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Reasons for the persistence of adverse events in the era of safer surgery – a qualitative approach

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Summary

OBJECTIVE: We sought to evaluate potential reasons given by board-certified doctors for the persistence of adverse events despite efforts to improve patient safety in Switzerland.

SUMMARY BACKGROUND DATA: In recent years, substantial efforts have been made to improve patient safety by introducing surgical safety checklists to standardise surgeries and team procedures. Still, a high number of adverse events remain.

METHODS: Clinic directors in operative medicine in Switzerland were asked to answer two questions concerning the reasons for persistence of adverse events, and the advantages and disadvantages of introducing and implementing surgical safety checklists. Of 799 clinic directors, the arguments of 237 (29.7%) were content-analysed using Mayring's content analysis method, resulting in 12 different categories.

RESULTS: Potential reasons for the persistence of adverse events were mainly seen as being related to the "individual" (126/237, 53.2%), but directors of high-volume clinics identified factors related to the "group and interactions" significantly more often as a reason (60.2% vs 40.2%; p = 0.003). Surgical safety checklists were thought to have positive effects on the "organisational level" (47/237, 19.8%), the "team level" (37/237, 15.6%) and the "patient level" (40/237, 16.9%), with a "lack of willingness to implement checklists" as the main disadvantage (34/237, 14.3%).

CONCLUSION: This qualitative study revealed the individual as the main player in the persistence of adverse events. Working conditions should be optimised to minimise interface problems in the case of cross-covering of patients, to assure support for students, residents and interns, and to reduce strain. Checklists are helpful on an "organisational level" (e.g., financial benefits, quality assurance) and to clarify responsibilities.

Key words: *adverse event; patient safety; surgical checklist; qualitative analysis; individual; working conditions; organisational level*

Introduction

Worldwide, between 45,000 and 100,000 patients die because of medical errors each year [1]. A systematic review suggested that the median overall incidence of in-hospital adverse events in industrialised countries amounts to 9.2%, of which, 43.5% were regarded as preventable [2]. Preventable adverse events lead to transient impairment in 30% to 50% of patients, to permanent impairment in 9% and even death in 3%, respectively [3].

Almost two-thirds of adverse events are associated with surgical care, with more than half of these events being operation-related or drug-related (i.e., administering the wrong type of medication, under-/over-dosing, adverse drug reactions) [2, 4]. A recent Dutch study showed that infection, bleeding, and injury due to a mechanical, physical, or chemical cause formed the largest group of injuries, as a result of surgical adverse events [4]. Almost half of the surgery-related adverse events were judged to be preventable.

In October 2004, the World Health Organisation (WHO) launched a patient safety programme to coordinate, disseminate, and accelerate improvements in patient safety worldwide [5]. The WHO World Alliance for Patient Safety has recognised the importance of creating an international language for patient safety, which led to the development of a conceptual framework for an International Classification for Patient Safety (ICPS) [6, 7]. Their goal was to enable the categorisation of patient safety information into a standardised set of concepts [7].

Important strategies to reduce medical errors include guidelines, clinical pathways, and other standardisation of procedures and improvement of communication; whereas the most important might be the implementation of checklists [8–10]. Checklists are well established in high-risk industries, such as aviation, aeronautics, and nuclear power plants. A perioperative checklist was published by the WHO in 2008 with the aim of decreasing the risk of human error and communication failures [11, 12]. At this time, about three quarters of clinics in operative medicine in Switzerland use checklists [13].

In comparison to the United States, measures related to patient safety are less developed in Switzerland, less widespread, and are subject to more resistance than in the US [14]. For Switzerland, the high number and type of adverse events and near misses reported in the Swiss Critical Incidence Reporting System (CIRS) is compelling evidence for the need to improve patient safety in Switzerland [15, 16].
The present study evaluated the potential reasons for the persistence of adverse events despite efforts to improve patient safety in Switzerland by analysing the advantages and disadvantages of introducing and implementing surgical safety checklists using free-reply arguments from directors of clinics in operative medicine.

Methods

Study design

For this qualitative study, an anonymous electronic survey was sent to all directors of clinics in operative medicine in Switzerland (classified according to the Swiss Medical Association [FMH]) during spring 2011 [17]. Eligible clinics were identified from the database of the Swiss college of surgeons (fmCh), the umbrella organisation of all surgical disciplines in medicine in Switzerland [18]. As the survey addressed healthy people on a voluntary basis, this study did not require further ethical considerations. The data were collected, stored, analysed, and shared in strict adherence with the ethics committee standards of our institution.

