Documentation of Adherence To Infection Prevention Best Practice in Patient Records – A Mixed-Methods Investigation

Alen Hascic
St. Gallen University
Aline Wolfensberger
University Hospital Zurich: UniversitatsSpital Zurich
Lauren Clack
University of Zurich
Peter Werner Schreiber
University Hospital Zurich
Stefan P Kuster
Cantonal Hospital St. Gallen
Hugo Sax (hugo.sax@mac.com)
University Hospital Zurich https://orcid.org/0000-0002-1532-2198

Research

Keywords: Infection prevention, infection control, healthcare-associated infections, prevalence study, mixed-method research, documentation

Posted Date: December 29th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-1098981/v1

Abstract

Background

Healthcare-associated infections remain a preventable cause of patient harm in healthcare. Full documentation of adherence to evidence-based best practices for each patient can support monitoring and promotion of infection prevention measures. Thus, we reviewed the extent, nature, and determinants of the documentation of infection prevention (IP) standards in patients with HAI.

Methods

We reviewed the electronic patient records (EMRs) of patients included in four annual point-prevalence studies 2013-2016 who developed a device- or procedure-related HAI (catheter-associated urinary tract infection (CAUTI), central line-associated bloodstream infection (CLABSI), ventilator-associated infection (VAP), surgical site infection (SSI)). We examined the documentation quality of mandatory preventive measures published as institutional IP standards. Additionally, we undertook semi-structured interviews with healthcare providers and a two-step inductive (grounded theory) and deductive (Theory of Planned Behaviour) content analysis.

Results

Of overall 2972 surveyed patients, 249 patients developed 272 healthcare-associated infections (8.4%). Of these, 116 patients met the inclusion criteria, classified as patients with CAUTI, CLABSI, VAP, SSI in 21 (18%), 7 (6%), 10 (9%), 78 (67%) cases, respectively. We found a documentation of the IP measures in electronic medical records (EMR) in 432/1308 (33%) cases. Documentation of execution existed in the study patients' EMR for CAUTI, CLABSI, VAP, SSI, and overall, in 27/104 (26%), 26/151 (17%), 46/122 (38%), 261/931 (28%), and 360/1308 (28%) cases, respectively, and documentation of non-execution in 2/104 (2%), 3/151 (2%), 0/122 (0%), 67/931 (7%), and 72/1308 (6%) cases, respectively. Healthcare provider attitude, subjective norm, and perceived behavioural control indicated reluctance to document IP standards.

Conclusions

EMRs rarely included conclusive data about IP standards adherence. Documentation had to be established indirectly through data captured for other reasons. It can be projected that a mandatory institutional documentation protocol and technically automated documentation would be necessary to alleviate this shortcoming in patient safety documentation.

Background

The prevention of healthcare-associated infections (HAI) represents a conundrum in healthcare delivery worldwide, and after decades of infection prevention and control efforts in most hospitals, the preventable proportion of HAI has recently been estimated to still range between 35% and 55% [1–3].

This study started with the idea of identifying the prevention potential in HAI of individual patients. It has been argued - for promotional purposes - that HAI in individual patients for which the evidence-based prevention practices have not been applied, should be declared as preventable [4]. To benefit from this promotional effect – and to investigate the causality for HAI in individual patients and care settings –, it would be necessary to dispose of a seamless documentation of the execution or non-execution of established prevention measures in the electronic medical record (EMR) on an individual level. Moreover, given the oftentimes severe consequences of HAI, patients – and the healthcare organisation alike – might have an invested interest to know whether all the preventive measures were applied during their hospital stay.

Thus, we scrutinized the EMR of a patient population who suffered from one of the four major procedure-related HAI and interviewed healthcare workers about their motivations to investigate the documentation quality of prevention practices and its determinants.

Methods

Setting

The study took place at University Hospital Zurich (USZ), Zurich, Switzerland, a 950-bed tertiary-care teaching hospital providing all medical specialties except paediatrics and orthopaedics, featuring six intensive care units (ICU) of which one is a burn unit, various organ transplant units, and a hematopoietic stem cell transplantation unit. The hospital had an infection prevention (IP) program with an interprofessional team of 20 interdisciplinary staff and prospective surveillance for catheter-associated urinary tract infection (CAUTI), central line-related bloodstream infection (CLABSI), ventilator-associated infection (VAP), and non-ventilator-associated pneumonia, and surgical site infection (SSI), teaching, promotion, outbreak investigation and control, and research. As a unique feature, the hospital leadership committed to an institutional target to decrease HAI prevalence from initially 8.7% in 2013 to under 5.0% in 2018 under the responsibility of medical and nursing directorates.

Quantitative investigation

All patients in the four annual PPS from 2013 to 2016 who encountered one of the four major procedure-related HAI, i.e., CAUTI, CLABSI, VAP, and SSI according to the European Centre for Disease Prevention and Control (ECDC) HAI definitions were included [5]. The surveillance protocol and HAI definitions were also based on the European PPS in 2011 - 2012 [5] and remained unchanged over the four years. The following variables were automatically extracted from the electronic patient record system: patient identity and case number, year of birth, gender, date of admission, transfer from another hospital (yes/no), department and unit attribution. Therapeutic antibiotic treatment (yes/no), immunosuppression

(yes/no), presence of an invasive procedure, i.e., peripheral venous catheter, central venous catheter, urine catheter, tracheal ventilation tube, surgery within the last 30 days or within the last year in case of implant placement (yes/no), were extracted manually from the electronic patient records. HAI according to ECDC definitions were noted with type of infection, date of onset, if acquired in USZ. These manual data extraction and determination of the HAI diagnosis were executed by trained and validated members of the IP team. The electronic medical record (EMR) integrates the medical entire documentation rendering any paper records or other physical data storage obsolete.

