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Impact of case-relevant and case-irrelevant communication within the surgical team on surgical site infection

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Background: Surgical-site infections (SSIs) are the most common complications after surgery. An influence from talking and distractions during surgery on patient outcomes has been suggested, but there is limited evidence. The aim of this prospective observational study was to assess the relationship between intraoperative communication within the surgical team and SSI, and between intraoperative distractions and SSI.

Methods: This prospective observational study included patients undergoing elective, open abdominal procedures. For each procedure, intraoperative case-relevant and case-irrelevant communication, and intraoperative distractions were observed continuously on site. The influence of communication and distractions on SSI after surgery was assessed using logistic regressions, adjusting for risk factors.

Results: A total of 167 observed procedures were analysed; their mean duration was 4.6(2.1) h. A total of 24 SSIs (14.4 per cent) were diagnosed. Case-relevant communication during the procedure was independently associated with a reduced incidence of organ/space SSI (propensity score-adjusted odds ratio 0.86, 95 per cent c.i. 0.77 to 0.97; $P=0.014$). Case-irrelevant communication during the closing phase of the procedure was independently associated with increased incidence of incisional SSI (propensity score-adjusted odds ratio 1.29, 1.08 to 1.55; $P=0.006$). Distractions had no association with SSI.

Conclusion: More case-relevant communication was associated with fewer organ/space SSIs, and more case-irrelevant communication during wound closure was associated with incisional SSI.

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Introduction

Surgical-site infections (SSIs) are the most common complications in surgery, with highest incidence rates after open abdominal procedures^{1,2}. Despite attempts to reduce SSIs through evidence-based practices, their incidence remains high^{3,4}. Most established risk factors for SSI refer to characteristics of the patient (such as co-morbidities, obesity) and the procedure (such as grade of contamination, duration)⁵. Few studies have explored the impact of the behaviour of the surgical personnel on SSI^{3,6,7}. These studies focused primarily on compliance with hygiene-related protocols and antiseptic procedures^{3,6}, and on the introduction of checklists⁷, but not on effects of teamwork and communication in the operating theatre.

Prospective observational studies during routine surgery emphasize the importance of good teamwork and

cooperation. Communication failures can be observed in almost every procedure⁸, and poor teamwork is linked to procedural error⁹. Briefing before surgery and information-sharing during surgery are related to fewer complications and less mortality¹⁰. With one notable exception¹⁰, the endpoints of studies investigating teamwork and communication in the operating theatre were not clinical outcomes. There is still little direct evidence of a relationship between intraoperative communication and postoperative complications¹¹.

Communication within the surgical team can be case-relevant or case-irrelevant (such as small-talk). Case-relevant communication assures the exchange of information¹⁰ and supports the team in developing a common understanding of the task¹². A common understanding, in turn, makes it easier for team members to anticipate developments and to align their actions



1 accordingly. As a result, team coordination should be
2 smoother^{13,14}, and performance should improve. Case-
3 irrelevant communication during surgery is more ambigu-
4 ous; it may promote a positive work environment in the
5 operative theatre¹⁵, but it also can divert the attention of
6 the surgical team from its main task, and has been found
7 to impair team performance^{16,17}.

8 Case-relevant and case-irrelevant communication may
9 have different effects in different phases of an operation.
10 Case-relevant communication is likely to be beneficial
11 throughout the surgery. Case-irrelevant communication is
12 more likely to occur during routine activities, such as the
13 wound closure phase¹⁸; it may thus distract surgeons while
14 they are suturing, which in turn may increase the risk of
15 incisional infections.

16 In addition to communication, distractions (such as
17 noises, traffic) may also compromise performance^{17,19}.
18 Previous studies have found that more distractions and
19 higher noise levels are related to poorer teamwork in the
20 operating theatre^{17,20}, and that more lapses in discipline
21 (operationalized as traffic, noise and visitors) are related to
22 a higher incidence of SSI³.