Assessment of responses

The electronic questionnaire consisted of multiple-choice and free-response items. The free-response items were embedded in the multiple-choice questions addressing the issues of what might be the reasons for the persistence of adverse events and what was the role of surgical safety checklists. The free-response items of the questionnaire read as follows: (1.) "Where do you see potential reasons for the persistence of adverse events in operative medicine in Switzerland? Please mention three arguments for each of the subsequent levels: The level of implementation (at the patient's bedside), the superordinate level (politics, authorities, administration) and on other levels." (2.) "Where do you personally see disadvantages or advantages of introducing and implementing surgical safety checklists in a clinic in operative medicine?"
The multiple-choice questions addressed information on the use of surgical safety checklists, acceptance problems during their introduction and acceptance problems of their use at the time of the survey. On the question regarding the degree of acceptance problems, the respondents were asked to reply based on a five-point Likert scale (1 = "no problems" to 5 = "very serious problems"). Furthermore, the questionnaire included information on hospital category, specialty, and size of the participating clinic (number of surgeries per year) (see supplementary material). Clinics with more than the median number of 2,200 surgeries/year were defined as high-volume clinics.

Data analysis

The focus of the present study was the analysis of the qualitative answers of the clinic directors. Analyses were done by two independent psychologists well-trained in qualitative statistics using Mayring's content analysis [19]: First, by defining the level of abstraction for the inductive formation of categories, and, second, by stepwise inductive formulating of content categories and generating of a code manual. Inter-rater reliability was calculated with Cohen's Kappa. Correlation analysis was performed using two-sided Spearman's rank correlation test. Categorical variables were dichotomised and analysed with chi-square tests. A p-value of 0.05 was considered as statistically significant; tests were two-tailed. All statistical analyses were calculated with SPSS statistical software Version 20 (SPSS Inc.; Chicago, USA).
Statements given by the participants were grouped in different categories.
Categories and subcategories were assigned "1" if they were mentioned and "0" if they were missing. Summarising of mentioned subcategories into the main category resulted in value "1", regardless of how often the subcategories were named. The number of respondents per (sub)category were summarised, and frequencies were calculated.

Results

Of 799 surveys mailed, there were 237 responses (response rate of 29.7%). Overall, 172/233 (73.8%) participants used surgical checklists with a median time since introduction of 24 (range 12–264) months (4 missing values). Of the respondents using checklists, acceptance problems during the introduction of surgical checklists were reported by 99/168 (58.9%; 4 missing values), acceptance problems at the time of the survey by 53/165 (32.1%; 7 missing values). The specialties of the participating clinic directors are shown in table 1.
Regarding the subsequent qualitative analysis, Cohen's Kappa was calculated on 27% of the statements and revealed good inter-rater reliability (0.79).

Reasons for the potential persistence of adverse events

The 237 participants gave a total of 377 arguments for the potential persistence of adverse events grouped in four different categories. The four categories were: "context" (48/237, 20.3%), "organisation" (89/237, 37.6%), "group/interaction" (114/237, 48.1%), and "individual" (126/237, 53.2%). All categories including subcategories and representative examples are shown in table 2.
Clinic directors of general surgery units significantly more often indicated arguments in the combined subcategories "labour turnover/shift change" and "interfaces/unclear lines of responsibility" compared with directors of more specialised clinics (16/66 (24.2%) vs 23/170 (13.5%); p= 0.012). Regarding the hospital category, directors of university hospitals named significantly more arguments in the summarised subcategories "unclear procedures", "routine" and "emergencies" (5/22 (22.7%) vs 18/212 (8.5%); p = 0.033). For high-volume clinics, significantly more mentions were found in the category "group/interac-

tion" (65/108 (60.2%) vs 45/112 (40.2%); p = 0.003), the combined subcategories "labour turnover/shift change", and "interfaces/unclear lines of responsibility" (25/108 (23.1%) vs 14/112 (12.5%); p = 0.039), and the subcategory "lack of discipline/motivation" (25/108 (23.1%) vs 9/112 (8.0%); p = 0.002). The correlation between hospital category and number of surgeries was small and nonsignificant (r= –0.052; p = 0.440).