The in-house IP standards are developed and continuously adapted according to an established formal process. They are established based on the most recent international IP guidelines by the IP team, then submitted by the IP committee after discussion and democratic vote to the medical and nursing directorates who declare them as binding for the entire institution. The standards are published in the hospital's intranet and accessible to every collaborator. In the remainder of the text, we will use 'IP standards' defined as the IP prevention measures corresponding to the above description.

For each of the included HAI, the documentation and execution status of all corresponding institutional IP standards was extracted. We opted for the 2016 version of the IP standards for their conciseness. There are for CAUTI, CLABSI, VAP, SSI, and overall, five, 23, 13, 15, and 56 IP standards, respectively. The documentation status in the EMR was defined as '*Conclusive documentation*', i.e., if conclusive data were found in the EMR that allowed to judge whether the corresponding IP standard was executed or NOT executed; 'Proof for adherence', i.e., conclusive data in the EMR that the IP standard was executed; 'Proof for NON-adherence, i.e., written proof in the EMR that the IP standard was NOT executed, and 'NO documentation', i.e., no data in the EMR that would have allowed to judge if the IP standard was executed or NOT executed.

One researcher (AH) extracted the data into a dedicated Microsoft Access 2016 (Redmond, WA) database between October and December 2016 from the USZ electronic patient record system. In case of more than one HAI, only the one occurring first was included. One senior consultant for infectious disease and IP overviewed the process (SPK), an additional consultant (HS) verified 30% of a randomly selected sample of cases. In case of disagreement with classification, the case was discussed and resolved. These discussions and decisions served to consecutively adapt the 70% remaining cases.

Qualitative inquiry

To learn more about the motivation of healthcare providers to document patient care and – more specifically – IP standards, we undertook a qualitative inquiry based on semi-structured interviews based on an interview guide targeting CAUTI, CLABSI, VAP, and SSI (**Annex Table 1**). A purposive sample of physicians and nurses from general wards, operating theatres, ICUs, and intermediate care units were interviewed to gather a broad range of experiences. The sample size was determined by saturation for new findings [6]. All interviews were conducted by one researcher (AH) in Swiss-German or German, recorded and transcribed as paraphrasing for the majority of content and verbatim for relevant quotes. Two researchers (AH, HS) performed a two-step content analysis of the interview-level transcripts. The

first step produced inductive codes following grounded theory [7]. Starting with a first interview transcript, the inductive coding progressed with the following transcripts establishing a code-book – with iterative re-coding of former interviews where necessary. In a second step the interviewees' statement towards documentation or non-documentation, were deductively ordered according to the three main domains of the Theory of Planned Behaviour (TPB), the *Attitude*, i.e., the degree to which a person sees the anticipated outcome of the behaviour as favourable or unfavourable, *Subjective Norm*, i.e., a person's view of whether important others approve or disapprove of the behaviour, and *Perceived Behavioural Control*, i.e., a person's subjective perception of ease or difficulty to perform the behaviour, including factual facilitators and barriers [8, 9]. These three domains act, according to the TPB, as determinants on the *Intention* to execute the behaviour, which in turn is the unique determinant to *Act*, i.e., execute the behaviour.

Results

Quantitative investigation results

Overall, 2972 patients were included, i.e., 699, 717, 784, and 772 in the study years, respectively (**Table 1**). Overall, 249 patients had 272 HAI corresponding to a prevalence of patients with any HAI of 8.4% (**Annex Table 2**). Of these, 116 (47%) patients matched our inclusion criteria and encountered 21 CAUTI (18%), 7 CLABSI (6%), 10 VAP (9%), and 78 SSI (67%).

We found *conclusive documentation* to IP standards for CAUTI, CLABSI, VAP, SSI, and overall in 29/104 (28%), 29/151 (19%), 46/122 (38%), 328/931 (35%), and 432/1308 (33%) cases, respectively; *proof of adherence* in 27/104 (26%), 26/151 (17%), 46/122 (38%), 261/931 (28%), and 360/1308 (28%) cases, respectively; *proof of NON-adherence* in 2/104 (2%), 3/151 (2%), 0/122 (0%), 67/931 (7%), and 72/1308 (6%) cases, respectively (Figure 1 – Figure 4). The number of standard items with ≥75% documentation was for CAUTI, CLABSI, VAP, SSI, and overall, one (20%), three (13%), three (23%), four (27%), 11 (20%), respectively (Figure 1 – Figure 4).

Qualitative inquiry results

Saturation was reached with 19 interviewees; eight nurses (eight female), 11 physicians (five female); nine from floor ward (seven female), three from ICU (three female), one from intermediate care unit (one female), and six from operating room (two female). Of the 67 inductive codes, 40 were allocated to the TPB dimension A*ttitude* with 148 coded interviewee statements (snippets), four to *Subjective Norm* with 78 snippets, and 23 to *Perceived Behavioural Control* with 491 snippets.

Attitude

According to the TPB, an individual's *Attitude* towards an action is the product of various positive or negative behavioural beliefs about what results from a given action, while the *Attitude* represents an

antecedent of the *Intention* to act, i.e., to document in our case [9]. We found the following *Attitudes* towards documentation.

