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Undergraduate medical students' behavioural intentions towards medical errors and how to handle them – a qualitative vignette study

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3 **Undergraduate medical students' behavioural intentions towards medical**
4 **errors and how to handle them – a qualitative vignette study**
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ABSTRACT

Objectives: In undergraduate medical education the topics errors in medicine and patient safety are underrepresented. The aim of this study was to explore undergraduate medical students' behavioural intentions when confronted with an error.

Setting: A qualitative casevignette-survey was conducted including one of six randomly distributed case-scenarios in which a hypothetical but realistic medical error occurred. The six cases differed regarding (1) who caused the error, (2) the presence of witnesses, and (3) the consequences of the error for the patient. Participants were asked: "What would you do?". Answers were collected as written free texts and analysed according to qualitative content analysis.

Participants: Altogether $n=159$ students answered a case vignette. The participants were an average of 24 years old ($M=24.6$, $SD=7.9$) and 69% were female, most of the participants were in their third, fourth, or fifth year of their undergraduate medical program ($n=107$), some in their first and second year ($n=27$) and some in their final year ($n=21$).

Results: During the inductive coding process, 19 categories emerged from the original data and clustered into the four themes (1) considering communication, (2) considering reporting, (3) considering consequences, and (4) emotional responsiveness. When the scenario inclined the student had caused the error the students were less likely to communicate with colleagues and take preventive action, while when a witness was present the students would disclose the error more often and take action. When the outcome to the patient was significant the students responded more emotionally.

Conclusions: The study highlights the importance of effective coping strategies for dealing with emotions to prevent hindering healthcare professionals in adequately dealing with errors. Educators need to introduce knowledge on how to deal with errors as well as emotional preparedness for errors into undergraduate medical education.

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ARTICLE SUMMARY

Strengths and Limitations of the study

- The article examines medical students behavioural intentions towards medical errors in a qualitative way
- Case vignettes are a useful tool to investigate influences on behavioural intentions, yet the influencing variables are selected
- 159 students, a large sample for a qualitative study, resulted in the four themes (1) considering communication, (2) considering reporting, (3) considering consequences, and (4) emotional responsiveness, regarding the behavioural intentions of medical students
- The design of the study and the sample size made an additional quantitative analysis of the results possible
- Emotional preparedness for errors in medicine is not yet introduced in the medical undergraduate and graduate curricula

INTRODUCTION

Concerning medical errors and patient safety, physicians take a central role in the health care system. On the one hand, physicians can prevent errors, ensure patient safety, and follow-up on errors to prevent further harm. But on the other hand they also can generate errors, near-misses, and preventable adverse events. Physicians have complex tasks in stressful, error-prone situations[1] and have to deal with the consequences of errors[2] or near misses[3]. Additionally, physicians themselves might be affected by an error and, as a “second victim”, can also be traumatized and suffering from the error[4]. Although in recent years the importance to develop skills to deal with medical errors for all professions in the healthcare setting has become clear, there has been little focus on the professionals’ attitude towards the topic and their skills to master situations in which errors occur.

As an important stage of acquisition of attitude, undergraduate medical education has to be taken into account. To date, only a few studies about students’ attitudes towards medical errors exist. By using quantitative approaches some studies show that first-year medical students’ attitudes are supporting an error-friendly environment and state that they would disclose errors and do everything they can to ensure patient safety[5-7]. But, if an error would happen to them, students have limited knowledge about what to do and they also feel uncertain about how to handle the situation if a colleague had made an error[5]. Most of the recent studies investigating the attitudes of medical students focus on the occurrence of disclosure, emotions, and the fear of malpractice litigation[8].

To understand undergraduate medical students behavioural intentions (defined as the hypothetical actions they intent to choose when they participate in a case of a medical error) may be another approach towards the topic. A study by Muller et al.[9] investigated how students would feel after a hypothetical error would happen to them and has shown that feelings were dependent on the outcome for the patient. In that study, the more harmful the outcome was to the patient, the angrier the students would be towards themselves, the more guilt they would feel, and the more afraid they would be of accusations and malpractice charges. Hence, factors such as the outcome of the patient after an error and the role or responsibility of the student (i.e. being a witness or being the person who has made the error) may essentially influence the underlying behavioural intentions as well. However, in their study, it

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3 remains unclear what the students would actually *do* if an error would have
4 happened to them, which will be the focus of our study.

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6 Scientific approaches to describe attitudes and to understand behaviour or
7 behavioural intentions are mainly based in qualitative research. In both medical
8 studies and medical education research, qualitative research methods have been
9 recognized as complementary and essential. Ritchie and Lewis[10] gave a definition
10 of qualitative research as “an attempt to present the social world, and perspectives
11 on that world, in terms of the concepts, behaviours, perceptions and accounts of the
12 people who inhabit it”. Qualitative research intends to understand how people
13 experience the world and seeks to unveil the underlying *what* and *how* of peoples’
14 perception.
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22 The main objective of the present case vignette study was to generate a basic
23 comprehension of how undergraduate medical students deal with errors and to
24 understand their behavioural intentions towards the topic. A qualitative research
25 method has been chosen to address the following research questions:
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28

- 29 1. What kind of behavioural intentions do students express when they participate in a
30 case of a medical error?
- 31 2. How do these behavioural intentions depend on factors such as the consequences
32 for the patient, the presence of witnesses, and their own role in committing error?
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METHODS

Participants and Setting

The survey was conducted using the online survey system Unipark (<http://www.unipark.de/>). The participants were recruited via email. All German medical student councils forwarded the link to an online questionnaire via their mailing lists. All data was collected anonymously and, at the beginning of the questionnaire, the students' agreement to analyse the data was obtained. Participation was voluntary and students took part in a lottery for book vouchers, if participating.

Each participant received one case scenario about a medical error. Six different cases (see paragraph Materials) were randomly distributed among the participants. Participants received a short written introduction and the instruction to answer one open question. Another completely independent part of the questionnaire contained demographic data and quantitative data that are published elsewhere[11].

The ethics committee of the medical faculty of the responsible University approved this survey (Ethical Approval no. UE036-13). The study was partly funded by a Volkswagen grant.

Materials

Six different scenarios of a case vignette about a hypothetical but realistic situation dealing with a medical error were developed. The original case vignette had been developed and tested in the Netherlands[12] and was translated into German for the present study.

The case vignette scenarios differed regarding three factors: The acting physician who caused the error (*self* or *other*), the presence of witnesses (*present* or *absent*), and the consequences of the medical error for the patient (*negative outcomes* or *no effects*). By varying these factors, we ended-up with an overall number of six different case vignette scenarios (see Table 1). After reading the randomly assigned case scenario, the participant was asked the open question: "What would you do?" The question was answered in a free text field.

	Negative outcome	No negative outcome
I, myself cause the error and there were no witnesses	1	4
I, myself caused the error and a colleague was witness	2	5
I, myself am the witness, and a colleague caused the error	3	6

Example

For all participants:

Scenario 4:

An elderly woman arrives in the Emergency Room because she has fallen. She is having difficulties with the right hip, where a large hematoma is visible. Incorrectly, an X-Ray of the left hip is being taken.

You are attending physician who made this error. However, this was not witnessed by anyone. After one week, the patient comes in for a follow-up. This time the correct side is being X-rayed. The patient is pain-free and the X-ray does not indicate any pathology.

What would you do?

Table 1: Overview of the six possible cases and the text for all participants and exemplary for scenario four.

Data analysis

To answer the first research question, all coding units were analysed using a descriptive qualitative content analysis approach. All provided answers were analysed according to qualitative content analysis per Mayring[13]. The coding process was performed by all four authors and can be described as follows: The raw material was defined as all written answers. The unit of analysis was defined as one answer. In terms of familiarisation with the raw material, all answers were read by three researchers (MK, IK and JK) as the first step. In the second step, all passages that did not directly correspond to the research question were removed and single

1
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3 answers were defined as context units. One paraphrase was defined as a coding
4 unit. Subsequently, all four researchers met and developed a coding scheme based
5 on 25 percent of the material. The passage of the text that reflected the category best
6 was chosen as an anchor example. Exclusion and inclusion criteria for each category
7 were specified as coding rules. After development of the coding scheme, it was
8 applied to the whole material by researcher MK. By doing so, all passages of the text
9 were codified into the coding system. To ensure quality of the coding process in
10 terms of interrater reliability, a fifth researcher (TK, not part of the author team)
11 independently coded 10 percent of the material. The interrater reliability was tested
12 using the same coding scheme, resulting in a Fleiss $\kappa = .84$. All coders were unaware
13 of which case vignettes the unit of analysis belonged to at all times of the
14 development and application of the coding scheme.
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24 For answering the second research question, the results were analysed
25 distinguishing in each case vignette scenario. The quantity of the categories that
26 arose was counted, according to Wolcotts[14] procedure for transforming qualitative
27 data. We explored differences between scenarios, which varied depending on patient
28 outcome, error witness, and error cause.
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RESULTS

Description of the sample

Altogether $n=320$ students opened the online survey and $n=159$ students answered a case vignette. Due to these drop-outs (students that opened the survey and thus got randomly allocated to one case but did not answer it) the distribution of participants to cases is uneven. Figure 1 shows the number of respondents per scenario and per factor.

Fig 1: Study design and number of participants according to the cases.

The participants were 24 years old ($M=24.6$, $SD=7.9$) on average and 110 of the participants (69%) were female. The majority of the participants were in the third, fourth, or fifth year of their studies ($n=107$). Other students ($n=27$) were in their first and second year and $n=21$ participants were in their final year; for $n=4$ there was no information available*.

Categories

For answering the first research question, during the inductive coding process the following 19 categories emerged from the original data (see Table 2), clustered into the four themes (1) considering communication, (2) considering reporting, (3) considering consequences, and (4) emotional responsiveness.

1. Considering communication

Within the theme considering communication we subsumed nine categories. The categories *Apologize to the patient* and *Disclosure of an error to the patient* include quotes in which the student signals a strong intention to offer an apology or a disclosure to the patient:

“After the surgery, I inform the patient about the mistake and apologize.” (#92)

* German undergraduate medical education can be divided into three parts: first and second year (preclinical years), where the focus is on basic sciences and biomedical knowledge; third, fourth, and fifth year, where the focus is on knowledge regarding illnesses (clinical years); and the final year (practical year), which is a clinical rotation.