Advantages and disadvantages of introducing and implementing surgical safety checklists

The participants (n = 237) gave a total of 149 advantages and 103 disadvantages with regard to introducing and implementing surgical safety checklists; they were grouped in four main categories each.

The advantages were categorised in: "nonspecific advantages" (25/237, 10.5%), "organisational level" (47/237, 19.8%), "team level" (37/237, 15.6%), and "patient level" (40/237, 16.9%); the disadvantages in the categories "implementation difficulties" (12/237, 5.1%), "application" (26/237, 11.0%), "willingness to implement" (34/237, 14.3%), and "effort" (31/237, 13.1%). All categories including subcategories and representative examples of advantages and disadvantages are shown in tables 3 and 4, respectively.

Clinic directors of general surgery indicated significantly more often disadvantages of introducing and implementing surgical safety checklists compared with other specialties (32/66 (48.5%%) vs 57/179 (33.5%); p = 0.033). They also mentioned significantly more often the category "implementation difficulties" (7/66 (10.6%) vs 5/170 (2.9%); p= 0.016) as well as the subcategories "dependence on hospital size" (4/66 (6.1%) vs 2/170 (1.2%); p = 0.032) and "acceptance" (12/66 (18.2%) vs 12/170 (7.1%); p = 0.011) as disadvantages.

Regarding the hospital category, clinic directors of university hospitals gave significantly more arguments in the subcategory "commitment" (3/22 (13.6%) vs 7/212 (3.3%); p = 0.023) as disadvantage. As disadvantages, directors of high-volume clinics gave significantly fewer arguments in the subcategory "paperwork" (1/108 (0.9%) vs 8/112 (7.1%); p = 0.020) and significantly more in the subcategories "control" (6/108 (5.6%) vs 0/112 (0.0%); p = 0.011) and "commitment" (9/108 (8.3%) vs 1/112 (0.9%); p = 0.008) as well as in the categories "implementation difficulties" (5/108 (4.6%) vs 0/112 (0.0%); p = 0.021) and "willingness to implement" (24/108 (22.2%) vs 10/112 (8.9%); p = 0.006).

Discussion

In recent years, substantial efforts have been made to improve patient safety by introducing surgical safety checklists to standardise surgeries and team procedures [11, 12]. To examine the potential reasons for the persistence of adverse events in surgery and the role of surgical safety checklists, the present qualitative study analyses the arguments of clinic directors in operative medicine in Switzerland.

It shows that the reasons for adverse events were mainly seen as being related to the "individual" (e.g., violation of rules, lack of experience, mistakes, and strain). Compared with participants of other operative disciplines, general surgeons named "labour turnover and shift changes" significantly more often as a reason for potential adverse events. Participants of high-volume clinics identified the "group and interactions" significantly more often as a potential reason. Checklists were thought to have potentially positive effects on the "organisational level", the "team level", and the "patient level"; with a "lack of willingness to implement" checklists in general as the potential main disadvantage.

The participants see the most important reason for adverse events in surgery in the "individual" itself, mentioning "lack of personal experience", problems with "dealing with rules and regulations", "motivational factors", "strain" and "overfatigue" as interfering factors. The actual health care system relies heavily on the work of inexperienced novices (e.g., students, interns, and residents), which might increase the rate of adverse events [20]. Several studies also suggest an association between sleep deprivation, extended work shifts, chronic staff shortage, and stress with more errors and adverse events [21–23]. Interestingly, studies on restrictions of work-hours, however, did not show an improvement in patient safety, whereas the reasons remained widely elusive [24, 25].

Problems related to "organisation" and "communication" are also seen to contribute to adverse events. Compared with participants of other operative disciplines, general surgeons saw twice as many reasons for the persistence of

Table 1: Specialties of the participating clinic directors (one missing value).

Specialty	n (%)
General Surgery	66 (27.8)
Anaesthesia	59 (24.9)
Plastic and reconstruction surgery	24 (10.1)
Gynaecology	22 (9.3)
Orthopaedics	20 (8.4)
Otolaryngology	9 (3.8)
Hand surgery	6 (2.5)
Cardiac surgery	4 (1.7)
Neurosurgery	4 (1.7)
Ophthalmology	3 (1.3)
Paediatric surgery	3 (1.3)
Urology	1 (0.4)
Others	15 (6.3)

Table 2: Examples of reasons for the persistence of potential adverse events despite the efforts to improve patient safety in Switzerland and the number of respondents per main category and combined subcategory (n = 237).