23 The primary goal of this prospective observational study
24 was to test the impact of communication within the surgi-
25 cal team on SSI for major elective open abdominal surgery.
26 Specifically, the effect of case-relevant and case-irrelevant
27 communication was studied during the whole surgical pro-
28 cedure, as well as during closure of the abdominal wound
29 on deep/organ and incisional SSI. The secondary aim was
30 to test the effect of distractions within the operating theatre
31 on the incidence of SSI.
32

33 **Methods**

34 **Study design and sample**

35 Patients undergoing elective open abdominal surgery
36 expected to last for at least 1 h were included, when
37 observers were available. Exclusion criteria were laparo-
38 scopic and emergency procedures, and pre-existing SSI.
39 The operations were performed in the visceral surgery
40 department and included procedures on the upper and
41 lower gastrointestinal tract and the hepatobiliary sys-
42 tem. All procedures were open, with median or oblique
43 laparotomy incisions.

44 The surgical procedures were observed by a team
45 of trained psychologists using a reliable observational
46 system²¹.

47 Surgical procedures were selected as follows. Each week,
48 the observer team indicated to the study coordinator the
49 days for which observers were available. The coordinator
50 then chose procedures that met the inclusion criteria for

those dates. If more than one operation met the inclusion
51 criteria, the first procedure of the day was chosen. For
52 225 days indicated, 171 suitable procedures were available
53 and observed. Four observed procedures were excluded
54 before analysis; two patients withdrew consent for the
55 follow-up interview, one patient died within 30 days, and
56 one procedure lasted for less than 30 min.
57

58 The operations were conducted in a Swiss university
59 hospital. They took place in one of three equally spaced
60 and identical operating theatres, all equipped with a
61 high-efficiency particulate air filter vertical laminar airflow
62 ventilation system. The surgical teams were composed of
63 at least one Board-certified surgeon, at least one resident,
64 one student, one scrub nurse, one or two circulating
65 nurses, at least one anaesthetist and one nurse anaesthetist.
66

67 The Internal Review Board of the Hospital approved the
68 study. All patients were informed about data collection.
69 Consent from all staff was obtained.
70

71 **Patients and procedures**

72 Preoperative preparation of the patient was performed
73 according to the standards of the clinic and included hair
74 clipping outside the operating theatre, skin disinfection
75 using povidone-iodine-based solution, administration of
76 antibiotics 60–30 min before the incision, with repetition
77 after 6 h of surgery. Drain placements including nasogastric
78 tubes; suture technique and postoperative care were per-
79 formed according to clinical standards.
80

81 Characteristics of the patient (age, sex, smoking history
82 within 30 days, excessive alcohol use, body mass index,
83 diabetes, oral steroid use, malignant diagnosis, American
84 Society of Anesthesiologists (ASA) physical status
85 classification) and of the surgical procedure (wound con-
86 tamination grade, type of surgery, duration of surgery,
87 bowel preparation, blood transfusion during surgery, and
88 whether or not a drain was placed) were extracted from the
89 patient file, surgery report and anaesthetics report. It was
90 also calculated whether the duration of the surgery was
91 above standard values (the 75th percentile) for each type
92 of surgery, as part of the National Nosocomial Infections
93 Surveillance (NNIS) Risk Index, which estimates risks of
94 infection after different procedures².
95

96 **Primary study endpoint**

97 Independent and trained infection control practitioners
98 assessed the presence of SSI according to standards defined
99 by the Centers for Disease Control and Prevention²². This
100 protocol also includes a follow-up phone call 30 days after
101 surgery. If an SSI was suspected, consultants or general
102
103
104



1 practitioners were asked to confirm and classify it. SSIs
2 were grouped as: superficial incisional, deep incisional, or
3 organ/space SSI. In line with other authors^{3,23}, superficial
4 and deep incisional SSI were combined into one category.

6 Assessment of communication and distractions

7
8 Case-relevant and case-irrelevant communication, as well
9 as distractions during the procedure, were assessed by
10 direct observation. Trained psychologists observed the
11 operations using an event-coding observational system that
12 has been shown to be reliable²¹. Observers were located in
13 the operating theatre, about 1.5 m from the operation table,
14 facing the lead surgeon. The observations started when the
15 patient was wheeled into the theatre, and ended with the
16 last suture. Analyses refer to the time between incision and
17 insertion of the last stitch.