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3 “...tell her [the patient], that an image of the other hip was taken by accident ...
4 and apologize.” (#13)
5
6

7 The category *Consideration to disclose* covers coding units in which the student only
8 considers disclosure or reflects upon the possibility of telling the patient about the
9 error, but is not sure of doing it.
10

11 “Ideally, the correct reaction would be to tell the patient about the error and the
12 resulting consequences in an explicit and understandable manner...” (#44)
13
14

15 “If I would know better about the consequences for me and how I would deal
16 with them, I would be rather prepared to be honest with the patient.” (#269)
17
18

19 The category *Consideration to not disclose* contains statements where the student
20 reflects rather on not informing the patient about the committed error:
21

22 “I would not tell the patient about the mistake because it is no longer relevant.”
23 (#228)
24
25

26 “...I am not sure if I would do that in a real case because I would be afraid to
27 be sued.... [I would] rather try to find a plausible excuse for the error or try to
28 conceal it.” (#44)
29
30

31 “I can’t rule-out that - in a bad team status / team climate - I would cover up
32 the error.” (#65)
33
34

35 In the category *Concealment*, all the coding units in which the student is sure about
36 keeping his knowledge about the error for himself are subsumed:
37
38

39 “I shut my mouth and hope that no one notices.” (#22)
40
41

42 “I don’t have the balls to admit my error – sad actually!” (#122)
43
44

45 “I would not disclose this to the patient and I would ensure that I make less
46 errors.” (#139)
47
48

49 Note, that the categories *disclosure of an error to the patient, considering disclosure,*
50 *considering no disclosure,* and *concealment* are mutually exclusive to each other.
51
52

53 Within the following categories statements are consolidated, in which the student
54 describes that he intends to talk about the error with someone. The four categories
55
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3 are not mutually exclusive: *communication with colleagues, communication with*
4 *nursing staff, communication with the superior/chief and communication with others.*

5
6 “Most likely, I would try to discuss this medical error with a superior or
7
8 colleague (regarding the further course of action).” (#6)

9
10
11 “I go to the respective colleague and discuss with him what we should do
12
13 further; that is, first speaking with the senior physician or speaking directly to
14
15 the team.” (#55)

16
17 “Discuss with colleagues and Boss (depending on the boss...)” (#88)

18
19 “Whether I would explain it to my boss, depends on my expectation of his
20
21 reaction.” (#228)

22
23 “I would admit my error ... [and] tell the nurses, X-ray technicians and other
24
25 physicians that they should bring it to my attention when they notice one of my
26
27 errors.” (#18)

28
29 “Discuss with all of those involved and superiors.” (#124)

30
31 “Call-in a team meeting.” (#255)

32 33 34 (2) Considering reporting

35 The theme considering reporting contains an overall number of two categories. They
36
37 differ from those in the first theme by including statements about reporting the error in
38
39 a written format instead of oral communication. The category *reporting in general*
40
41 covers statements in which the student explains that he would report the error but
42
43 does not specify how they would do it, where they would report it, or to whom they
44
45 would report it:

46
47 “Then one must officially report this, I just don’t know where.” (#58)

48
49 If, additionally to the intention to report the error, the statement mentions a reporting
50
51 system or equivalent structures, it is subsumed under the category *reporting to an*
52
53 *incident reporting system*:

54
55 “Report in the potentially existing error reporting system (i.e. Critical Incident
56
57 Reporting System).” (#220)

1
2
3 “Report in anonymous system.” (#4)
4

5 “[Give] info to the error management of the clinic.” (#206)
6
7

8 (3) Considering consequences

9 The theme considering consequences consists of five categories describing the
10 consequences of the error or the next steps that one will undertake. The category
11 *actions resulting from the error* includes statements that pictures concrete actions
12 that has to follow the error from the students’ perspective, such as:
13
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15

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17
18 “Initiate respective therapy.” (#48)
19

20 “Immediately, when the error was noticed, I would call the patient back into the
21 practice/clinic and x-ray the correct side.” (#75)
22
23

24 “Presumably, from now on, together with the patient, I would mark the
25 extremity that I am supposed to x-ray with a marker.” (#2)
26
27

28 If consequences other than a direct action were named or if the student reflects upon
29 a strategy for future prevention, the quote was assigned to the category
30 *Consequences in general / Prevention*:
31
32
33

34
35 “I would...see how to avoid it [the error] in the future. Then a solution strategy
36 should be found and discussed with all involved wards.” (#40)
37
38

39 “...mention catastrophic state of the ER and, through the top supervisor,
40 insist on better controls.” (#90)
41
42

43 “...it is about everyone learning from errors and reducing them, and reinforcing
44 teamwork without any punishment. Employees should be encouraged to admit
45 errors without any fear.” (#155)
46
47

48 “...revisit the case later and discuss in quality management so that colleagues
49 can learn more from it.” (#246)
50
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53 The category *personal learning* covers statements that mention the conclusions that
54 the student draws on for his or her own future actions:
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3 “I...am more sensitive towards this topic in the future so that such an error will
4 not happen to me once again.” (#132)
5

6
7 “The learning effect would probably be really big for me and I would learn from
8 this error.” (#228)
9

10
11 If the search for causes leading to the error was described, quotations are subsumed
12 to the category *cause analysis*:
13

14
15
16 “I’d deliberate on how this error could have happened. Was it me making a
17 wrong request? If so, why? Or, an incorrect execution by the X-ray nurse? If
18 so, why?” (#2)
19

20
21
22 “I would conduct an error search and, firstly, see where the error occurred.”
23 (#40)
24

25
26 “Talk with my colleague and ask him how this could have taken place.” (#28)
27

28
29 “Search the reason how this mix-up came to be... Deliberate the working
30 process.” (#117)
31

32
33 If students mentioned legal aspects or considered a special documentation,
34 statements were subsumed in the category *Legal aspects / Documentation*:
35

36
37 “I would inform her about her rights, even if this would be to my disadvantage.”
38 (#175)
39

40
41 “Inform [her] about rights for damage compensation.” (#177)
42

43
44 “Because she [the patient] would lose a lot of time and nerves in a lawsuit, I
45 would advise her to really ask herself whether that’s what she wants in the
46 case that she has this idea [to go to court] on her own. I am not a supporter of
47 immediate lawsuits after errors in a medical procedure.”
48

49
50 “...if it must be, I would apologize. (Note: Of course it must be but I would be
51 worried, for example, to then be sued.)” (#269)
52
53

54
55 (4) Emotional responsiveness
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3 The theme emotional responsiveness contains four categories that cover a range of
4 emotional reactions to the error. The category *Meaning for the patient / Patients'*
5 *perspective* covers statements in which the student reflects on the meaning of the
6 error or possible consequences for the patient or mentions the patient's perspective:
7
8
9

10
11 "I think I would in this case first discuss with my senior physician before I
12 would inform the patient and possibly unnecessarily worry [her]." (#7)
13

14
15 "Make sure that my error really has no effect or damage with the patient. If this
16 should be, I wouldn't tell the patient in order to not unnecessarily concern [the
17 patient]." (#32)
18

19
20
21 "I would explain the incident to the patient and point-out that this has really
22 negative consequences for her. I would hope for the patient's understanding of
23 the stress in the hospital." (#112)
24

25
26
27 "The lady could die if I do not monitor the right hip (and if the kind lady is older,
28 the additional radiation exposure is justifiable." (#118)
29

30
31 "...ask her [the patient] whether she wants to continue to be treated by me or
32 another physician, or go to another clinic." (#161)
33

34
35 The category *Being emotionally touched* subsumes statements in which the student
36 expresses his own emotions or feelings towards the situation:
37

38
39
40 "I am happy that my error had no consequences for the patient." (#119)
41

42
43 "I am relieved that there is no pathological finding in the right hip." (#122)
44

45
46 "How lucky. I shut my mouth and hope that no one notices." (#22)
47

48 If the question of guilt is raised, the quote was grouped to the category *guilt*:
49

50
51 "Obviously, I myself am guilty." (#188)
52

53
54 "If my colleague notices an error but didn't say anything, he is also guilty."
55 (#203)
56

Statements that describe the uncertainty and doubts of the student about how to handle the situation were arranged in the category *Uncertainty / doubts*:

“Quite honestly, I can – as I am at the beginning of my studies and have no patient or clinical experience whatsoever – not exactly imagine how I would react in this type of situation.” (#21)

“...so really I don’t know what I should do.” (#114)

“If I know better about the consequences for me and the handling of it, I would be prepared to be honest with the patient. Admitting to an error is essential – but at what price?” (#269)

“Currently, I don’t know how one should handle errors – to whom to report?” (#116)

“...if she would not like to be operated by me and nobody else is on duty or available, I would be at a loss.” (#110)

Transformed qualitative data

Regarding the overall frequency of codes, it showed that in total 406 quotes were coded (see Table 2). Categories containing the largest numbers of quotes were *disclosure of an error to the patient* (n=47; 30%), *communication with the superior/chef* (n=46; 29%), *communication with colleagues* (n=45; 28%), and *actions resulting from the error* (n=42; 42%). Many students wrote quotes that were subsumed into categories considering communication with somebody else then the patient (n=107). About half of the students made statements regarding the issue of disclosure of the error: overall n=77 (56%) quotes were subsumed to one of the four categories comprising the topic (*disclosure of an error to the patient, considering disclosure, considering no disclosure, concealment*). Only a minority of the students (n=25; 16%) considered reporting the error, and only a few (n=5; 3%) mentioned to report it in an incident reporting system. Categories considering emotional responsiveness contained proportionally few quotes (n=66; 41%) within *meaning for the patient* (n=27; 17%) was counted the most frequent.