Category	Subcategory	Number of respondents (%)	Content	Examples of arguments
Context		48 (20.3)		"Provisions of labour law" "Restrictive medical data protection prevents reasonable solutions" "Lack of support" "Incomprehension of the directors" "Incomprehension of the medical necessity" "Too great administrative burden at the expense of medical care" "Increase of bureaucracy"
	Politics	33 (13.9)	Political interventions in the health care system	
	Lack of understanding		Lack of awareness of the problem, lack of support by policy makers	
	Administration	21 (8.9)	Administration, data flood	
Organisation		89 (37.6)		"Safety culture" "Lack of quality assurance" "Lack of concepts" "Lack of infrastructure and funding to implement safety valves" "Staff savings" "Pressure on savings" "Wrong savings approaches" "Lack of safety precautions" "Inadequate techniques" "Lack of checklists" "Lack of measurements"
	Culture	13 (5.5)	Business and organisational culture	
	Scarcity of resources – Personnel – Financial	74 (31.2)	Resources in general Staff shortage Cost pressure	
	Lack of safety systems	14 (5.9)	Organisational safety systems	
Group/interaction		114 (48.1)		"Due to planning optimisation surgeries are performed in another operation room" "Short-term changes of operation rooms or surgeons" "Processes and procedures are often not enough efficient in hospitals" "Lack of automation of work processes" "Lack of an accurate methodology" "Disappearance in daily routine" "Increasing problems in emergency cases" "Imprudence in emergency cases" "Frequent changes of treating physicians and nursing personnel" "Too many shift changes of physicians and anesthetist" "Responsibility of too many people for a single treatment" "Uncertainty about responsibilities" "Interface problems" "Insufficiently documented co-morbidities" "Poor indication" "Inadequate workup of patients" "Insufficient information" "Ignorance of allergies" "Lack of recognition of the patient by the surgeon" "The physician who provides the indication is not the operating surgeon" "Scheduling of the surgery is not performed by the surgeon" "Inappropriate communication" "Errors in communication" "Discussion with the patient" "Lack of language skills of staff or patient"
	Programme changes	5 (2.1)	Short-term changes in the operation programme	
	Unclear procedures	24 (10.1)	Suboptimal implementation of instruments, lack of standardisation and automatisms	
	– Routine – Emergencies		Everyday routine Unclear procedures in emergency cases	
	Labour turnover/shift change	41 (17.3)	Work force	
	Interfaces/unclear lines of responsibility		Collaboration/responsibility of several people on patients	
	Information deficits	36 (15.2)	Lack of/defective information	
	Lack of knowledge of the patient		Knowledge and recognition of the patient by the physician	
	Lack of communication	45 (19)	Problems, deficits and deficiencies in communication	
	- Communication patient - physician		Communication between patient and physician in charge	

Individual		126 (53.2)		"Lack of training" "Slowness" "Lack of schoolings for human factor trainings" "Violation of the checklist" "Readiness to take risks" "Violation of standard operating procedures" "Negligence" "Lack of consistency" "Banalisation of the procedure" "Human failure" "False documentation" "Surgical mistakes" "Same names with insufficient further differentiation" "Transposition of similar names" "Concentration errors" "Distraction" "Overload" "Overwork" "Time factor" "Lack of time" "Rationalisation of time" "Hectic everyday life" "Increasing pressure on available beds" "Pressure for rentability (DRG system)" "Fatigue" "Overfatigue"
	Lack of experience	19 (8.0)	Degree of experience	
	Violation of provisions/rules	6 (2.5)	Dealing with rules and regulations	
	Lack of discipline/motivation	36 (15.2)	Motivational realisation of measures and directives	
	Mistakes	13 (5.5)	Not meeting the requirements	
	– Confusions		Confusion of patients, medications, etc.	
	Carelessness	10 (4.2)	Attention and attentiveness	
	Strain	78 (32.9)	Workload	
	– Time pressure		Disparity between workload and timeframe	
	– Stress – Pressure to perform		Stress and hectic Concretion of work	
	Overfatigue	5 (2.1)	Level of fatigue	

adverse events in too frequent "labour turnover and shift changes" with subsequent "interface problems". The negative effect of transfers of care on complication frequencies due to cross-covering and delayed test ordering has been shown by others [26, 27].