Documentation is meant to guarantee the **continuity of care** in the case of patient handovers between physicians or care teams.

“Each therapeutic decision should be noted in a way so that if the treating physician falls ill the next day, one can understand why something has been changed.” (Male resident, floor ward)

Documentation can also serve as a **reminder** for themselves or for their colleagues.

"To remember why the patient has one [invasive device]." (Male resident, floor ward)

"[To] *remind yourself, oh what did I* [do] *again yesterday on this patient and then you can read up. For your own history, but also for night shifts."* (Female resident, floor ward)

Some healthcare providers consider documentation as a **safeguard against legal consequences**.

"In this profession you have one foot in prison, (laughs) by now." (Female resident, floor ward)

However, on the contrary, the **fear of negative (legal) consequences** was also a reason to abstain from documentation, in order to avoid evidence of one's own misconduct.

"In the case of a secondary infection, you don't want the report to say that you made the operating field unsterile, but then continued to work anyway. Then you dig your own grave." (Male resident, floor ward)

Other reasons against documentation were **repetitions**, which seem to weaken the motivation to document a medical procedure in writing.

“If the indication [for a urinary catheterization] *leads to a prescription for several days, the re-evaluation will not be documented every day. For example, it is clear that the prostate volume will not get so small in one day that it would allow us to take the catheter out.”* (Female resident, floor ward)

Finally, a **perceived lack of relevance** was the most frequent answer to the question why a certain action should or should not be documented.

"I think it's unnecessary. Not only because of the time, but simply because it (pause 3 seconds) makes no sense." (Female resident, floor ward)

In general, healthcare providers said they do not document the **course of an action** but limit themselves to documenting the result.

"It's really just like when the process is done, the result where you write it down. You don't write down the workflow." (Female nurse, floor ward)

Subjective Norm

Human behaviour is considerably influenced by the perceived judgement of one's actions by subjectively important others. As a physician resident points out, a "laissez-faire attitude of superiors" can impair the necessary discipline to document.

Professional pride seems to positively influence the quality of documentation.

"The documentation by nurses is a picture of our care - concise, using technical terms, precise." (Female nurse, floor ward)

Interestingly, even the **design of digital interfaces** can transport the message that documentation is necessary and expected.

"If it is visible [on the screen] *and one can only select it by a click it will be used because it suggests that it could have a legal relevance."* (Female resident, operating room)

On the other hand, young residents in particular wonder what the **senior physician will think of them** if they go into too much detail in their account of procedures.

"The one who co-signs the report would probably delete it if I had documented it." (Male resident, floor ward)

The decision not to document is apparently governed by the assumption that a medical procedure is carried out according to an established 'standard'. Only **deviations from the norm** would be noted.

"Hand hygiene and all these things that are, like, self-evident are not documented. Except if something goes wrong, the patient touches the wound, then yes." (Female nurse, floor ward)

"It would make sense to document when you have deviated from the internal standard and give a reason why." (Female resident, operating room)

Especially actions that appear to be **self-evident** in the eyes of the community are not documented.

"I see this [hand hygiene] *as something personal, and so, very self-evident."* (Male resident, operating room)

Perceived Behavioural Control

The third antecedent of the *Intention* to *Act* in the TPB reflects the control one has over one's capability to execute planned actions. This includes both, perceived but also real barriers and facilitators to execution.

The time needed for documentation depends on the **design of the documentation process**. Many interviewees expressed their frustration with bad information technology interfaces, or their ideas and desire for better systems, especially through automatization.

"I would document much more if I had voice recognition software." (Female resident, floor ward)

Time restraints count among the most frequently cited barriers to go and write a procedure down.

"Lack of time is of course the biggest obstacle." (Female resident, ICU)

The **lack of consistent digitalization** was often criticized in the context of documentation.

"The results of an electronic arterial blood pressure measurement have to be noted on a paper slip and from there, they have again to be typed into the [EMR] *system by hand."* (Female nurse, floor ward)

"Many different documentation systems lead to you forgetting it and it is very cumbersome." (Female nurse, floor ward)

A **noisy work environment** can jeopardize work in general but also interfere with the quality of documentation.

"Too many people in one room, I cannot concentrate!" (Female nurse, floor ward)

Discussion

This study investigated the documentation of adherence to IP standards in individual EMRs. It became evident that there was no mandatory institutional practice to deliberately document IP standards. In consequence, the status of IP standards adherence had to be evaluated based on data that were registered in EMRs for other reasons. Even so, we found the degree of documentation to be poor. The qualitative inquiry corroborated and explained these findings: IP standards do not fall in the category of topics for which healthcare providers see value in documentation, there is no cultural impetus to document them, and EMR interface design does not facilitate documentation in general.

Our findings are not entirely surprising. Infection prevention measures are not considered as primary medical tasks but rather as a way of how to perform patient care safely. This might lead to the notion that their documentation is not necessary. In the last two decades, however, some of these prevention measures have become subject to systematic monitoring, such as the adherence to the WHO "My five moments" hand hygiene [10, 11], the proportion of patients receiving antibiotic prophylaxis within one hour before the incision [12], and the proportion of patients with a urinary catheter with an accepted indication [13]. These measurements, however, are usually captured and reported at the population level and are not part of the individual EMR. Hand hygiene adherence for example is mostly collected and reflected as a quality attribute of the institution [10] and not documented from the individual perspective of the patient.