	Case vignette scenario						
	Overall	Outcome		Witness		Error Cause	
		Not Negative	Negative	No Witness	Witness	Self causes error	Colleague causes error
1. Categories considering communication							
<i>excuse to the patient</i>	32 (20%)	9 (14%)	23 (24%)	11 (18%)	16 (27%)	27 (22%)	5 (14%)
<i>disclosure of an error to the patient</i>	47 (30%)	14 (22%)	33 (35%)	13 (21%)	24 (40%)	37 (30%)	10 (27%)
<i>considering disclosure</i>	16 (10%)	6 (9%)	10 (11%)	7 (11%)	8 (13%)	15 (12%)	1 (3%)
<i>considering no disclosure</i>	16 (10%)	10 (16%)	6 (6%)	5 (8%)	8 (13%)	13 (11%)	3 (8%)
<i>Concealment</i>	9 (6%)	6 (9%)	3 (3%)	8 (13%)	0 (0%)	8 (7%)	1 (3%)
<i>communication with colleagues</i>	45 (28%)	18 (28%)	27 (29%)	2 (3%)	14 (23%)	16 (13%)	29 (78%)
<i>communication with nursing staff</i>	1 (1%)	1 (2%)	0 (0%)	0 (0%)	1 (2%)	1 (1%)	0 (0%)
<i>communication with the superior/chief</i>	46 (29%)	14 (22%)	32 (34%)	20 (32%)	15 (25%)	35 (29%)	11 (30%)
<i>communication with others</i>	15 (9%)	3 (5%)	12 (13%)	4 (6%)	7 (12%)	11 (9%)	4 (11%)
2. Categories considering reporting							
<i>reporting in general</i>	20 (13%)	5 (8%)	15 (16%)	7 (11%)	6 (10%)	13 (11%)	7 (19%)
<i>reporting to an incident reporting system</i>	5 (3%)	2 (3%)	3 (3%)	2 (3%)	3 (5%)	5 (4%)	0 (0%)
3. Categories considering consequences							
<i>actions resulting from the error</i>	42 (27%)	13 (20%)	29 (31%)	18 (29%)	14 (23%)	32 (26%)	10 (27%)
<i>consequences in general / prevention</i>	17 (11%)	12 (19%)	5 (5%)	7 (11%)	4 (7%)	11 (9%)	6 (16%)
<i>personal learning</i>	5 (3%)	5 (8%)	0 (0%)	2 (3%)	2 (3%)	4 (3%)	1 (3%)
<i>cause analysis</i>	15 (9%)	10 (16%)	5 (5%)	6 (10%)	6 (10%)	12 (10%)	3 (8%)
<i>legal aspects/ documentation</i>	9 (6%)	3 (5%)	6 (6%)	3 (5%)	4 (7%)	7 (6%)	2 (5%)
4. Categories considering emotional responsiveness							
<i>meaning for the patient / patients perspective</i>	27 (17%)	15 (23%)	12 (13%)	7 (11%)	13 (22%)	20 (16%)	7 (19%)
<i>being emotionally touched</i>	8 (5%)	4 (6%)	4 (4%)	3 (5%)	4 (7%)	7 (6%)	1 (3%)
<i>guilt</i>	7 (4%)	2 (3%)	5 (5%)	2 (3%)	5 (8%)	7 (6%)	0 (0%)
<i>uncertainty / doubts</i>	24 (15%)	9 (14%)	15 (16%)	15 (24%)	6 (10%)	21 (17%)	3 (8%)

Table 3: Descriptive overview of the categories in all the cases; Percentage comparison refers to the proportion of participants who mentioned that category in reply to the characteristic of the case vignette scenarios

Comparison of the Case vignette scenarios

For answering the second research question, how (A) error cause, (B) error witness and (C) patient outcome affect students' behavioural intentions, we inspected Table 2 and will present the results that stand-out the most below. Percentage comparison refers to the proportion of participants who mentioned that category in reply to the characteristic of the case vignette scenarios.

(A) Error cause

When a colleague caused the error in the case vignette scenario, more students would communicate with the colleague (78% vs. 13%), take preventive action in general (16% vs. 9%), and report the error (19% vs. 11%) than when the student caused the error himself. For the scenarios in which the student caused the error himself, guilt (6% vs. 0%), uncertainty/doubts (17% vs. 8%), and excuse to the patient (22% vs. 14%) was reported more frequently than when a colleague caused the error.

(B) Error witness

Scenarios in which a witness observed the error evoked more quotes concerning both disclosure to the patient (40% vs. 21%) and emotional responsiveness towards the meaning for the patient (22% vs. 11%) than those scenarios without a witness. Additionally, the categories concealment (0% vs. 13%) and uncertainty/doubts about how to deal with the error (10% vs. 24%) appeared less frequent in scenarios involving a witness than without a witness.

(C) Patient outcome

If the outcome of the scenario was negative for the patient, more students mentioned disclosure of the error to the patient (35% vs. 22%), communication to the superior/chief (34% vs. 22%), reporting of the error in general (16% vs. 8%), and actions resulting from the error (31% vs. 20%) than when there were no negative outcomes for the patient.

In the scenarios in which the error did not have negative outcomes for the patient, students mentioned more often the consequences in general (19% vs. 5%), personal

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3 learning (8% vs. 0%), cause analysis (15% vs. 5%), and meaning for the patient /
4 patients perspective (23% vs. 13%) than when the patient suffered from the error.
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8 Table 2 shows a descriptive overview of the distribution the categories over all the
9 case scenarios.
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11 12 **DISCUSSION**

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14 This study aimed to obtain insight in the behavioural intentions of medical students
15 after observing or causing a hypothetical medical error. First, we investigated the
16 intentions they expressed after reading a case scenario. The written answer on how
17 they would deal with the situation showed that the reactions clustered around four
18 main themes: communication, reporting, consequences, and emotional
19 responsiveness. Students mentioned communication to the patient involved (ranging
20 from disclosing to the patient to considering to not disclose to concealment), as well
21 as talking about the error with colleagues, nurses, the superiors, or others. Next to
22 these forms of direct communication, students intended to report the error into an
23 incident reporting system or otherwise in terms of sharing the error experience with
24 the healthcare organisation. Additionally, students considered different
25 consequences of the error and action they would intend to take. These include extra
26 medical care for the patient and informing the patient about legal aspects, as well as
27 learning from the error for future improvement. The latter contains cause analysis to
28 better understand how the error could happen, plans or thoughts on how the error
29 could be prevented, and personal learning about individual knowledge and skills that
30 may need improvement.
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43 Furthermore, we explored how students' behavioural intentions are influenced by
44 three fundamental characteristics of the setting in which the error took place. First, it
45 showed that the behavioural intentions were influenced by whether the error was
46 made by oneself or not on all four themes. When the student himself caused the
47 error, the emotional responsiveness was more dominant whereas, when a colleague
48 caused the error, students felt more inclined to communicate the error, report it, and
49 take preventive actions. It could be that if someone else made the error, the context
50 seemed more secure to effectively deal with the situation that arose. Additionally, one
51 may be less consumed with the emotions provoked by the error.
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4 Our data suggests that the intentions to communicate about the error and the
5 emotional responsiveness were especially influenced by whether there was a witness
6 perceiving the error. The impact of an error seemed to be stronger in the case of a
7 witness: The empathy with the patient perspective is higher and more often students
8 intend to inform the patient about the error. With a witness, students no longer
9 consider concealing the error and are more efficacious/certain about how to deal with
10 the error compared to situations in which nobody saw the error.
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17 Our findings represent a different ways to handle errors: There are those who react
18 emotionally and are uncertain what to do, and those that were able to express
19 behavioural intentions targeting preventive actions. It seems that when students are
20 involved in the generation of errors, the existing cognitively-driven behavioural
21 intentions become dominated by the emotional responsiveness.
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27 Moreover the outcomes of the error for the patient appeared to influence students'
28 behavioural intentions. In the case of negative outcomes, attention is directed
29 towards communication with the patient, the superior/chief, reporting the error, and
30 actions to limit harm due to the error. Meanwhile, in cases in which the patient is not
31 harmed, students use the error as a chance for improvement of the healthcare
32 system and their own competencies by analysing the causes of the error, reflecting
33 on options for prevention and the meaning for the patient, as well as using the error
34 for personal learning. This indicates that the student's first reaction to an error is the
35 patient's health and the correct communication is prioritized. Only when the patient's
36 health is not in danger, learning and prevention get more attention. This outcome is
37 worrisome because, especially in those incidents where patients have suffered,
38 changing protocols and taking actions for safer healthcare should be of high
39 importance.
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50 Our results are in line with findings that students generally have a positive attitude
51 towards patient safety and are generally willing to participate in patient-safety
52 initiatives [5-7]. Our results support that the knowledge of what to do in a case of an
53 error is limited for most students [cf. 5]. We were able to gain more insight into the
54 findings by Muller [9], who has shown that the more students were emotionally
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involved in the error, the more they were afraid of litigations. Our results add to this result that students generally have some knowledge on how to handle errors and have ideas of whom to communicate to and did express the wish to disclose the error to the patient as well as the wish to let the organization and team learn from the error. However, most of these generally helpful behavioural intentions might be disenabled by the emotional responses. Emotional responsiveness seems to be triggered especially when students are directly involved in the generation of the error.

Practical implications

Our study demonstrates that medical students already have clear and concrete behavioural intentions in case of medical error. It also highlights the importance to establish approaches for dealing with errors and also for coping with emotions caused by these special situations in the undergraduate medical education. While protocols, algorithms and knowledge, of course, have an important part in preventing an error, they cannot prepare for the emotional response that comes with involuntarily harming a patient. Medical educators, thus far, do not have common educational approaches on how to stimulate, teach, or test emotional preparedness when facing negative consequences for the patient. In addition, the results of the study emphasize the importance of a safe climate of the immediate work environment and the relationship with colleagues and boss. In particular, employers should stimulate a collaborative work climate that enables colleagues to watch/observe each other and engage in mutual learning. This especially holds true when collaborating with younger colleagues and students. A clear and transparent information policy of what to do in case of errors is important to instigate a climate of safety.

Limitations

Although behavioural intention is closer linked to behaviour than attitudes, it is still not the actual behaviour and the link between both needs to be studied more deeply. However, if medical students do not know what to do and do not have any intention to perform a certain way in case of an error, the probability of showing adequate behaviour is seen as highly unlikely [15].

