J., Semmer, N. K., Candinas, D., & Beldi, G. (2014). Impact of team familiarity in the operating room on surgical complications. *World Journal of Surgery*, 38(12), 3047–3052. <https://doi.org/10.1007/s00268-014-2680-2>
- Kvarnström, S. (2008). Difficulties in collaboration: A critical incident study of interprofessional healthcare teamwork. *Journal of Interprofessional Care*, 22(2), 191–203. <https://doi.org/10.1080/13561820701760600>
- Lewis, K. (2003). Measuring transactive memory systems in the field: Scale development and validation. *Journal of Applied Psychology*, 88(4), 587–604. <https://doi.org/10.1037/0021-9010.88.4.587>
- Lingard, L., Espin, S., Whyte, S., Regehr, G., Baker, G. R., Reznick, R., Bohnen, J., Orser, B., Doran, D., & Grober, E. (2004). Communication failures in the operating room: An observational classification of recurrent types and effects. *Quality and Safety in Health Care*, 330–334.
- Lingard, L., Reznick, R., DeVito, I., & Espin, S. (2002). Forming professional identities on the health care team: Discursive constructions on the “other” in the operating room. *Medical Education*, 36, 728–734.
- Littlepage, G., Robison, W., & Reddington, K. (1997). Effects of task experience and group experience on group performance, member ability, and recognition of expertise. *Organizational Behavior and Human Decision Processes*, 69(2), 133–147. <https://doi.org/10.1006/obhd.1997.2677>