The degree of available data on IP standard adherence varied largely across individual standards and type of infection. IP standards with ≥75% documentation were found regarding the indication for invasive central vascular lines, urinary catheters, and ventilation tubes in the context of CAUTI, CLABSI,

and VAP. Additionally, for central lines, the standard 'Don't change lines on a regular basis" could be inferred from the irregular change intervals in the nursing charts. VAP was the healthcare-associated infection with the highest proportion of conclusive IP standard documentation. There, adherence to list of approved indications, use of non-invasive ventilation, and use of oro-tracheal route were among the standards with ≥75% documentation. With SSI, body temperature, antibiotic prophylaxis, and dressing handling were among the standards with ≥75% documentation. While we found no unequivocal principle behind determinants of likely documentation of IP standard adherence, there are some partially overlapping categories to be addressed. First, there is the documentation of indications for invasive medical procedures such as inserting urinary catheters, central vascular lines, intubation, etc. These procedures are typically noted in the EMR due to their invasive nature and potential legal implications and therefore, generally met a high proportion of documentation. Second, a category also meeting a fair proportion of documentation concerned routines that are traditionally noted in the nursing chart or correspond to medical prescriptions, e.g., daily sedation stop, weaning protocol, oral hygiene in ventilated patients, dates of changing central lines, preoperative administration of antibiotic prophylaxis, body temperature during surgery, etc. Interestingly, the most frequent documentation of non-adherence to IP standards appeared with the latter two examples of objective technical measurements. Third, there are practices that are usually decided on an institutional level, e.g., changing humidifier filters every 24 hours, use of coated catheters in long-term central lines, not to use a razor for preoperative hair removal, general use of subglottic suction ventilation tubes, use of sterile gaze or transparent film dressing for short-term catheters, perform hand hygiene before surgery, no use of ointments on catheter insertion sites, use of new sterile caps after infusion hub manipulation, etc. We found this category to be barely documented in the individual EMR, which was explained by interviewees as 'too obvious' to note because these things are 'supposed to happen'. We know, however, from a large body of literature, e.g., on adherence to hand hygiene, that institutional rules sometimes meet a surprisingly low adherence and do not 'just happen'. An exception to the described pattern is noteworthy, regarding the rule of 30° headrest elevation. At the time of the study this was part of an intervention to reduce VAP and was monitored through established documentation [14]. Forth, it was sometimes impossible to infer IP standard adherence from EMR data due lacking detail in the description of a specific process, e.g., the use of sterile gloves and gowns during surgery, the insertion of drains through a separate incision, and the performance of hand hygiene before and after insertion of a catheter, etc. Fifth, there are ways of working that rather require a behavioural orientation due to their frequent occurrence in various contexts, e.g., ensuring uninterrupted workflows, correct hand hygiene during patient care, minimal duration of catheterization and would drains, keeping the operating table sterile, avoiding unnecessary disconnection of urinary catheters, considering alternatives for catheterization, etc. EMR documentation in this category was also rare.

We performed a qualitative inquiry to investigate the views and motivations of healthcare providers regarding documentation of IP standards and medical information in general. The results support and explain the quantitative findings. They reflect a current reality of suboptimal EMR documentation interfaces and processes in the context of a challenging work reality that limits the will to document to subjects of recognizable practical benefit. This insight holds promise. Modifiable checklists and registers,

the ability to easily design and run reports, and user-friendly provider interfaces have been identified as key elements to promote effective use of the EMR [15]. Kennedy Page and Schadler showed that the time to complete a document decreased and staff satisfaction increased significantly among nursing staff after redesigning the EMR with a focus on usability [16]. Such structure design modifications hold the greatest promise for success according to the hierarchy of intervention effectiveness [17]. Zahabi et al. recommended guidelines for EMR interface design to increase documentation quality [18]. Additionally, a possible but radical idea to change the perceived benefit for documentation (i.e., positive *Attitude*) could be to inform patients at their admission about the institution's IP standards and provide them with an account of adherence at their discharge. Obviously, this would have to be accompanied by a profound error and safety culture change towards openness (i.e., *Subjective norm*) and facilitating documentation infrastructure and process (i.e., *Perceived and actual behavioural control*) [4].

While there are myriads of reports on monitoring of IP behaviour on hand hygiene, none of these discuss the possibility to specifically document hand hygiene execution in the individual EMR. This is surprising when considering that newer automated hand hygiene monitoring systems would lend themselves to measure patient-centric data and transfer the achieved overall quality automatically in the EMR [19]. We believe that automated registration of IP adherence-relevant data – including through sensor technology – holds a specially promising potential to capture patient-level data in general because of its independence of human desirability bias. Timely feedback of such data might not only be interesting for the patient but would likely give healthcare providers a novel, empathic view of their IP behaviour. But conscious documentation of IP standard adherence – or non-adherence - in the EMR would still be beneficial to raise awareness of these procedures that are often forgotten or taken for granted. To this end, the EMR data entry should be structured and user-centred to avoid unnecessary additional workload. This requirement for better design extends to the IP standards that should be created as one piece of the policy, execution, documentation, feedback cycle.

This study has limitations. It took place in a single institution in a confined period and patient population. While this limits generalizability, we think that the findings nevertheless aptly rise the fundamental question of the value and challenges of IP standard documentation on the patient level. The study design did not, however, explore the question whether a more comprehensive documentation would have a positive influence of adherence to IP measures. It also remains unclear if a full disclosure of non-adherence would ever be possible in the current legal and cultural landscape. Neither did we question the respective effect of individual IP standards on infectious risks. These questions would warrant further investigation.