Even if we tried to reach medical students from all over Germany the sample of our study is rather small and, due to the uneven number of dropout per case, our findings

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3 should not be overgeneralised. However, for a qualitative study, the sample size itself
4 and recurrence of themes and categories, suggests that saturation has been
5 reached. In our sample, we neither differentiated between the year of study nor did
6 we investigate behavioural intentions of residents. There is a possibility that the final
7 semester students' professionalism increases and more students would handle
8 errors appropriately once the medical education program is finished. Additionally, as
9 we only included German students, there could be a cultural bias and our data
10 should be confirmed in other countries cultural settings.
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16 17 **CONCLUSION**

18 Making use of standardized case vignettes and qualitative research methods we are
19 beginning to better understand the driving forces between anonymous reporting,
20 error disclosure, and concealment. Students need to understand that dealing with
21 errors is part of being a physician. Medical educators need to understand that they
22 need to educate in a way that they know exactly what to do when dealing with an
23 error *and* are equipped with effective coping strategies for dealing with strong
24 emotions so that they are enabled to adequately handle the situation.
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Contributorship statement

Dr. Isabel Kiesewetter had the idea and took part in the design of the study, the data coding and analysis and the drafting of the manuscript.

Dr. Karen Konings took part in the data coding and analysis and the drafting of the manuscript

Dr. Moritz Kager took part in the design of the study, the data acquisition, coding and analysis of data and the revision of the manuscript.

Dr. Jan Kiesewetter took part in the design of the study, the data coding and analysis and the drafting of the manuscript.

Competing interests

All authors have declared no conflicts of interest

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Data sharing statement

No additional data available.

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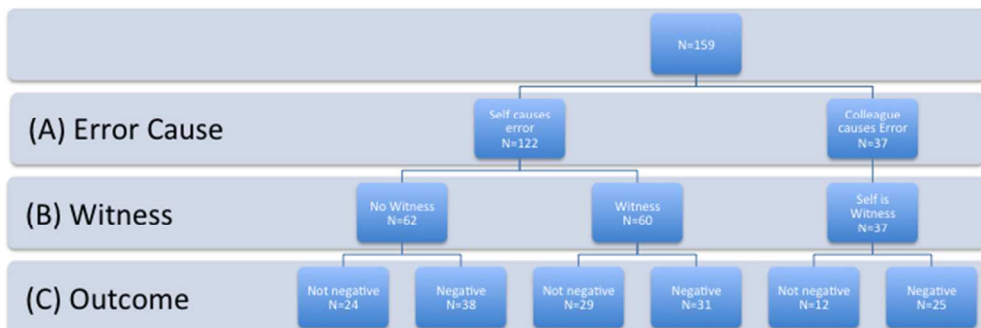


Figure 1. Study design and number of participants according to the cases.

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Undergraduate medical students' behavioural intentions towards medical errors and how to handle them – a qualitative vignette study

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Undergraduate medical students' behavioural intentions towards medical errors and how to handle them – a qualitative vignette study

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ABSTRACT

Objectives: In undergraduate medical education, the topics errors in medicine and patient safety are underrepresented. The aim of this study was to explore undergraduate medical students' behavioural intentions when confronted with an error.

Design: A qualitative case vignette-survey was conducted including one of six randomly distributed case-scenarios in which a hypothetical but realistic medical error occurred. The six scenarios differed regarding (1) who caused the error, (2) the presence of witnesses, and (3) the consequences of the error for the patient. Participants were asked: "What would you do?". Answers were collected as written free texts and analysed according to qualitative content analysis.

Setting: Students from German medical schools participated anonymously through an online questionnaire tool.

Participants: Altogether n=159 students answered a case scenario. Participants were on average 24.6 years old ($SD=7.9$) and 69% were female. They were undergraduate medical students in their first or second year (n=27) third, fourth, or fifth year (n=107) or final year (n=21).

Results: During the inductive coding process, 19 categories emerged from the original data and were clustered into four themes (1)considering communication, (2)considering reporting, (3)considering consequences, and (4)emotional responsiveness. When the student himself caused the error in the scenario, participants did mention communication with colleagues and taking preventive action less frequently than if someone else had caused the error. When a witness was present, participants more frequently mentioned disclosure of the error and taking actions than in the absence of a witness. When the outcome was significant to the patient, participants more often showed an emotional response than if there were no consequences.

Conclusions: The study highlights the importance of coping strategies for healthcare professionals to adequately deal with errors. Educators need to introduce knowledge and skills on how to deal with errors and emotional preparedness for errors into undergraduate medical education.

ARTICLE SUMMARY

Strengths and Limitations of the study

- This study is one of the first examining medical students' behavioural intentions towards medical errors using qualitative methods.
- Case vignettes are shown to be a useful method to investigate influences on behavioural intentions.
- The relationship between behavioural intentions and actual behaviour in the context of medical error is not investigated in this study and needs to be the focus of future research.
- Participants represented a sample of German medical students, thus transferability to residents, other health care professions and different cultural background is questionable.

INTRODUCTION

Concerning medical errors and patient safety, physicians take a central role in the health care system. On the one hand, physicians can prevent errors, ensure patient safety, and follow-up on errors to prevent further harm. On the other hand, they also can generate errors, near misses, and preventable adverse events. Physicians have complex tasks in stressful, error-prone situations[1] and have to deal with the consequences of errors[2] or near misses[3]. Additionally, physicians themselves might be affected by an error and, as a “second victim”, can also be traumatized and suffering from the error[4]. In recent years the importance of developing skills to deal with medical errors for all professions in the healthcare setting has become clear[5-7]. Although various international committees have demanded the early integration of medical-error and patient-safety educational structures for medical professionals[8-10], thus far, there are very few international publications describing implemented formats for undergraduate medical education[11]. In Germany, where the sample of the present study is taken from, there only exist a few of those structures with little consistency, as well[12].

When new educational structures are developed, the students' attitude towards the topic of teaching has to be taken into account[13]. As there are studies exploring the residents' or physicians in training's attitudes concerning medical errors[14-16], only a few studies about students' attitudes towards medical errors exist[17, 18]. By using quantitative approaches some studies have shown that first-year medical students' attitudes are supporting an error-friendly environment and state that they would disclose errors and do everything they can to ensure patient safety[11, 19, 20]. But, if an error would happen to them, students have limited knowledge about what to do and they also feel uncertain about how to handle the situation if a colleague had made an error[11]. Most of the recent studies investigating the attitudes of medical students focus on the occurrence of disclosure, emotions, and the fear of malpractice litigation[21].

Martinez et al. conducted a study examining medical students' experiences with medical errors by analyzing anonymous descriptions of medical errors, they had committed or witnessed[22]. They have shown that not only many medical students had made or observed significant errors, but also that students experienced severe distress and uncertainty. Moreover, in the population of this study, students reported high motivation to disclose the error to patients and take responsibility.

To understand undergraduate medical students' behavioural intentions could be another approach to investigating this very sensitive subject and to leave aside the pressing ethical issues emerging when discussing actual cases. Behavioural intentions are defined as the hypothetical actions people intent to choose in a specific event and have been concluded to be a valid proxy measure for behaviour among clinicians [23]. A study by Muller et al.[24] investigated how students would feel after they would commit a hypothetical error and this study has shown that feelings depended on the outcome to the patient. The more harmful the outcome was, the angrier the students would be towards themselves, the more guilt they would feel, and the more afraid they would be of accusations and malpractice charges. Hence, factors such as the outcome of the patient after an error and the role or responsibility of the student (i.e. being a witness or being the person who has made the error) may essentially influence the underlying behavioural intentions as well. However, in their study, it remains unclear what the students would actually *do* if an error would have happened to them, which will be the focus of our study.

Scientific approaches to describe attitudes and to understand behaviour or behavioural intentions are mainly based in qualitative research. In both medical studies and medical education research, qualitative research methods have been recognized as complementary and essential. Qualitative research intends to understand how people experience the world and seeks to reveal the underlying *what* and *how* of peoples' perception[25].

The main objective of the present case vignette study was to generate a basic comprehension of how undergraduate medical students deal with errors and to understand their behavioural intentions towards the topic. A qualitative research method has been chosen to address the following research questions:

1. What kind of behavioural intentions do students express when they participate in a case with a medical error?
2. How do these behavioural intentions depend on factors such as the consequences for the patient, the presence of witnesses, and their own role in committing error?

METHODS

Participants and Setting

The survey was conducted using the online survey system Unipark (<http://www.unipark.de/>). The participants were recruited via email. All 38 German medical student councils forwarded the link to an online questionnaire via their mailing lists. All data were collected anonymously and the students' agreement to analyse the data was obtained before starting with the questionnaire. Participation was voluntary and those who participated took part in a lottery for book vouchers (10 vouchers with a value of 20€). The online survey was filled out from a private computer and participants were came into personal contact with the researchers.

Each participant received one case scenario about a medical error, unaware that there were other versions. Six different cases (see paragraph Materials, Table 1) were randomly distributed among the participants. Participants received a short, written introduction and the instruction to answer one open question. Another completely independent part of the questionnaire contained demographic data and quantitative data that are published elsewhere[26].

The ethics committee of the responsible medical faculty approved this survey (Ethical Approval no. UE036-13). The study was partly funded by a Volkswagen foundation grant.

Materials

Six different scenarios of a case vignette about a hypothetical, but realistic situation dealing with a medical error were developed (see Table 1). The case vignette had been developed by the second author and an internist at Maastricht University Medical Centre and six scenarios were created after an idea from Van Mierlo et al.[27] The six scenarios were tested in the Netherlands[28] and translated into German for the present study.

The case vignette scenarios differed regarding three factors: The acting physician who caused the error (*self* or *other*), the presence of witnesses (*present* or *absent*), and the consequences of the medical error for the patient (*negative outcomes* or *no effects*). By varying these factors, we ended-up with an overall number of six different case vignette scenarios (see Table 1). After reading the randomly assigned case

scenario, the participant was asked the open question: "What would you do?" The question was answered in a free text field.

Case for all participants:

An elderly woman arrives in the Emergency Room because she has fallen. She is having difficulties with the right hip, where a large hematoma is visible. Incorrectly, an X-Ray of the left hip is being taken.

Negative patient outcome

No consequences for patient

What would you do?

I, myself caused the error and there were no witnesses

Scenario 1

Scenario 4

I, myself caused the error and a colleague was witness

Scenario 2

Scenario 5

I, myself am the witness and a colleague caused the error

Scenario 3

Scenario 6

Table 1: Case description and overview of the six possible scenarios.