18 Each exchange of communication within the sterile team
19 (surgeons and scrub nurses), and between the sterile team
20 and anaesthetists, was time-stamped and coded as either
21 case-relevant or case-irrelevant. An exchange of commu-
22 nication was defined as one or several verbal statements
23 related to the same theme and not interrupted by pauses²¹.

24 Case-relevant communication was defined as: exchange
25 about the patient in surgery or the procedure performed.
26 This included: communication about current or future
27 actions and explanations (for example, the surgeons talk
28 about the next steps of the procedure); leadership state-
29 ments (for example, the surgeon requests insertion of a
30 nasogastric tube); and case-related teaching (for example,
31 the surgeon replies to a question on the use of a spe-
32 cific instrument)²¹. Case-relevant communication was
33 expressed as the mean per hour for the entire procedure.

34 Case-irrelevant communication was coded when mem-
35 bers of the sterile team: talked about topics unrelated
36 to the patient or the procedure; or joked or laughed²¹.
37 Case-irrelevant communication was also expressed as the
38 mean per hour for the entire procedure, and as the mean
39 count during the wound closure phase. The closure phase
40 was defined as the last 20 min of the procedure, because
41 this is the duration required for suturing the abdominal fas-
42 cia and skin after midline or oblique laparotomy. This was
43 independent of the duration of the whole procedure.

44 Distraction coding included the following events: noise
45 events produced by a member of the non-sterile team (for
46 instance loud noises when opening packages); traffic in
47 the operating theatre (operationalized by counting doors
48 to the theatre that were opened); and side-conversations
49 in the theatre (non-sterile personnel, including the anaes-
50 thetist, scrub nurses, technicians and visitors engaging
51 in conversation with one another, unless those conver-
52 sations were very quiet). Noise events, door openings

and side-conversations were each expressed as the mean
per hour.

To assess interobserver agreement, 29 (17.4 per cent)
of the 167 operations were observed simultaneously by
two observers. Cohen's weighted κ was used to assess
interobserver agreement, based on 5-min intervals. All
values of κ were greater than 0.70, which is considered
substantial agreement²⁴.

Statistical analysis

The prespecified primary outcomes were incisional or
organ/space SSI. Descriptive information was expressed as
frequencies and percentages for categorical variables, and
as mean(s.d.) for continuous variables. To assess associa-
tions of SSI rates with patient characteristics, procedure
characteristics, communication and distractions, univari-
able logistic regression analyses were performed. Because
the number of outcome events (SSIs) was small, conven-
tional multivariable analysis with all baseline characteristics
as co-variables was not feasible. Therefore the propensity
score co-variable adjustment technique was used^{25,26}. The
variables included in the propensity score were selected
based on *a priori* considerations (Table 1).

Probability values and 95 per cent c.i. were two-tailed.
SPSS® for Windows® version 22 software (IBM, Armonk,
New York, USA) was used for analysis; $P < 0.050$ was
considered statistically significant. Because no previous
research provided expected effect sizes for the type of
procedures, sample size considerations were based on the
recommendations of Peduzzi and colleagues²⁷, assuming
an overall infection rate of 15–20 per cent.

Results

A total of 167 observed procedures were analysed; their
mean duration was 4.6(2.1)h. Twenty-four patients
(14.4 per cent) developed an SSI; 14 (8.4 per cent) were
deep/organ space SSI and ten (6.0 per cent) incisional SSI.
Descriptive statistics and results of univariable logistic
regression relating patient characteristics and surgery
characteristics to SSI are shown in Table 1. No patient
characteristic or procedure type was significantly related
to SSI. Among the surgical risk factors, blood transfu-
sion during surgery was a significant univariable risk for
incisional, as well for organ/space SSI.

Case-relevant and case-irrelevant communication

Separate univariable analyses showed that case-relevant
communication throughout the procedure was signifi-
cantly associated with a lower risk of space/organ SSI.