Conclusions

This in-depth investigation found that deliberate documentation of adherence to IP standards in EMR was not an established process and conclusive data for adherence was infrequent. Conclusive indirect proof was mainly associated with invasive medical procedures and traditionally established routine chart data. The qualitative inquiry confirmed that patient-level documentation of IP standards does not fall in

the category of topics for which healthcare providers see value in documentation, there is no cultural impetus to document them, and EMR interfaces do not facilitate documentation in general. Based on these results we hypothesise that improved EMR interface design and automatic capturing and integration of routine IP behaviour could bridge this gap. We also pose that disposing of patient-level IP data would most likely result in increased awareness of IP and help to advance patient safety - and should become an institutional standard.

List Of Abbreviations

IP	Infection prevention
HAI	Healthcare-associated infections
EMR	Electronic medical record
ICU	Intensive care unit
CAUTI	Catheter-associated urinary tract infection
CLABSI	Central line-associated bloodstream infection
VAP	Ventilator-associated pneumonia
SSI	Surgical site infection

Declarations

Ethics approval and consent to participate

The Ethics Review Board of the Canton of Zurich waived the necessity for a formal ethics evaluation for this study based on the Swiss Law on Research on Humans (Nr. Req-2016-00386).

Consent for publication

All authors and acknowledged individuals have provided their consent for publication.

Availability of data and material

Data is available from the corresponding author upon request.

Competing interests

PWS received travel grants from Pfizer and Gilead, speaker fees from Pfizer and fees for advisory board activity from Pfizer and Gilead outside of the submitted work. HS received travel grants and/or speakers honorary from AstraZeneca, Livinguard, and agfam outside of the submitted work.

Funding

This study received no dedicated funding. PWS and AW were supported by the academic career program ‘Filling the Gap’ of the Medical Faculty of the University of Zurich.

Authors' contributions

Study design (AH, HS, LC), data collection (AH, AW, HS, SPK), data interpretation/analysis (AH, HS, SK), writing of the manuscript (AH, HS), critical revision of the manuscript (AH, PWS, AW, SPK), agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved (all authors).

Acknowledgements

We would like to warmly thank the interviewees for the qualitative inquiry for dedicating their time and sharing their clinical experience; we also acknowledge the efforts of the entire IP team at USZ for performing the point prevalence year after year.

References

1. Harbarth S, Sax H, Gastmeier P. The preventable proportion of nosocomial infections: an overview of published reports. J Hosp Infect. 2003;54:258–66.
2. Umscheid CA, Mitchell MD, Doshi JA, Agarwal R, Williams K, Brennan PJ. Estimating the Proportion of Healthcare-Associated Infections That Are Reasonably Preventable and the Related Mortality and Costs. Infect Control Hosp Epidemiology. 2011;32:101–14.
3. Schreiber PW, Sax H, Wolfensberger A, Clack L, Kuster SP, Swissnoso. The preventable proportion of healthcare-associated infections 2005-2016: Systematic review and meta-analysis. Infection Control & Hospital Epidemiology. 2018;34:1–19.
4. Dellinger EP, Villaflor-Camagong D, Whimbey E. Gradually Increasing Surgical Site Infection Prevention Bundle with Monitoring of Potentially Preventable Infections Resulting in Decreasing Overall Surgical Site Infection Rate. Surg Infect. 2021;1–5.
5. Zarb P, Coignard B, Griskeviciene J, Muller A, Vankerckhoven V, Weist K, et al. The European Centre for Disease Prevention and Control (ECDC) pilot point prevalence survey of healthcare-associated infections and antimicrobial use. Eurosurveillance. 2012;17:1–16.

6. Patton MQ. Qualitative research and evaluation methods. Sage Publications, Inc; 2002.
7. Cohen S, Glaser BG, Strauss AL. The Discovery of Grounded Theory: Strategies for Qualitative Research. Br J Sociol. 1969;20:227.
8. Ajzen I. The theory of planned behavior. Organizational behavior and human decision processes. 1991;50:179–211.
9. Marra AR, Noritomi DT, Cavalcante AJW, Camargo TZS, Bortoleto RP, Junior MSD, et al. A multicenter study using positive deviance for improving hand hygiene compliance. Am J Infect Control. 2013;41:984–8.
10. Sax H, Allegranzi B, Chraïti M-N, Boyce J, Larson E, Pittet D. The World Health Organization hand hygiene observation method. Am J Infect Control. 2009;37:827–34.
11. Sax H, Allegranzi B, Uckay I, Larson E, Boyce J, Pittet D. "My five moments for hand hygiene": a user-centred design approach to understand, train, monitor and report hand hygiene. J Hosp Infect. 2007;67:9–21.
12. Hawn MT, Richman JS, Vick CC, Deierhoi RJ, Graham LA, Henderson WG, et al. Timing of Surgical Antibiotic Prophylaxis and the Risk of Surgical Site Infection. Jama Surg. 2013;148:649–57.
13. Schweiger A, Kuster SP, Maag J, Züllig S, Bertschy S, Bortolin E, et al. Impact of an evidence-based intervention on urinary catheter utilization, associated process indicators, and infectious and non-infectious outcomes. J Hosp Infect. 2020;106:364–71.
14. Wolfensberger A, Meier M-T, Clack L, Schreiber PW, Sax H. Preventing ventilator-associated pneumonia—a mixed-method study to find behavioral leverage for better protocol adherence. Infect Control Hosp Epidemiology. 2018;39:1222–9.
15. Janett RS, Yeracaris PP. Electronic Medical Records in the American Health System: challenges and lessons learned. Ciência Saúde Coletiva. 2020;25:1293–304.
16. Page CAK, Schadler A. A Nursing Focus on EMR Usability Enhancing Documentation of Patient Outcomes. Nurs Clin N Am. 2014;49:81–90.
17. Cafazzo JA, St-Cyr O. From discovery to design: the evolution of human factors in healthcare. Healthcare quarterly (Toronto, Ont). 2012;15 Spec No:24–9.
18. Zahabi M, Kaber DB, Swangnetr M. Usability and Safety in Electronic Medical Records Interface Design. Hum Factors J. 2015;57:805–34.
19. Chen J, Cremer JF, Zarei K, Segre AM, Polgreen PM. Using Computer Vision and Depth Sensing to Measure Healthcare Worker-Patient Contacts and Personal Protective Equipment Adherence Within Hospital Rooms. Open Forum Infect Dis. 2016;3:ofv200.