Note. Example: Scenario 4 - *You are the attending physician who made this error. However, this was not witnessed by anyone. After one week, the patient comes in for a follow-up. This time the correct side is being X-rayed. The patient is pain-free and the X-ray does not indicate any pathology.*

Data analysis

To answer the first research question, data were analysed using a descriptive qualitative content analysis approach according to Mayring[29]. This process is illustrated in Figure 1, showing the general step model of inductive category development.

Figure 1: Step model of inductive category development according to Mayring[30]

The coding process in our study was performed by all four authors and can be described as follows: The raw material was defined as all written answers, the unit of

analysis was defined as one answer. In terms of familiarisation with the raw material, all answers were read by three researchers (MK, IK and JK) as the first step. In the second step (paraphrasing), all passages that did not directly correspond to the research question were removed (e.g. decorating, repeating or clarifying utterances). One paraphrase was defined as a coding unit. Subsequently, all four researchers met and developed a coding scheme based on 25 percent of the data material. The passage of the text that best reflected the category was chosen as an anchor example. Exclusion and inclusion criteria for each category were specified as coding rules. After the development of the coding scheme, it was applied to the whole material by researcher MK. Thus, all passages of the text were codified into the coding system. To manage data, no specific software for qualitative data except Microsoft Word and Excel were used. To clarify the coding process, an excerpt of the coding scheme is shown in Table 2.

Unit of analysis/quote	Paraphrase	Category	Coding rules and anchor examples
Talk with a colleague and point out to him that an error has happened to him and ask him how it might have happened. I would also be more cautious, so that those things wouldn't happen to me. In this case I wouldn't disclose to the patient. (#28, scenario 5)	Point out to the colleague that an error has happened to him	Communication with colleagues	Statements are coded, if the error is directly addressed when speaking to colleagues/physicians. Statements are not coded, if there is no distinct contact person. Anchor example: "Talk with a colleague and indicate to him that an error has happened to him"
	Asking how the error occurred	Cause analysis	Statements are coded as soon as a search for an error, search for causes/causal relations is mentioned. Anchoring example. Anchor example: "Search the reason how this mix-up came to be... Deliberate the working process."
	I, myself am more cautious in the future	Personal learning	Statements are coded where a personal perspective resulting in a learning process is apparent. Anchor example: "I,

		myself am more cautious in the future.”
Would conceal the error from the patient	Concealment	Statements are coded when it indicates concealment or not talking/reporting of the error to the patient. Anchor example: “I would not inform the patient.”

Table 2: Excerpt of the coding scheme.

To ensure quality of the coding process in terms of interrater reliability, a fifth researcher (TK, not part of the author team) independently coded 10 percent of the material. The interrater reliability for the categorical data was tested using the same coding scheme, resulting in a Fleiss $\kappa = .84$, indicating sufficient agreement [31]. None of the coders were aware which case vignettes the unit of analysis belonged to at all times during the coding scheme’s development and application. Data saturation was discussed within the research team after development of the coding scheme, based on 25% of the data, and after finalization of the coding process of all data. As all of the text’s passages could be allocated to one category defined by the coding scheme and no new categories had emerged while analysing the remainder 75% of the data, the researchers agreed that a sufficient saturation of data was reached for the purpose of the present study.

In order to answer the second research question, the results were analysed distinguishing each case vignette scenario. The quantity of the categories that arose was counted, according to Wolcotts[32] procedure for transforming qualitative data. We explored differences between scenarios, which varied depending on patient outcome, error witness, and cause of error.

RESULTS

Description of the sample

Altogether $n=320$ students opened the online survey and $n=159$ students answered a case vignette. Due to drop-outs (i.e., students who opened the survey and thus got randomly allocated to one scenario but did not answer it) the distribution of participants to cases is uneven. Figure 2 shows the number of respondents per scenario and per factor.

Figure 2: Study design and number of participants according to the cases.

The participants were on average 24.6 years old ($SD=7.9$) and 110 of them (69%) were female. The majority of the participants were in the third, fourth, or fifth year of their studies ($n=107$). Other students ($n=27$) were in their first and second year and $n=21$ participants were in their final year; for $n=4$ no information was available*.

Categories

For answering the first research question, during the inductive coding process the following 19 categories emerged from the original data (see Table 2), clustered into four themes: (1) considering communication, (2) considering reporting, (3) considering consequences, and (4) emotional responsiveness.

1. Considering communication

Within the theme considering communication we subsumed nine categories. The categories *Apologize to the patient* and *Disclosure of an error to the patient* include quotes in which the student signals a strong intention to offer an apology or a disclosure to the patient:

“After the surgery, I inform the patient about the mistake and apologize.” (#92, scenario 4)

* German undergraduate medical education can be divided into three parts: first and second year (preclinical years), where the focus is on basic sciences and biomedical knowledge; third, fourth, and fifth year, where the focus is on knowledge regarding illnesses (clinical years); and the final year (practical year), which is a clinical rotation.

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2
3 “...tell her [the patient], that an image of the other hip was taken by accident ...
4 and apologize.” (#13, scenario 2)
5
6

7 The category *Consideration to disclose* covers coding units in which the student only
8 considers disclosure or reflects upon the possibility of telling the patient about the
9 error, but is not sure of doing it.
10

11 “Ideally, the correct reaction would be to tell the patient about the error and the
12 resulting consequences in an explicit and understandable manner...” (#44,
13 scenario 4)
14
15

16 “If I would know better about the consequences for me and how I would deal
17 with them, I would be rather prepared to be honest with the patient.” (#269,
18 scenario 2)
19
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21

22 The category *Consideration to not disclose* contains statements where the student
23 reflects rather on not informing the patient about the committed error:
24

25 “I would not tell the patient about the mistake because it is no longer relevant.”
26 (#228, scenario 1)
27
28

29 “...I am not sure if I would do that in a real case because I would be afraid to
30 be sued.... [I would] rather try to find a plausible excuse for the error or try to
31 conceal it.” (#44, scenario 4)
32
33
34

35 “I can’t rule-out that - in a bad team status / team climate - I would cover up
36 the error.” (#65, scenario 4)
37
38
39

40 In the category *Concealment*, all the coding units in which the student is sure about
41 keeping his knowledge about the error for himself are subsumed:
42

43 “I shut my mouth and hope that no one notices.” (#22, scenario 1)
44
45

46 “I don’t have the balls to admit my error – sad actually!” (#122, scenario 1)
47
48

49 “I would not disclose this to the patient and I would ensure that I make less
50 errors.” (#139, scenario 1)
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54 Note that the categories *disclosure of an error to the patient*, *considering disclosure*,
55 *considering no disclosure*, and *concealment* are mutually exclusive to each other.
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3 Within the following categories statements are consolidated, in which the student
4 describes that he intends to talk about the error with someone. The four categories
5 are not mutually exclusive: *communication with colleagues*, *communication with*
6 *nursing staff*, *communication with the superior/chief* and *communication with others*.
7

8
9 “Most likely, I would try to discuss this medical error with a superior or
10 colleague (regarding the further course of action).” (#6, scenario 1)
11

12
13 “I go to the respective colleague and discuss with him what we should do
14 further; that is, first speaking with the senior physician or speaking directly to
15 the team.” (#55, scenario 6)
16

17
18 “Discuss with colleagues and Boss (depending on the boss...)” (#88, scenario
19 2)
20

21
22 “Whether I would explain it to my boss, depends on my expectation of his
23 reaction.” (#228, scenario 1)
24

25
26 “I would admit my error ... [and] tell the nurses, X-ray technicians and other
27 physicians that they should bring it to my attention when they notice one of my
28 errors.” (#18, scenario 1)
29

30
31 “Discuss with all of those involved and superiors.” (#124, scenario 4)
32

33
34 “Call-in a team meeting.” (#255, scenario 4)
35

36 37 38 (2) Considering reporting

39 The theme considering reporting contains an overall number of two categories. They
40 differ from those in the first theme by including statements about reporting the error in
41 a written format instead of oral communication. The category *reporting in general*
42 covers statements in which the student explains that he would report the error but
43 does not specify how they would do it, where they would report it, or to whom they
44 would report it:
45
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51 “Then one must officially report this, I just don’t know where.” (#58, scenario 2)
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54 If, additionally to the intention to report the error, the statement mentions a reporting
55 system or equivalent structures, it is subsumed under the category *reporting to an*
56 *incident reporting system*:
57
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3 “Report in the potentially existing error reporting system (i.e. Critical Incident
4 Reporting System).” (#220, scenario 3)
5

6
7 “Report in anonymous system.” (#4, scenario 2)
8

9 “[Give] info to the error management of the clinic.” (#206, scenario 3)
10

11 (3) Considering consequences

12 The theme considering consequences consists of five categories describing the
13 consequences of the error or the next steps that one will undertake. The category
14 *actions resulting from the error* includes statements that pictures concrete actions
15 that has to follow the error from the students’ perspective, such as:
16
17
18
19
20

21 “Initiate respective therapy.” (#48, scenario 4)
22

23 “Immediately, when the error was noticed, I would call the patient back into the
24 practice/clinic and x-ray the correct side.” (#75, scenario 3)
25
26
27

28 “Presumably, from now on, together with the patient, I would mark the
29 extremity that I am supposed to x-ray with a marker.” (#2, scenario 1)
30
31
32

33 If consequences other than a direct action were named or if the student reflects upon
34 a strategy for future prevention, the quote was assigned to the category
35 *Consequences in general / Prevention*:
36
37
38

39 “I would...see how to avoid it [the error] in the future. Then a solution strategy
40 should be found and discussed with all involved wards.” (#40, scenario 1)
41
42

43 “...mention catastrophic state of the ER and, through the top supervisor,
44 insist on better controls.” (#90, scenario 2)
45
46
47

48 “...it is about everyone learning from errors and reducing them, and reinforcing
49 teamwork without any punishment. Employees should be encouraged to admit
50 errors without any fear.” (#155, scenario 2)
51
52

53 “...revisit the case later and discuss in quality management so that colleagues
54 can learn more from it.” (#246, scenario 6)
55
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3 The category *personal learning* covers statements that mention the conclusions that
4 the student draws on for his or her own future actions:
5
6