Table 1 Patient and surgery characteristics; descriptive statistics and univariable relationships to incisional and organ/space surgical-site infection

	Overall (n = 167)		Organ/space SSI (n = 14)			Incisional SSI (n = 10)		
	No SSI (n = 143)	n*	OR‡	P	n*	OR‡	P	
Patient characteristics								
Age (years)†	61.5(14.5)	60.9(14.6)	63.1(14.3)	1.01(0.97, 1.05)	0.580	67.6(12.5)	1.04(0.98, 1.1)	0.163
Male sex	90 (53.9)	77 (53.8)	7 (50)	0.86 (0.29, 2.57)	0.783	6 (60)	1.29 (0.35, 4.75)	0.706
Smoking in past 30 days	40 (24.0)	37 (25.9)	1 (7)	0.22 (0.03, 1.74)	0.152	2 (20)	0.72 (0.15, 3.53)	0.682
Excessive alcohol use	32 (19.2)	27 (18.9)	3 (21)	1.17 (0.31, 4.49)	0.817	2 (20)	1.07 (0.22, 5.35)	0.930
BMI > 27 kg/m ²	61 (36.5)	52 (36.4)	6 (43)	1.31 (0.43, 3.99)	0.632	3 (30)	0.75 (0.19, 3.03)	0.686
Diabetes mellitus	30 (18.0)	27 (18.9)	2 (14)	0.72 (0.15, 3.39)	0.674	1 (10)	0.48 (0.06, 3.93)	0.492
Oral steroid use	18 (10.8)	15 (10.5)	1 (7)	0.66 (0.08, 5.38)	0.695	2 (20)	2.13 (0.41, 10.99)	0.365
Malignant condition	118 (70.7)	98 (68.5)	12 (86)	2.76 (0.59, 12.83)	0.197	8 (80)	1.84 (0.37, 8.99)	0.453
Surgery characteristics								
Type of surgery								
Upper GI tract	30 (18.0)	29 (20.3)	1 (7)	0.30 (0.04, 2.41)	0.258	0 (0)	–	–
Liver/pancreas	88 (52.7)	73 (51.0)	9 (64)	1.73 (0.55, 5.4)	0.349	6 (60)	1.44 (0.39, 5.32)	0.586
Lower GI tract	33 (19.8)	27 (18.9)	3 (21)	1.17 (0.31, 4.49)	0.817	3 (30)	1.84 (0.45, 7.59)	0.398
Other	16 (9.6)	14 (9.8)	1 (7)	0.71 (0.09, 5.83)	0.749	1 (10)	1.02 (0.12, 8.69)	0.983
Bowel preparation	12 (7.2)	131 (91.6)	1 (7)	0.84 (0.10, 6.98)	0.872	0 (0)	–	–
Duration of surgery (h)†	4.6(2.1)	4.4(1.9)	5.5(2.3)	1.26(0.99, 1.67)	0.064	5.7(3.8)	1.32(1.00, 1.74)	0.047
Duration of surgery > 75th percentile	111 (66.5)	91 (63.6)	12 (86)	3.43 (0.74, 15.92)	0.116	8 (80)	2.29 (0.47, 11.17)	0.307
Blood transfusion during surgery	41 (24.6)	29 (20.3)	7 (50)	3.93 (1.28, 12.09)	0.017	5 (50)	3.93 (1.07, 14.5)	0.040
Drain placed	137 (82.0)	115 (80.4)	13 (93)	3.17 (0.40, 25.22)	0.277	9 (90)	2.19 (0.27, 18.02)	0.466
ASA fitness grade > II	108 (64.7)	94 (65.7)	7 (50)	0.49 (0.16, 1.48)	0.205	7 (70)	1.14 (0.28, 4.62)	0.852
Wound contamination grade > 2	15 (9.0)	14 (9.8)	1 (7)	0.71 (0.09, 5.83)	0.749	0 (0)	–	–

*Number of patients with percentages in parentheses unless indicated otherwise; values are †mean(s.d.) and ‡95 per cent c.i. in parentheses. All patient and surgery characteristics were included in the propensity score. SSI, surgical-site infection; OR, odds ratio; BMI, body mass index; GI, gastrointestinal; ASA, American Society of Anesthesiologists.