- Littlepage, G. E., Schmidt, G. W., Whisler, E. W., & Frost, A. G. (1995). An input-process-output analysis of influence and performance in problem-solving groups. *Journal of Personality and Social Psychology*, 69(5), 877–889. <https://doi.org/10.1037/0022-3514.69.5.877>
- Manser, T. (2009). Teamwork and patient safety in dynamic domains of healthcare: A review of the literature. *Acta Anaesthesiologica Scandinavica*, 53(2), 143–151. <https://doi.org/10.1111/j.1399-6576.2008.01717.x>
- Manser, T., Harrison, T. K., Gaba, D. M., & Howard, S. K. (2009). Coordination patterns related to high clinical performance in a simulated anesthetic crisis. *Anesthesia & Analgesia*, 108(5), 1606–1615. <https://doi.org/10.1213/ane.0b013e3181981d36>
- Mazzocco, K., Petitti, D. B., Fong, K. T., Bonacum, D., Brooker, J., Graham, S., Lasky, R. E., Sexton, J. B., & Thomas, E. J. (2009). Surgical team behaviors and patient outcomes. *The American Journal of Surgery*, 197(5), 678–685. <https://doi.org/10.1016/j.amjsurg.2008.03.002>
- Michinov, E., Olivier-Chiron, E., Rusch, E., & Chiron, B. (2008). Influence of transactive memory on perceived performance, job satisfaction and identification in anaesthesia teams. *British Journal of Anaesthesia*, 100(3), 327–332. <https://doi.org/10.1093/bja/aem404>
- Muthén, L. K., & Muthén, B. O. (1998–2015). *Mplus user's guide* (7th ed.). Muthén & Muthén.
- Nagpal, K., Vats, A., Lamb, B., Ashrafian, H., Sevdalis, N., Vincent, C., & Moorthy, K. (2010). Information transfer and communication in surgery: A systematic review. *Annals of Surgery*, 252(2), 225–239. <https://doi.org/10.1097/SLA.0b013e3181e495c2>
- Noort, M. C., Reader, T. W., & Gillespie, A. (2019). Speaking up to prevent harm: A systematic review of the safety voice literature. *Safety Science*, 117, 375–387. <https://doi.org/10.1016/j.ssci.2019.04.039>
- O'Connor, P., O'Dea, A., Lydon, S., Offiah, G., Scott, J., Flannery, A., Lang, B., Hoban, A., Armstrong, C., & Byrne, D. (2016). A mixed-methods study of the causes and impact of poor teamwork between junior doctors and nurses. *International Journal for Quality in Health Care*. <https://doi.org/10.1093/intqhc/mzw036>
- O'Reilly, C. A., & Roberts, K. H. (1977). Task group structure, communication, and effectiveness in three organizations. *Journal of Applied Psychology*, 62(6), 674–681. <https://doi.org/10.1037/0021-9010.62.6.674>
- Oborn, E., Barrett, M., Gibson, S., & Gillard, S. (2019). Knowledge and expertise in care practices: The role of the peer worker in mental health teams. *Sociology of Health & Illness*, 41(7), 1305–1322. <https://doi.org/10.1111/1467-9566.12944>
- Paige, J. T., Garbee, D. D., Yu, Q., & Rusnak, V. (2017). Team training of inter-professional students (TTIPS) for improving teamwork. *BMJ Simulation and Technology Enhanced Learning*. <https://doi.org/10.1136/bmjstel-2017-000194>
- Patel, V. L., Cytryn, K. N., Shortliffe, E. H., & Safran, C. (2000). The collaborative health care team: The role of individual and group expertise. *Teaching and Learning in Medicine*, 12(3), 117–132. [https://doi.org/10.1207/s15328015tlm1203\\_2](https://doi.org/10.1207/s15328015tlm1203_2)
- Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, 63(1), 539–569. <https://doi.org/10.1146/annurev-psych-120710-100452>
- Powell, A. E., & Davies, H. T. O. (2012). The struggle to improve patient care in the face of professional boundaries. *Social Science & Medicine*, 75(5), 807–814. <https://doi.org/10.1016/j.socscimed.2012.03.049>
- Raemer, D. B., Kolbe, M., Minehart, R. D., Rudolph, J. W., & Pian-Smith, M. C. M. (2016). 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. *Academic Medicine*, 91(4), 530–539. <https://doi.org/10.1097/acm.0000000000001033>
- Reader, T. W., Flin, R., Mearns, K., & Cuthbertson, B. H. (2009). Developing a team performance framework for the intensive care unit. *Critical Care Medicine*, 37(5), 1787–1793. <https://doi.org/10.1097/CCM.0b013e31819f0451>
- Schmutz, J. B., Meier, L. L., & Manser, T. (2019). How effective is teamwork really? The relationship between teamwork and performance in healthcare teams: A systematic review and meta-analysis. *BMJ Open*, 9(9), e028280. <https://doi.org/10.1136/bmjopen-2018-028280>
- Sexton, J. B., Thomas, E. J., & Helmreich, R. L. (2000). Error, stress, and teamwork in medicine and aviation: Cross sectional surveys. *The BMJ*, 320(7237), 745–749. <https://doi.org/10.1136/bmj.320.7237.745>
- Sundstrom, E., McIntyre, M., Halfhill, T., & Richards, H. (2000). Work groups: From the Hawthorne Studies to the work teams of the 1990s. *Group Dynamics: Theory, Research, and Practice*, 4(1), 44–67. <https://doi.org/10.1037/1089-2699.4.1.44>
- Tan, K. T., Adzhahar, F. B. B., Lim, I., Chan, M., & Lim, W. S. (2014). Transactive memory system as a measure of collaborative practice in a geriatrics team: Implications for continuing interprofessional education. *Journal of Interprofessional Care*, 28(3), 239–245. <https://doi.org/10.3109/13561820.2014.901938>
- Thomas, E. J., Sexton, J. B., & Helmreich, R. L. (2003). Discrepant attitudes about teamwork among critical care nurses and physicians. *Critical Care Medicine*, 31(3), 956–959. <https://doi.org/10.1097/01.CCM.0000056183.89175.76>
- Tschan, F., Seelandt, J. C., Keller, S., Semmer, N. K., Kurmann, A., Candinas, D., & Beldi, G. (2015). Impact of case-relevant and case-irrelevant communication within the surgical team on surgical-site infection. *British Journal of Surgery*, 102(13), 1718–1725. <https://doi.org/10.1002/bjs.9927>
- Tschan, F., Semmer, N. K., Gautschi, D., Hunziker, P., Spychiger, M., & Marsch, S. U. (2006). Leading to recovery: Group performance and coordinative activities in medical emergency driven groups. *Human Performance*, 19(3), 277–304. [https://doi.org/10.1207/s15327043hup1903\\_5](https://doi.org/10.1207/s15327043hup1903_5)
- Vashdi, D. R., Bamberger, P. A., & Erez, M. (2013). Can surgical teams ever learn? The role of coordination, complexity, and transitivity in action team learning. *Academy of Management Journal*, 56(4), 945–971. <https://doi.org/10.5465/amj.2010.0501>
- Weiss, M., Kolbe, M., Grote, G., Spahn, D. R., & Grande, B. (2017). Why didn't you say something? Effects of after-event reviews on voice behaviour and hierarchy beliefs in multi-professional action teams. *European Journal of Work and Organizational Psychology*, 26(1), 66–80. <https://doi.org/10.1080/1359432x.2016.1208652>
- Wildman, J. L., Shuffler, M. L., Lazzara, E. H., Fiore, S. M., Burke, C. S., Salas, E., & Garven, S. (2012). Trust development in swift starting action teams: A multilevel framework. *Group & Organization Management*. <https://doi.org/10.1177/1059601111434202>
- Williams, M., Hevelone, N., Alban, R. F., Hardy, J. P., Oxman, D. A., Garcia, E., Thorsen, C., Frendl, G., & Rogers, S. O. Jr. (2010). Measuring communication in the surgical ICU: Better communication equals better care. *Journal of the American College of Surgeons*, 210(1), 17–22. <https://doi.org/10.1016/j.jamcollsurg.2009.09.025>
- Wilson, K. A., Burke, C. S., Priest, H. A., & Salas, E. (2005). Promoting health care safety through training high reliability teams. *Quality and Safety in Health Care*, 14(4), 303–309. <https://doi.org/10.1136/qshc.2004.010090>
- Xu, R., Carty, M., Orgill, D., Lipsitz, S., & Duclos, A. (2013). The teaming curve: A longitudinal study of the influence of surgical

team familiarity on operative time. *Annals of Surgery*, 258(6), 953–957. <https://doi.org/10.1097/SLA.0b013e3182864ffe>

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### Conflict of Interest

NS is the Director of London Safety & Training Solutions Ltd, which provides teamworking, patient safety, and improvement skills training and advice on a consultancy basis to hospitals and training programs in the UK and internationally. The other authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

### Authorship

MJB designed this study, prepared the study protocol, contributed to the data analyses, and drafted the manuscript. FWN analyzed the data, interpreted the findings, and helped to write the manuscript. NS was involved in the design of the study, helped with the data collection, and revised the manuscript. SG helped with the study protocol and the data collection and contributed to the manuscript. TM was involved in the design of the study and helped writing the manuscript.

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## Appendix

### Areas of Expertise for Anesthesia

- Operating the ventilator
- Handling stressful situations
- Infection control
- Intubation
- Dealing with ventilation problems
- Dealing with hemodynamic instability
- Drug administration
- Dealing with airway management problems
- Operating the syringe driver