7 “I...am more sensitive towards this topic in the future so that such an error will
8 not happen to me once again.” (#132, scenario 3)
9

10
11 “The learning effect would probably be really big for me and I would learn from
12 this error.” (#228, scenario 1)
13
14

15
16 If the search for causes leading to the error was described, quotations are subsumed
17 to the category *cause analysis*:
18
19

20
21 “I’d deliberate on how this error could have happened. Was it me making a
22 wrong request? If so, why? Or, an incorrect execution by the X-ray nurse? If
23 so, why?” (#2, scenario 1)
24
25

26 “I would conduct an error search and, firstly, see where the error occurred.”
27 (#40, scenario 1)
28
29

30
31 “Talk with my colleague and ask him how this could have taken place.” (#28,
32 scenario 5)
33
34

35 “Search the reason how this mix-up came to be... Deliberate the working
36 process.” (#117, scenario 3)
37
38

39 If students mentioned legal aspects or considered a special documentation,
40 statements were subsumed in the category *Legal aspects / Documentation*:
41

42 “I would inform her about her rights, even if this would be to my disadvantage.”
43 (#175, scenario 4)
44
45

46 “Inform [her] about rights for damage compensation.” (#177, scenario 4)
47
48

49 “Because she [the patient] would lose a lot of time and nerves in a lawsuit, I
50 would advise her to really ask herself whether that’s what she wants in the
51 case that she has this idea [to go to court] on her own. I am not a supporter of
52 immediate lawsuits after errors in a medical procedure.” (#232, scenario 6)
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3 “...if it must be, I would apologize. (Note: Of course it must be but I would be
4 worried, for example, to then be sued.)” (#269, scenario 2)
5
6

7 (4) Emotional responsiveness

8 The theme emotional responsiveness contains four categories that cover a range of
9 emotional reactions to the error. The category *Meaning for the patient / Patients’*
10 *perspective* covers statements in which the student reflects on the meaning of the
11 error or possible consequences for the patient or mentions the patient’s perspective:
12
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16 “I think I would in this case first discuss with my senior physician before I
17 would inform the patient and possibly unnecessarily worry [her].” (#7, scenario
18 1)
19
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21
22 “Make sure that my error really has no effect or damage with the patient. If this
23 should be, I wouldn’t tell the patient in order to not unnecessarily concern [the
24 patient].” (#32, scenario 3)
25
26

27
28 “I would explain the incident to the patient and point-out that this has really
29 negative consequences for her. I would hope for the patient’s understanding of
30 the stress in the hospital.” (#112, scenario 2)
31
32

33
34 “The lady could die if I do not monitor the right hip (and if the kind lady is older,
35 the additional radiation exposure is justifiable.” (#118, scenario 1)
36
37

38 “...ask her [the patient] whether she wants to continue to be treated by me or
39 another physician, or go to another clinic.” (#161, scenario 4)
40
41

42
43 The category *Being emotionally touched* subsumes statements in which the student
44 expresses his own emotions or feelings towards the situation:
45
46

47 “I am happy that my error had no consequences for the patient.” (#119,
48 scenario 3)
49
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51 “I am relieved that there is no pathological finding in the right hip.” (#122,
52 scenario 1)
53
54

55 “How lucky. I shut my mouth and hope that no one notices.” (#22, scenario 1)
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If the question of guilt is raised, the quote was grouped to the category *guilt*:

“Obviously, I myself am guilty.” (#188, scenario 4)

“If my colleague notices an error but didn’t say anything, he is also guilty.”
(#203, scenario 4)

Statements that describe the uncertainty and doubts of the student about how to handle the situation were arranged in the category *Uncertainty / doubts*:

“Quite honestly, I can – as I am at the beginning of my studies and have no patient or clinical experience whatsoever – not exactly imagine how I would react in this type of situation.” (#21, scenario 2)

“...so really I don’t know what I should do.” (#114, scenario 6)

“If I know better about the consequences for me and the handling of it, I would be prepared to be honest with the patient. Admitting to an error is essential – but at what price?” (#269, scenario 2)

“Currently, I don’t know how one should handle errors – to whom to report?”
(#116, scenario 3)

“...if she would not like to be operated by me and nobody else is on duty or available, I would be at a loss.” (#110, scenario 2)

Transformed qualitative data

Regarding the overall frequency of codes, it showed that in total 406 quotes were coded (see Table 2). Categories containing the largest numbers of quotes were *disclosure of an error to the patient* (n=47; 30%), *communication with the superior/chef* (n=46; 29%), *communication with colleagues* (n=45; 28%), and *actions resulting from the error* (n=42; 42%). Many students wrote quotes that were subsumed into categories considering communication with somebody else, rather than with the patient (n=107). About half of the students made statements regarding the issue of disclosure of the error: overall n=77 (56%) quotes were subsumed to one of the four categories comprising the topic (*disclosure of an error to the patient, considering disclosure, considering no disclosure, concealment*). Only a minority of

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2
3 the students (n=25; 16%) considered reporting the error, and only a few (n=5; 3%)
4 mentioned to report it in an incident reporting system. Categories considering
5 emotional responsiveness contained proportionally few quotes (n=66; 41%) within
6 *meaning for the patient* (n=27; 17%) was counted the most frequent.
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	Case vignette scenario						
	Overall	Outcome		Witness		Cause of error	
		Not Negative	Negative	No Witness	Witness	Self causes error	Colleague causes error
1. Categories considering communication							
<i>excuse to the patient</i>	32 (20%)	9 (14%)	23 (24%)	11 (18%)	16 (27%)	27 (22%)	5 (14%)
<i>disclosure of an error to the patient</i>	47 (30%)	14 (22%)	33 (35%)	13 (21%)	24 (40%)	37 (30%)	10 (27%)
<i>considering disclosure</i>	16 (10%)	6 (9%)	10 (11%)	7 (11%)	8 (13%)	15 (12%)	1 (3%)
<i>considering no disclosure</i>	16 (10%)	10 (16%)	6 (6%)	5 (8%)	8 (13%)	13 (11%)	3 (8%)
<i>Concealment</i>	9 (6%)	6 (9%)	3 (3%)	8 (13%)	0 (0%)	8 (7%)	1 (3%)
<i>communication with colleagues</i>	45 (28%)	18 (28%)	27 (29%)	2 (3%)	14 (23%)	16 (13%)	29 (78%)
<i>communication with nursing staff</i>	1 (1%)	1 (2%)	0 (0%)	0 (0%)	1 (2%)	1 (1%)	0 (0%)
<i>communication with the superior/chief</i>	46 (29%)	14 (22%)	32 (34%)	20 (32%)	15 (25%)	35 (29%)	11 (30%)
<i>communication with others</i>	15 (9%)	3 (5%)	12 (13%)	4 (6%)	7 (12%)	11 (9%)	4 (11%)
2. Categories considering reporting							
<i>reporting in general</i>	20 (13%)	5 (8%)	15 (16%)	7 (11%)	6 (10%)	13 (11%)	7 (19%)
<i>reporting to an incident reporting system</i>	5 (3%)	2 (3%)	3 (3%)	2 (3%)	3 (5%)	5 (4%)	0 (0%)
3. Categories considering consequences							
<i>actions resulting from the error</i>	42 (27%)	13 (20%)	29 (31%)	18 (29%)	14 (23%)	32 (26%)	10 (27%)
<i>consequences in general / prevention</i>	17 (11%)	12 (19%)	5 (5%)	7 (11%)	4 (7%)	11 (9%)	6 (16%)
<i>personal learning</i>	5 (3%)	5 (8%)	0 (0%)	2 (3%)	2 (3%)	4 (3%)	1 (3%)
<i>cause analysis</i>	15 (9%)	10 (16%)	5 (5%)	6 (10%)	6 (10%)	12 (10%)	3 (8%)
<i>legal aspects/ documentation</i>	9 (6%)	3 (5%)	6 (6%)	3 (5%)	4 (7%)	7 (6%)	2 (5%)
4. Categories considering emotional responsiveness							
<i>meaning for the patient / patients perspective</i>	27 (17%)	15 (23%)	12 (13%)	7 (11%)	13 (22%)	20 (16%)	7 (19%)
<i>being emotionally touched</i>	8 (5%)	4 (6%)	4 (4%)	3 (5%)	4 (7%)	7 (6%)	1 (3%)
<i>guilt</i>	7 (4%)	2 (3%)	5 (5%)	2 (3%)	5 (8%)	7 (6%)	0 (0%)
<i>uncertainty / doubts</i>	24 (15%)	9 (14%)	15 (16%)	15 (24%)	6 (10%)	21 (17%)	3 (8%)

Table 3: Descriptive overview of the categories in all the cases; Percentage comparison refers to the proportion of participants who mentioned that category in reply to the characteristic of the case vignette scenarios

Comparison of the Case vignette scenarios

In order to answer the second research question, how (A) cause of error, (B) error witness and (C) patient outcome affects students' behavioural intentions, we inspected Table 3 and will present the most outstanding results below. Percentages refer to the proportion of participants that mentioned the particular category in reply to the characteristic of the case vignette scenarios.

(A) Error cause

When a colleague caused the error in the case vignette scenario, more students would communicate with the colleague (78% vs. 13%), take preventive action in general (16% vs. 9%), and report the error (19% vs. 11%) than when the student caused the error himself. For the scenarios in which the student caused the error himself, guilt (6% vs. 0%), uncertainty/doubts (17% vs. 8%), and excuse to the patient (22% vs. 14%) was reported more frequently than when a colleague caused the error.

(B) Error witness

Scenarios in which a witness observed the error evoked more quotes concerning both disclosure to the patient (40% vs. 21%) and emotional responsiveness towards the meaning for the patient (22% vs. 11%) than those scenarios without a witness. Additionally, the categories concealment (0% vs. 13%) and uncertainty/doubts about how to deal with the error (10% vs. 24%) appeared less frequently in scenarios involving a witness than without a witness.

(C) Patient outcome

If the outcome of the scenario was negative for the patient, more students mentioned disclosure of the error to the patient (35% vs. 22%), communication to the superior/chief (34% vs. 22%), reporting of the error in general (16% vs. 8%), and actions resulting from the error (31% vs. 20%) than when there were no negative outcomes for the patient.