Table 2 Communication and distractions during surgery; descriptive statistics, univariable and propensity score-adjusted relationship to incisional or organ/space surgical-site infection

	Organ/space SSI					Incisional SSI						
	Overall*	No SSI*	Mean (s.d.)*	Univariable OR†	Adjusted OR†	Mean (s.d.)*	Univariable OR†	Adjusted OR†	P	P		
Communication												
Case-relevant communication	19.2(6.5)	19.4(6.7)	15.4(3.2)	0.90 (0.81, 0.99)	0.030	0.86 (0.77, 0.97)	0.014	21.6(4.9)	1.05 (0.96, 1.16)	0.296	1.08 (0.95, 1.23)	0.239
Case-irrelevant communication												
Whole procedure	6.2(4.3)	6.0(3.7)	5.9(6.1)	0.98 (0.85, 1.13)	0.780	1.00 (0.86, 1.17)	0.955	9.5(7.8)	1.13 (1.02, 1.26)	0.023	1.19 (1.04, 1.36)	0.012
During closure	3.1(3.2)	2.9(2.9)	2.92(3.3)	1.01 (0.83, 1.22)	0.939	0.98 (0.81, 1.2)	0.869	6.9(4.5)	1.31 (1.12-1.53)	0.001	1.29 (1.08, 1.55)	0.006
Distractions												
Noise	10.2(4.4)	10.4(4.4)	8.3(3.3)	0.87 (0.75, 1.02)	0.088	0.84 (0.71, 1.01)	0.057	10.3(4.7)	1.00 (0.86, 1.16)	0.993	0.97 (0.82, 1.15)	0.723
Door openings (traffic)	31.8(6.3)	31.8(6.6)	31.8(4.6)	1.00 (0.92, 1.09)	0.990	0.99 (0.90, 1.09)	0.787	31.2(5.7)	0.98 (0.89, 1.09)	0.749	0.93 (0.83, 1.05)	0.245
Side-conversations	10.5(5.2)	10.5(5.4)	9.9(3.3)	0.98 (0.87, 1.09)	0.684	0.98 (0.87, 1.10)	0.674	12.6(4.9)	1.07 (0.96, 1.19)	0.222	1.08 (0.95, 1.23)	0.229

*Values are mean(s.d.) events per hour. †values in parentheses are 95 per cent c.i. SSI, surgical-site infection; OR, odds ratio.

Case-irrelevant communication during the whole procedure, and during the closure phase, was a significant univariable risk factor for incisional SSI (Table 2).

Taking known risk factors for SSI into account, adjusted logistic regression analysis was performed, including the propensity score (Table 2). As information on ASA fitness grade, which is part of the NNIS Risk Index, was missing

for three procedures (no SSI), the adjusted logistic regression analysis is based on 164 operations.

The adjusted model shows that more case-relevant communication during the whole procedure (events per hour) was associated with a decreased incidence in organ/space SSI (Fig. 1) (adjusted odds ratio (OR) 0.86, 95 per cent c.i. 0.77 to 0.97; P = 0.014).

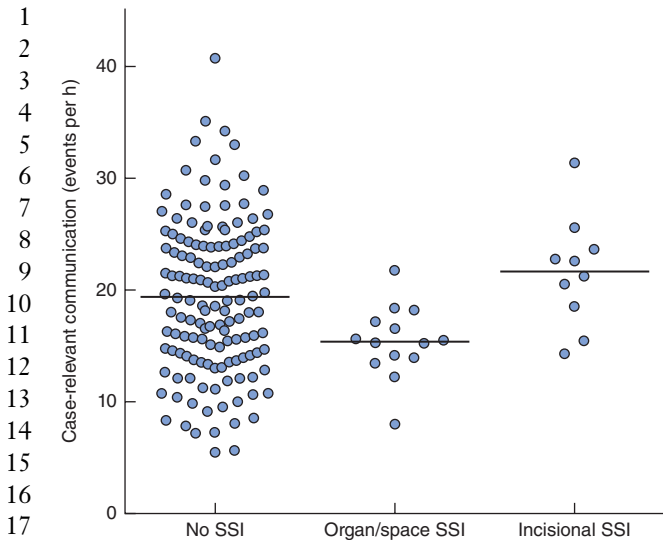


Fig. 1 Case-relevant communication per hour for procedures with no surgical-site infection (SSI) (143 patients), organ/space SSI (14) or incisional SSI (10). Bars denote mean values