Figures

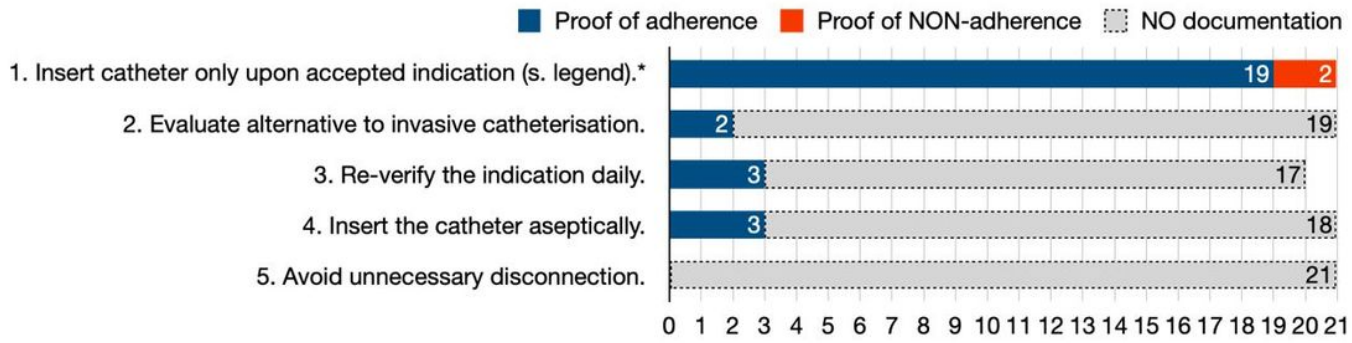

Figure 1

Documentation of catheter-associated urinary tract infection (CAUTI) prevention standard adherence

Ad 1., list of institutionally accepted indications: urinary retention, urine monitoring/balancing, surgery, prolonged immobilization, decubitus ulcers in case of incontinence, comfort in case of palliation; **ad 3.,** one patient had a duration of only one day of catheterization.