In the scenarios in which the error did not have negative outcomes for the patient, students mentioned more often the consequences in general (19% vs. 5%), personal

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3 learning (8% vs. 0%), cause analysis (15% vs. 5%), and meaning for the patient /
4 patient's perspective (23% vs. 13%) than when the patient suffered from the error.
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8 Table 3 shows a descriptive overview of the distribution the categories over all the
9 case scenarios.
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DISCUSSION

This study aimed to obtain insight in the medical students' behavioural intentions after having observed or having caused a hypothetical medical error. The qualitative analysis of students' written answers on how they would deal with a hypothetical error case scenario revealed four main themes: communication, reporting, consequences, and emotional responsiveness.

We explored how students' behavioural intentions are influenced by three fundamental characteristics of the setting in which the error took place.

First, it showed that the behavioural intentions might be influenced by whether the error was made by oneself or not. When the student himself caused the error, the emotional responsiveness was more dominant, whereas when a colleague caused the error, students felt more inclined to communicate, to report the error, and to take preventive actions. Second, our data suggests that the presence or absence of a witness influenced the students' intentions to communicate about the error, and also their emotional responsiveness. Students showed more empathy with the patients and more often intended to inform the patient about the error if a witness was present. With a witness present, students also were also more certain about how to deal with the error compared to situations in which nobody saw the error. Third, the outcomes of the error for the patient appeared to influence students' behavioural intentions. In the case of negative outcomes, attention was directed towards communication with the patient or the superior/chief, reporting the error, and actions to limit the harm caused by error. Meanwhile, in cases in which the patient was not harmed, students used the error as a chance to improve the healthcare system and their own competences by analysing the causes of the error, reflecting on options for prevention and the meaning for the patient, as well as using the error for personal learning.

Our findings suggest students consider different ways on how to handle errors: There are those who react emotionally and are uncertain what to do, and those who were able to express behavioural intentions targeting preventive actions. It seems that when students are involved in the generation of errors, the existing cognitively driven behavioural intentions become dominated by the emotional responsiveness. In this case the students anticipate an emotional response, considering the meaning for a patient, are emotionally touched, even feel guilt and experience uncertainty. This ties

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2
3 to early work of William Osler who proposed that good physicians are somewhat
4 detached from their patient's suffering in order to function well [33].

5
6 This highlights the importance of establishing educational approaches for practically
7 dealing with errors, while also coping with emotions caused by these special
8 situations, preferably in the undergraduate medical education. The scarce evidence
9 on patient safety courses shows that while protocols, algorithms and knowledge have
10 an important part in preventing an error, they cannot prepare for the emotional
11 response that comes with involuntarily harming a patient or being involved in an error
12 [34]. In this line Patey and colleagues [35] did not find a difference after a training for
13 medical students about the feelings when making errors. It seems that thus far,
14 medical educators are not equipped how to stimulate, teach, or test emotional
15 preparedness when facing negative consequences for the patient. In medical
16 practice the need for emotional preparedness becomes even more imperative. In a
17 survey of over three thousand physicians in internal medicine, a majority had anxiety
18 about future errors and their job-related stress increased, even when involved only in
19 near misses [34]. Apart from offering training approaches, the call for organizational
20 accountability due to emotional impact on physicians has been emphasised [36].
21 Even if emotional reactions in terms of empathy can be considered as important skill
22 for a physician, especially in those incidents where patients have suffered, changing
23 protocols and taking actions for safer healthcare should be of high importance[7].
24 Thus, both issues are important aspects that, according to the authors' opinion, have
25 to be integrated and trained in patient safety curricula.
26
27

28
29 Students in our study also emphasised the importance of communication to the
30 patient involved (ranging from disclosing to the patient to considering not to disclose
31 to concealment), as well as talking about the error with colleagues, nurses, the
32 superiors, or others. This finding highlights the importance of courses including error
33 disclosure for medical students [35, 37], and team communication courses [38-40].
34 Hypothetical cases, like in the vignettes, or one's own cases could be discussed
35 within group coaching sessions, to enhance deep learning on (near) errors [41]. The
36 inclusion of the students' consideration if and when to speak to their superiors
37 depending on the (supposed) team climate was especially interesting. In the
38 literature, this resembles the construct of psychological safety, shown to be
39 important for leader inclusiveness in healthcare [42]. In his second assessment of
40 progress in ten key-patient safety domains called "Patient Safety At Ten:
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Unmistakable Progress, Troubling Gaps” Wachter [43] states a slightly dropped rating for implementation of training initiatives, as only few organizations adopt robust teamwork, culture change or simulation programs [i.e. 44, 45]. Some students intended to report the error to an incident reporting system, or otherwise in terms of share the error experience with the healthcare organisation, but did not know how to do so. This goes in line with the finding of Toenessen, Swart and Marx [46], who have shown the need for more information concerning patient safety reporting. Further it ties to findings of Martinez et al. [22], who showed that students who witnessed physicians take responsibility for errors and disclose errors to patients said that they aspired to these standards.

The various consequences of the error and actions students would intend to take included extra medical care for the patient and informing the patient about legal aspects, as well as learning from the error for future improvement. The latter contains cause analysis to better understand how the error could happen, plans or thoughts how the error could be prevented, and personal learning about individual knowledge and skills that may need improvement [47-49].

Our results are in line with findings that students generally have a positive attitude towards patient safety and are generally willing to participate in patient safety initiatives [11, 19, 20]. Our results underline that knowledge of what to do in the case of an error is limited for most students [cf. 11]. We were able to gain more insight into the findings by Muller [24], who has shown that the more students were emotionally involved in the error, the more they were afraid of litigations. Our results add to this result that students generally have some knowledge on how to handle errors and have ideas whom to communicate to and did express the wish to disclose the error to the patient, as well as the wish to let the organization and team learn from the error.

Limitations

An obvious limitation of the study is the representativeness of the sample. Even if we tried to reach medical students from all over Germany the sample of our study is rather small. As we only included German students, there could be a cultural bias and our data should be confirmed in other countries and cultural settings. Recruitment might have impacted our data as participation was voluntary and compensation was only small. Compensation might also have influenced the

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3 recruitment, but compensation was so limited that potentially only students interested
4 in the subject participated.

5
6 Although the sample size was not major, for a qualitative study, the sample size itself
7 and recurrence of themes and categories suggests that saturation has been reached.
8
9 In our sample, we neither differentiated between the year of study nor did we
10 investigate behavioural intentions of residents. There is a possibility that the final
11 semester students' professionalism increases and more students would handle
12 errors appropriately once the medical education program is finished. Investigating the
13 differences in behavioural intentions throughout the years of study would be an
14 interesting focus for future research.

15
16 Although behavioural intention is closer linked to behaviour than attitude, it is still not
17 the actual behaviour and the link between both needs to be studied more deeply.
18
19 However, if medical students do not know what to do and do not have any intention
20 to perform a certain way in case of an error, the probability of showing adequate
21 behaviour is seen as highly unlikely [50]. Further studies could potentially utilize the
22 methodology of case vignettes with errors and give adaptive feedback depending on
23 their free-text answers [51] i.e. in order to convey norms of reporting, error disclosure
24 and communication.

25
26 Last, we chose to do a quantitative transformation of the qualitative data to compare
27 the influencing factors. Our drawn conclusions are to be seen as observations from
28 qualitative data and not confused with statistically sound comparisons of interval-
29 scaled data.

30 31 32 33 34 35 36 37 38 39 40 **CONCLUSION**

41 By using standardized case vignettes and qualitative research methods we are
42 beginning to better understand the driving forces between anonymous reporting,
43 error disclosure, and concealment. Students need to understand that dealing with
44 errors is part of being a physician. Medical educators need to understand that it is
45 necessary to educate students in a way that they know exactly what to do when
46 dealing with an error, *and* are equipped with effective coping strategies for dealing
47 with strong emotions, so that they are enabled to adequately handle the situation.
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Author's contribution statement

Dr. Isabel Kiesewetter had the idea and took part in the design of the study, the data coding and analysis and the drafting of the manuscript.

Dr. Karen Könings took part in the data coding and analysis and the drafting of the manuscript.

Dr. Moritz Kager took part in the design of the study, the data acquisition, coding and analysis of data and the revision of the manuscript.

Dr. Jan Kiesewetter took part in the design of the study, the data coding and analysis and the drafting of the manuscript.

Competing interests statement

All authors have declared no conflicts of interest.

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Data sharing statement

No additional data available.

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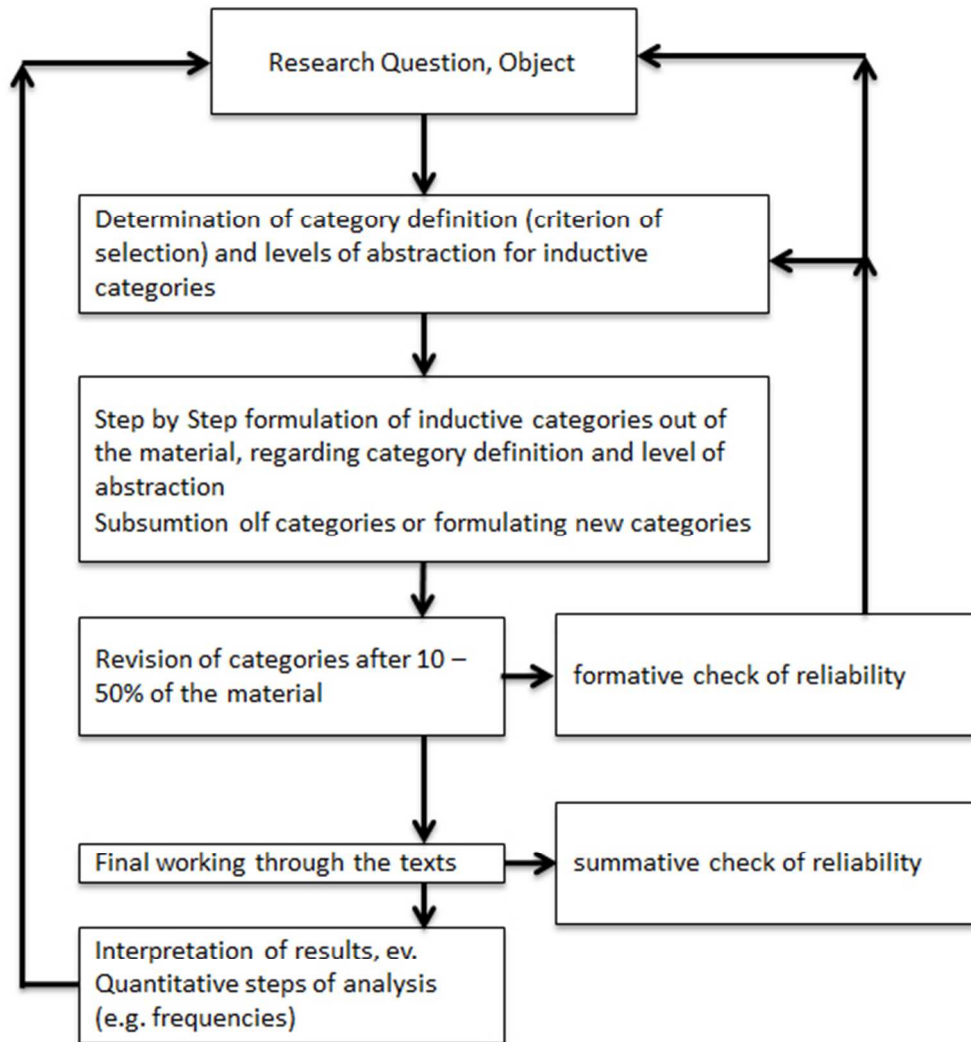