Regarding incisional SSI, the adjusted model for case-irrelevant communication throughout the procedure (events per hour) showed that more case-irrelevant communication overall was related to a higher incidence of incisional SSI (adjusted OR 1.19, 1.04 to 1.36; $P=0.012$). In particular, more case-irrelevant communication during closure was related to a higher incidence of incisional SSI (adjusted OR 1.29, 1.08 to 1.55; $P=0.006$). To investigate whether the effect was due to case-irrelevant communication overall, or to case-irrelevant communication during the closure phase, a logistic regression model was used, adjusting for the effect of case-irrelevant communication during closure for the propensity score, as well as for case-irrelevant communication before closure. The results show that more case-irrelevant communication during closure remained significantly related to a higher risk of incisional SSI (adjusted OR 1.23, 1.01 to 1.50; $P=0.048$), whereas case-irrelevant communication before closure was not significant (adjusted OR 1.09, 0.92 to 1.29; $P=0.308$) (Fig. 2).

Perioperative distractions

None of the observed distractions (noise events, door openings, side-conversations) was significantly related to incisional or organ/space SSI in univariable or propensity score-adjusted logistic regression analyses (Table 2).

Discussion

In this study, more case-relevant communication during the whole procedure was associated with a lower risk of

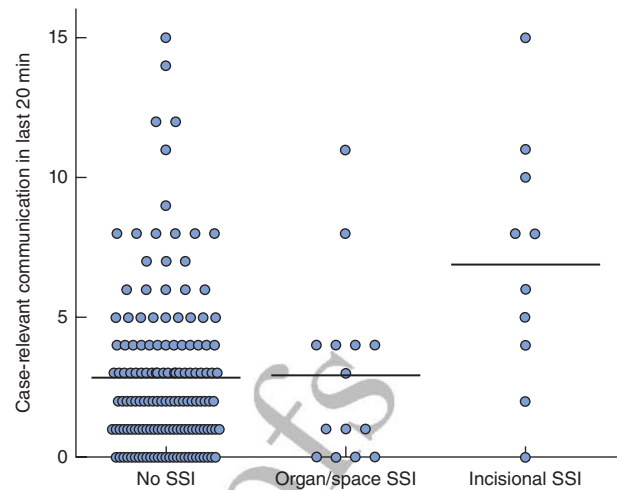


Fig. 2 Case-irrelevant communication in the last 20 min of procedures with no surgical-site infection (SSI) (143 patients), organ/space SSI (14) or incisional SSI (10). Bars denote mean values

organ/space SSI, whereas more case-irrelevant communication during the closure phase was associated with an increased risk of incisional SSI. Distractions were not associated with SSI.

Case-relevant communication assures the exchange of information^{28,29}; less sharing of information has been found to be related to more complications¹⁰. Exchanging case-relevant information may foster a shared understanding of the task within the team. Indeed, studies from medicine and other fields have shown that task-related communication helps team members to cooperate more smoothly³⁰; this is likely to be particularly important during difficult phases of the operation¹⁰. Smooth cooperation implies that the surgeons do not have to switch attention between their primary task and the need to assure team coordination, thus avoiding microinterruptions. In addition, persistent misunderstandings and loss of information have been observed frequently in surgery^{8,31}; they may be attenuated by exchanging more case-relevant communication during the procedure.

Things are more complex for case-irrelevant communication. Case-irrelevant communication may improve team climate. Relaxed communication and the use of humour are seen as an important part of team-building processes^{9,32}. However, case-irrelevant communication may also divert attention from the primary task and may impair performance^{17,19}. The present results support the distracting effect of case-irrelevant communication under specific circumstances: case-irrelevant communication predicted incisional SSI. It appears that case-irrelevant



1 communication during closure was responsible for the
2 higher rate of wound infection.