According to Baker et al., there is a trend towards higher numbers of adverse events in teaching hospitals compared with small-to-large community hospitals [28]. Besides differences in the patient population and documentation, and the complexity of treatment in teaching hospitals, miscommunication and coordination of care between various healthcare providers were suggested as potential reasons [28]. In a study of Gawande et al., communication was found to be a causal factor in 43% of errors made in surgery [29]. This is congruent with our finding that participants of high-volume clinics identified significantly more often factors related to the "group and interactions" for the persistence of adverse events. This includes not only the frequency of "labour turnover", but also "unclear procedures", "information deficits" with regard to patients, a "lack of communication" in general and with patients in particular, and "short-term programme changes". A probable association of short-term programme changes with an increased risk of surgical errors due to inexperience and communication errors, resulting from a change in the responsible personnel for a patient's care or inadequate handoff of information, has been well documented with regard to emergencies [29, 30].

Surgical checklists are a cost-effective means to reduce complications and patient deaths, even if the underlying mechanisms are not yet well understood and are most likely multifactorial [15, 31, 32]. The participants in the present

Table 3: Examples of arguments for the advantages of introducing and implementing surgical safety checklists and the number of respondents per category (n = 237).

Category/subcategory	Number of respondents (%)	Content	Examples of arguments
Nonspecific advantages	25 (10.5)	Nonspecific advantages and absence of disadvantages/problems	"Only advantages" "No problems" "No problems - one must do it"
Organisational level – Financial aspect – Quality assurance	47 (19.8) 42 (17.7) 6 (2.5)	Positive effect on the organisation Financial advantages Quality measures and quality assurance	"The organisation's credibility is strengthened" "Liability premium is lowered" "Documentation of a quality behaviour"
Team level – Procedure – Responsibility – Security – Communication/information – Concentration	37 (15.6) 9 (3.8) 7 (3.0) 9 (3.8) 9 (3.8) 12 (5.1)	Positive effect on the team Clear, structured procedure (Clear/shared) competences Team security Improved communication and information content Enhanced concentration and attention	"Motivation of the employees" "Involvement of the whole team" "Clarification of procedures and processes" "Standardisation of procedures" "Clear list and assignment of responsibility" "Additional security for the team" "Facilitation of communication between the members of the surgical team" "It can update the short-term memory" "The pause shortly before the cut calms and lowers the rush"
Patient level – Patient safety – Mistakes	40 (16.9) 27 (11.4) 15 (6.3)	Positive effect on the patient in general Increased safety of the patient Fewer mistakes by the treating person	"Calming of the patient" "Evident improvement of patient safety with a recognised method which is simple and fast" "Avoidance of an adverse event" "Avoidance of wrong site surgery"

study mentioned positive effects of checklists for the "patient", the interaction of the involved "team", but especially on the "organisational level"; this includes "financial advantages" and "quality assurance". Whereas the implementation of a checklist-based surgical safety intervention requires financial investments at first, it will pay off by improvements in quality of care [33]. The use of checklists comprises changes in systems and behaviour of individual operating personnel [34]. It leads to a process optimisation and standardisation, respectively, and minimises information loss during transfers and between disciplines [31]. The definition of the roles and responsibilities of the team members is a prerequisite to guarantee user commitment to a checklist [33].

The main disadvantages for the use of checklists are a "lack of acceptance", "lack of role models" and "low commitment". Amalberti et al. found that historical and cultural precedents and beliefs that are linked to autonomy and performance pose the greatest threat to improved safety [20]. Surgeons and anaesthetists are accustomed to professional independence and confronted with high time pressure [35]. Although checklists only denote tasks, that have to be performed anyway, healthcare personnel are prone to refuse them, because they fear a loss of autonomy and expect an increased workload [33].

Participants of general surgery indicated significantly more disadvantages, particularly problems related to "acceptance" – mainly for the specialised disciplines. Like participants of high-volume clinics, they mentioned significantly more often a problem of a "nationwide introduction" and "realisation", among others owing to the fear that checklist were "not adapted to the specific organisation and the size of the hospital". Vats et al. found that consultant surgeons adopted checklists only after engaging local surgical experts to expound the benefits [36]. To achieve a maximum acceptance of checklists, it is important to adapt the checklist on specific needs of a clinic or a hospital. The success of a surgical checklist relies inevitably on the health care providers as end users and their motivation of using it [33]. They, thus, need to be involved in the development and introduction process using an inter-professional and cross-hierarchical approach [33, 37].