***Infection prevention standards with ≥75% conclusive documentation.

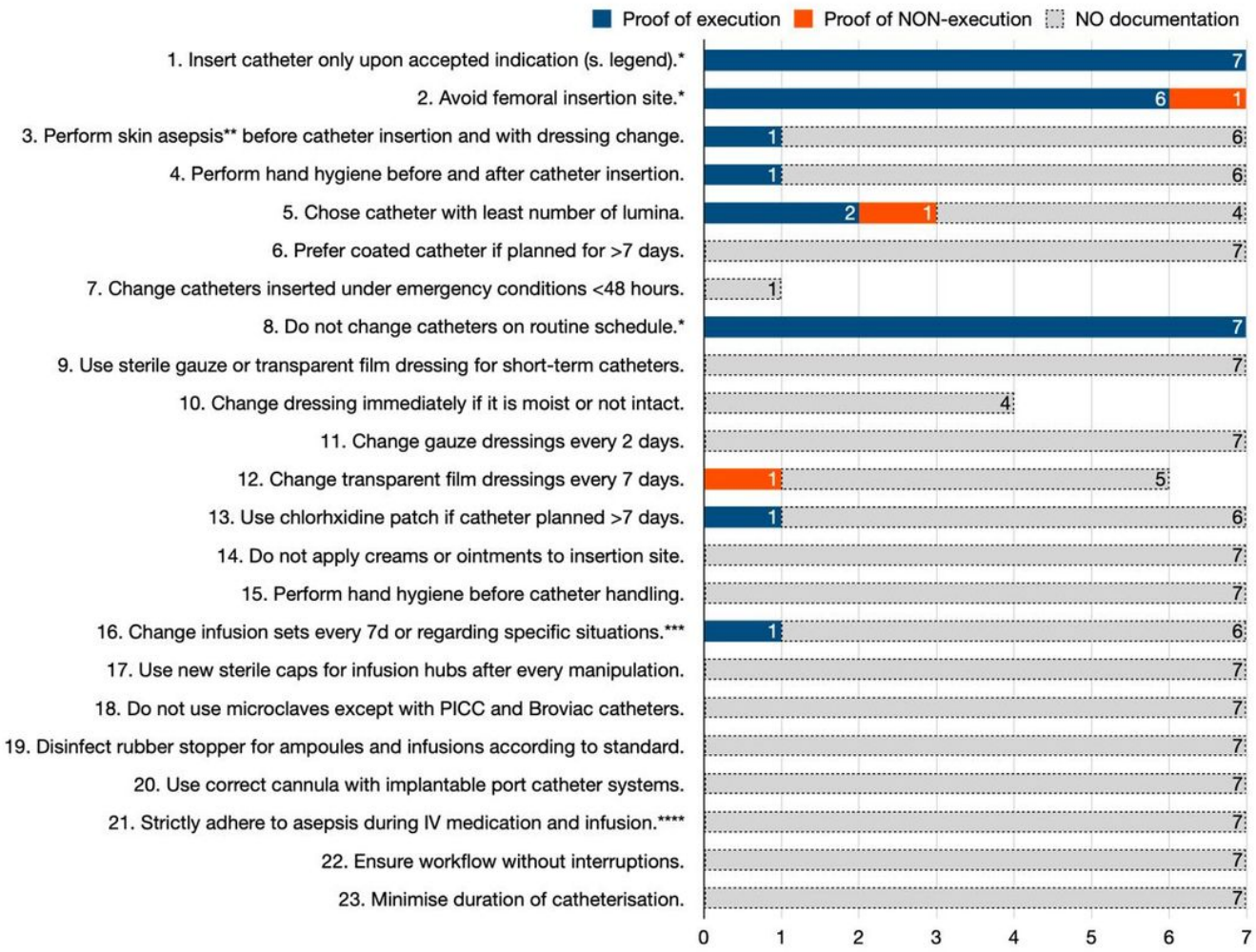

Figure 2

Documentation of central line-associated bloodstream Infection (CLABSI) prevention standard adherence

Ad 1., list of institutionally accepted indications: prolonged administration of circulatory drugs, administration of high osmolar substances, administration of infusions and drugs irritating the veins, measurement of venous O_2 and pressure, semi-recumbent position in neurosurgery (air embolism prophylaxis), foreseeable intravenous therapy of >2 weeks if peripherally inserted central catheter (PICC) contraindicated, very difficult vein conditions and repeated punctures; **ad 7.,** only one catheter was inserted in emergency situation; **ad 10.,** three patients did not fulfil the criteria of moist or non-intact dressing; **ad 12.,** in one case, no film dressing was used.

***Infection prevention standards with ≥75% conclusive documentation.

**Skin asepsis requires chlorhexidine/alcohol 2%.

***Specific situations were: 6h after transfusion; every 8h with lipid solution; every 24h with parenteral nutrition.

****This includes not speaking or wearing a mask.

PICC, peripherally inserted central catheters

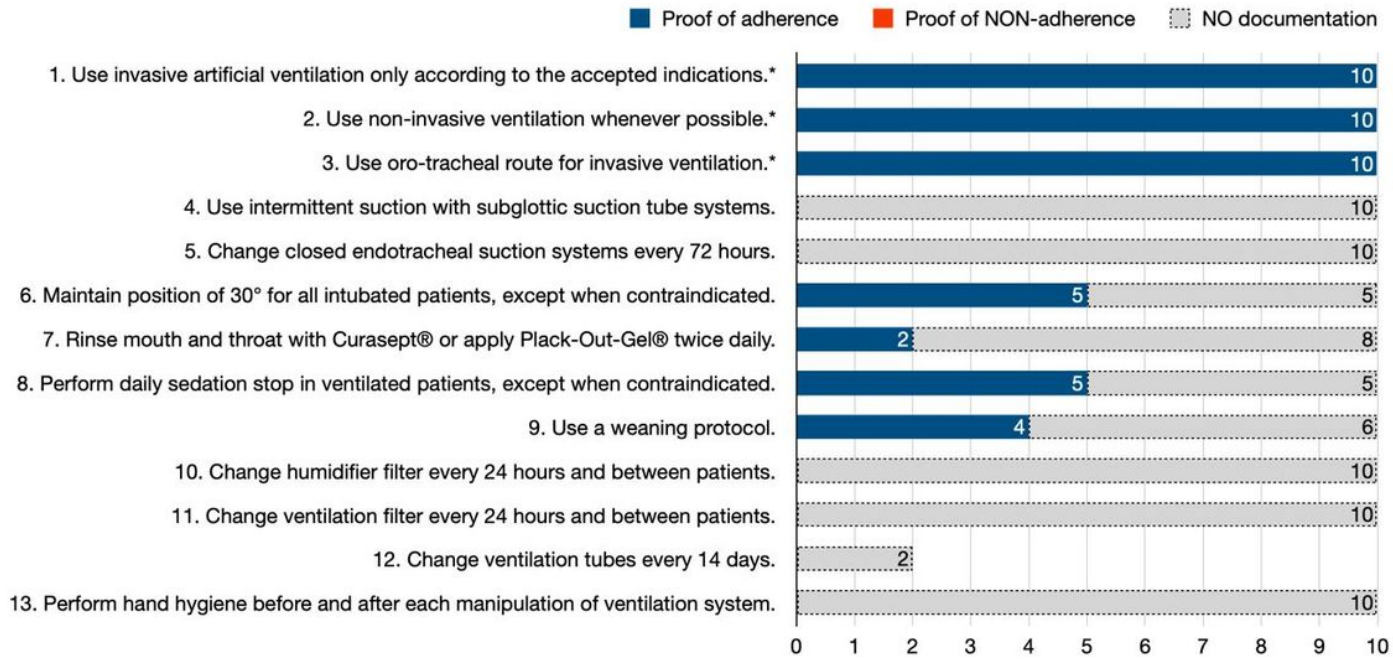

Figure 3

Documentation of ventilator-associated pneumonia (VAP) prevention standard adherence