3 During closure, the most difficult part of the operation
4 is over, and routine activities are left for most team mem-
5 bers (clearing and removing equipment). During routine
6 phases, teams are more likely to engage in case-irrelevant
7 talk¹⁸, which may increase the probability of minor errors
8 for several reasons. First, performing a manual task while
9 engaging in an unrelated conversation is a form of multi-
10 tasking, which may increase the likelihood of errors³³.
11 Second, negative effects of demanding tasks often mani-
12 fest themselves only after the period of high workload³⁴,
13 because attentiveness often decreases when people start
14 to relax. For example, residents working long hours have
15 more car accidents on their way home³⁵. Third, although
16 supervised by an experienced surgeon, closure of the
17 abdominal wall is often performed by a junior surgeon,
18 for whom suturing is not yet a routine task^{36,37}. In con-
19 trast to experienced surgeons, who can shield themselves
20 quite well from distractions^{38,39}, the performance of junior
21 surgeons, including manual performance, tends to degrade
22 in distracting environments^{16,40–42}. Lower concentration
23 may induce less careful suturing, more damaged tissue, or
24 too much tension in the sutures, thus raising the risk of
25 incisional SSI. Fatigue may be an additional aggravating
26 factor⁴³.

27 These results confirm the findings of a previous study³
28 suggesting that lapses in discipline increase the risk of SSI.
29 They refine these earlier findings by identifying the most
30 sensitive phase (wound closure) for this effect. It is, how-
31 ever, not clear why only case-irrelevant communication
32 affected the surgeons in the closure phase, and other dis-
33 tractions did not. It is possible that conversation conveys
34 meaning to a greater extent than other distractions. Mean-
35 ingful noise is difficult to ignore⁴⁴, and is more likely to
36 impair concentration and coordination¹⁷.

37 This study also adds to the growing evidence that
38 the quality of teamwork in the operating theatre is
39 related to patient outcomes¹¹. A shared understanding
40 of important characteristics of a situation is a central
41 feature of good teamwork, as suggested by the finding
42 that operations done by familiar teams result in fewer
43 complications^{45,46}. Case-related communication may be
44 an efficient way to achieve this common understanding.
45 However, there is an alternative explanation that cannot
46 be ruled out: it is possible that case-related is simply a
47 marker of good teamwork. This alternative explanation
48 would imply that improving teamwork would result in
49 better communication; the present interpretation implies
50 that improving communication would result in better
51 teamwork.
52

Using behaviour observation as a method, and simulta-
neously assessing case-relevant and case-irrelevant com-
munication as well as distractions, constitutes a strength
of this study. This method allowed communication to be
assessed separately during the closure phase of the pro-
cedure. Furthermore, whereas most other studies investi-
gated procedures lasting less than 2 h⁴⁷, this study focused
on long, open abdominal procedures with the highest risk
of SSI. A strength of this study is also the focus on every-
day behaviour, rather than on communication failure^{48,49};
general, ordinary aspects of communication measurably
affected SSI. This supports previous findings that intraop-
erative behaviour that is not dramatic, yet lacks focus, may
cause minor errors that often go unnoticed³.

The present study is limited by the fact that a controlled
randomized design was not feasible; instead a prospective
design was adopted. However, reverse causation is not a
plausible explanation for the present results, because SSIs
were assessed after the operation and pre-existing SSIs
were excluded. Most importantly, the exact mechanisms
linking communication events to SSI remain unexplored.
Because this was a single-site study and only elective open
abdominal surgery was included, generalization of the
results is limited. Many confounding factors, including
team climate, and thus probably also communication, may
vary considerably between hospitals⁵⁰.

This study measured the effect of intraoperative com-
munication on SSIs because they are the most frequent
complications in surgery. The results highlight the impor-
tance of understanding intraoperative communication.
Case-relevant communication during the whole proce-
dure appeared to reduce the risk of organ/space SSI,
whereas case-irrelevant communication during the closure
phase seemed to increase the risk of incisional SSI. Yet,
case-irrelevant communication can foster a positive team
climate⁹, and it is understandable that the surgical team
relaxes after a long and difficult procedure¹⁸. Prohibiting
case-irrelevant communication might create tension and
frustration, which may have detrimental effects. It may
be more appropriate for teams to adapt behaviour to the
situation by allowing a short period of tension release
or a break, before focusing anew on the task of wound
closure⁵¹.

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