Participants of university hospitals and of high-volume clinics indicated significantly more often than did others the "repeated control" of interventions and a "lack of commitment" as main disadvantages of checklists. However, they indicated significantly less frequently additional paperwork as a disadvantage. It is evident that a long checklist has a negative effect on the task performance and that, on the other hand, if it is too short it may have no effect at all [33]. By creating redundancy in the process, safety is known to be enhanced if only a few items are concerned and the performance is not impaired [38].

The main strength of this study relies on the fact that it was conducted in all language regions of Switzerland, covering all hospital categories and specialties of the Swiss College of Surgeons (fmCh). It is the first qualitative study in Switzerland that evaluated potential reasons for the persistence of adverse events despite the efforts to improve patient safety. A limitation of this study is the methodological setting as a survey based on subjective information. Another limitation is the response rate of 29.7%. However, the response rate is comparable with that of other surveys among surgeons and has to be considered in the view of the mainly qualitative character of the survey [39, 40]. Not high enough priority in the struggle of physician's daily business and workload might be the most important reason for a low response rate [41, 42]. We lack information re-

Table 4: Examples of arguments for the disadvantages of introducing and implementing surgical safety checklists and the number of respondents per category (n = 237).

Category/subcategory	Number of respondents (%)	Content	Examples of arguments
Implementation difficulties – Dependence on hospital size	12 (5.1) 6 (2.5)	Implementation of checklists Adaptation of checklists to hospital size	"Nationwide introduction" "Realisation of a checklist" "Complete checklists are more important in large hospitals" "Adaptation of checklists to organisation and size of the hospital"
Application – Regularity/Consistency – Control – Responsibilities – Blind checking off/lack of following	26 (11.0) 8 (3.4) 6 (2.5) 5 (2.1) 8 (3.4)	 Regularity of application Control of interventions Unclear responsibilities Checklists limit thoughtfulness	"Checklists must be consistently implemented" "Repeated checks of the accuracy of information by different partners" "Who makes the documentation?" "Who takes the lead?" "With checklists automatisms are triggered. If situations occur which are not covered by the checklist, mistakes will occur. Blind checking might be dangerous as well."
Willingness to implement – Acceptance – Lack of role models – Commitment	34 (14.3) 24 (10.1) 3 (1.3) 10 (4.2)	 Agreement to an intervention Behaviour of role models Will and engagement for an application	"Frequent lack of acceptance by surgeons, especially of specialised disciplines" "Without pressure, many won't participate due to convenience" "Practice of role models" "General lack of will by surgeons and anesthetists" "Missing compliance of surgeons at all hierarchical levels"
Effort – Paperwork – Expenditure of time	31 (13.1) 9 (3.8) 14 (5.9)	Amount of the effort Material quantity Temporal component of the effort	"Additional expenses" "Considerable effort" "Additional expenditure of time which is not recorded" "Additional paperwork in an already large stack of forms" "Time-consuming"

garding the missing participants, and a selection bias in the subjects cannot be excluded.

In conclusion, the persistence of adverse events depends on individual factors, such as "lack of discipline", "experience", and "strain" and, mainly in high-volume clinics, on "group-related and interactional" factors. Labour conditions can be optimised to minimise interface problems in case of cross-coverings of patients, guarantee support for students, residents and interns and reduce strain. The occurrence of "information deficits" should not only be recalled regarding cross-coverings, but also with respect to the frequency of "labour turnover" and "short-term programme changes" in high-volume clinics.

Advantages of introducing and implementing surgical safety checklists outweigh disadvantages. Checklists are helpful on an "organisational level" and to clearly assign responsibilities. However, it is crucial to consider disadvantages: especially compliance (including "acceptance", "commitment") and "effort". To improve the willingness to implement checklists, an adaptation to the organisation and size of the hospital by a consensus among all members of the team is a prerequisite. Role models might be helpful, especially in general surgery and specialised disciplines.

Further research in operative medicine on a prospective basis will prove the validity of the clinic directors' arguments.

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Authors' contribution: Study conception and design: Businger, Kaderli. Acquisition of data: Kaderli, Businger. Analysis and interpretation of data: Kaderli, Seelandt, Umer, Tschan, Businger. Drafting of manuscript: Kaderli, Seelandt. Critical revision of manuscript: Kaderli, Seelandt, Umer, Tschan, Businger. Statistical analysis: Seelandt, Tschan. Authors Kaderli and Seelandt contributed equally to this work. Dr. Businger had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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