Ad 1., institutional list of accepted indications: respiratory failure with profound unconsciousness with failure of protective reflexes, obstruction or swelling of the upper airway, clinical fatigue, Inadequate work of breathing with deterioration of gas exchange, respiratory insufficiency with deterioration of gas exchange; **ad 6.,** institutional list of accepted contraindications to bed elevation rule: circulatory instability, instable pelvic or spinal injury, craniocerebral and other neuro-intensive medical conditions, modified according to cerebral perfusion pressure; **ad 12.,** only two cases were ventilated for more than 14 days.

***Infection prevention standards with ≥75% conclusive documentation.

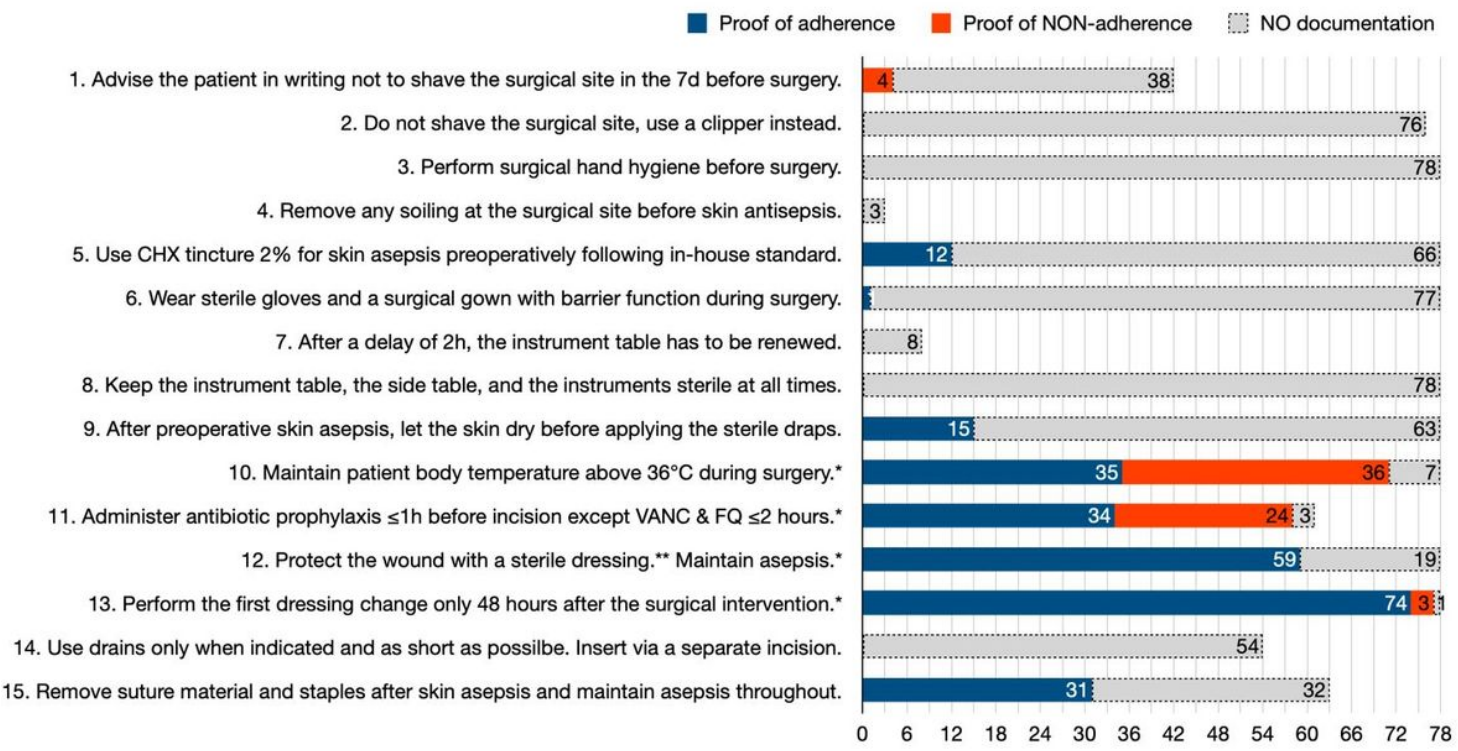

Figure 4

Documentation of surgical site infection (SSI) prevention standard adherence

Ad 1., in 36 cases, the decision to operate was taken less than 7 days before the procedure; **ad 2.,** in two cases, no hair removal was necessary; **ad 4.,** only three cases had noticeable soiling on the surgical site; **ad 5.,** in 12 cases, adherence to standard was documented, in 66 other cases, nothing was documented; **ad 7.,** only eight cases had a waiting time of ≥2h; **ad 11.,** in 17 cases, antibiotic prophylaxis was not indicated; **ad 14.,** in 24 cases no drains were inserted; **ad 15.,** in 15 cases, an absorbable suture was used.

***Infection prevention standards with ≥75% conclusive documentation.

**Accepted sterile dressings: transparent film, gauze, or fleece.

VANC, vancomycine; FQ, fluorochinolones.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AnnexTables.docx