Figure 1: Step model of inductive category development according to Mayring[30]

47x50mm (300 x 300 DPI)

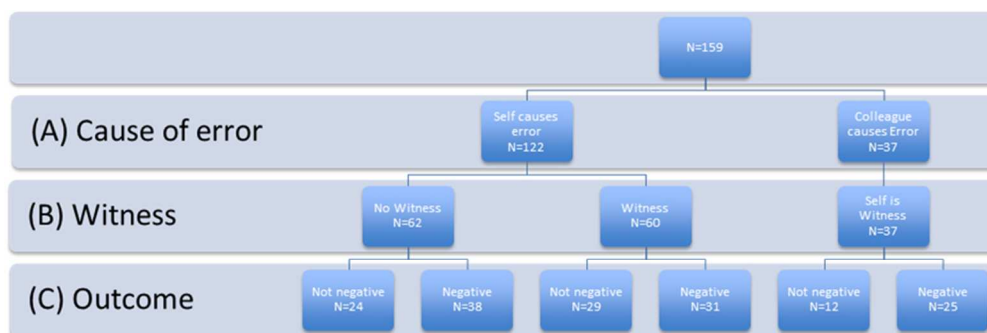


Figure 2: Study design and number of participants according to the cases.

79x26mm (300 x 300 DPI)

peer review only

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

According to:

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

N/A IF NOT APPLICABLE

No.	Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity			
<i>Personal Characteristics</i>			
1.	Inter viewer/facilitator	Which author/s conducted the interview or focus group?	N/A
2.	Credentials	What were the researcher's credentials? E.g. PhD, MD	N/A
3.	Occupation	What was their occupation at the time of the study?	N/A
4.	Gender	Was the researcher male or female?	N/A
5.	Experience and training	What experience or training did the researcher have?	N/A
<i>Relationship with participants</i>			
6.	Relationship established	Was a relationship established prior to study commencement?	Page 6
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	Page 6
8.	Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Page 6
Domain 2: study design			
<i>Theoretical framework</i>			
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Page 7
<i>Participant selection</i>			
10.	Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Page 6
11.	Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Page 6
12.	Sample size	How many participants were in the study?	Page 9
13.	Non-participation	How many people refused to participate or	Page 9

	dropped out? Reasons?	
<i>Setting</i>		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Page 6
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	Page 6
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Page 9
<i>Data collection</i>		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Page 6/7
18. Repeat interviews	Were repeat inter views carried out? If yes, how many?	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	N/A
20. Field notes	Were field notes made during and/or after the inter view or focus group?	N/A
21. Duration	What was the duration of the inter views or focus group?	N/A
22. Data saturation	Was data saturation discussed?	Page 8
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	
Domain 3: analysis and findings		
<i>Data analysis</i>		
24. Number of data coders	How many data coders coded the data?	Page 8/9
25. Description of the coding tree	Did authors provide a description of the coding tree?	Page 8/9
26. Derivation of themes	Were themes identified in advance or derived from the data?	Page 8
27. Software	What software, if applicable, was used to manage the data?	Page 8
28. Participant checking	Did participants provide feedback on the findings?	N/A
<i>Reporting</i>		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Page 11-17
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Page 11-17
31. Clarity of major themes	Were major themes clearly presented in the findings?	Page 11
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Page 11-17

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Undergraduate medical students' behavioural intentions towards medical errors and how to handle them – a qualitative vignette study

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3 **Undergraduate medical students' behavioural intentions towards medical**
4 **errors and how to handle them – a qualitative vignette study**
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ABSTRACT

Objectives: In undergraduate medical education, the topics of errors in medicine and patient safety are underrepresented. The aim of this study was to explore undergraduate medical students' behavioural intentions when confronted with an error.

Design: A qualitative case vignette-survey was conducted including one of six randomly distributed case-scenarios in which a hypothetical but realistic medical error occurred. The six scenarios differed regarding (1) who caused the error, (2) the presence of witnesses, and (3) the consequences of the error for the patient. Participants were asked: "What would you do?". Answers were collected as written free texts and analyzed according to qualitative content analysis.

Setting: Students from German medical schools participated anonymously through an online questionnaire tool.

Participants: Altogether n=159 students answered a case scenario. Participants were on average 24.6 years old ($SD=7.9$) and 69% were female. They were undergraduate medical students in their first or second year (n=27) third, fourth, or fifth year (n=107) or final year (n=21).

Results: During the inductive coding process, 19 categories emerged from the original data and were clustered into four themes (1) considering communication, (2) considering reporting, (3) considering consequences, and (4) emotional responsiveness. When the student him/herself caused the error in the scenario, participants did mention communication with colleagues and taking preventive action less frequently than if someone else had caused the error. When a witness was present, participants more frequently mentioned disclosure of the error and taking actions than in the absence of a witness. When the outcome was significant to the patient, participants more often showed an emotional response than if there were no consequences.

Conclusions: The study highlights the importance of coping strategies for healthcare professionals to adequately deal with errors. Educators need to introduce knowledge and skills on how to deal with errors and emotional preparedness for errors into undergraduate medical education.

ARTICLE SUMMARY

Strengths and Limitations of the study

- This study is one of the first examining medical students' behavioural intentions towards medical errors using qualitative methods.
- Case vignettes are shown to be a useful method to investigate influences on behavioural intentions.
- How the students would actually behave in the case vignettes' situations is not part of this research.
- The relationship between behavioural intentions and actual behaviour in the context of medical error is not investigated in this study and needs to be the focus of future research.
- Participants represented a sample of German medical students, thus transferability to residents, other health care professions and different cultural background is questionable.

INTRODUCTION

Concerning medical errors and patient safety, physicians take a central role in the health care system. On the one hand, physicians can prevent errors, ensure patient safety, and follow-up on errors to prevent further harm. On the other hand, they also can generate errors, near misses, and preventable adverse events. Physicians have complex tasks in stressful, error-prone situations[1] and have to deal with the consequences of errors[2] or near misses[3]. Additionally, physicians themselves might be affected by an error and, as a “second victim”, can also be traumatized and suffering from the error[4]. In recent years, the importance of developing skills to deal with medical errors for all professions in the healthcare setting has become clear[5-7]. Although various international committees have demanded the early integration of medical-error and patient-safety educational structures for medical professionals[8-10], thus far, there are very few international publications describing implemented formats for undergraduate medical education[11]. In Germany, where the sample of the present study is taken from, there only exist a few of those structures with little consistency [12].

When new educational structures are developed, the students' attitude towards the topic of teaching has to be taken into account[13]. While there are studies exploring the residents' or physicians in training's attitudes concerning medical errors[14-16], only a few studies about students' attitudes towards medical errors exist[17, 18]. By using quantitative approaches, some studies have shown that first-year medical students' attitudes support an error-friendly environment and state that they would disclose errors and do everything they can to ensure patient safety[11, 19, 20]. But, if an error would happen to them, students have limited knowledge about what to do and they also feel uncertain about how to handle the situation if a colleague had made an error[11]. Most of the recent studies investigating the attitudes of medical students focus on the occurrence of disclosure, emotions, and the fear of malpractice litigation[21].

Martinez et al. conducted a study examining medical students' experiences with medical errors by analyzing anonymous descriptions of medical errors they had committed or witnessed[22]. They show that not only many medical students had made or observed significant errors, but also that students experienced severe distress and uncertainty. Moreover, in the population of this study, students reported high motivation to disclose the error to patients and to take responsibility.

To understand undergraduate medical students' behavioural intentions could be another approach to investigating this very sensitive subject and to leave aside the pressing ethical issues emerging when discussing actual cases. Behavioural intentions are defined as the hypothetical actions people intent to choose in a specific event and have been concluded to be a valid proxy measure for behaviour among clinicians [23]. A study by Muller et al.[24] investigated how students would feel after committing a hypothetical error and showed that feelings depended on the outcome to the patient. The more harmful the outcome was, the angrier the students would be towards themselves, the more guilt they would feel, and the more afraid they would be of accusations and malpractice charges. Hence, factors such as the outcome of the patient after an error and the role or responsibility of the student (i.e. being a witness or being the person who has made the error) may essentially influence the underlying behavioural intentions as well. However, in their study, it remained unclear what the students would actually *do* after committing an error, which will be the focus of our study.

Scientific approaches to describe attitudes and to understand behaviour or behavioural intentions are mainly based in qualitative research. In both medical studies and medical education research, qualitative research methods have been recognized as complementary and essential. Qualitative research intends to understand how people experience the world and seeks to reveal the underlying *what* and *how* of people's perceptions[25].

The main objective of the present case vignette study was to generate a basic comprehension of how undergraduate medical students deal with errors and to understand their behavioural intentions towards the topic. A qualitative research method was chosen to address the following research questions:

1. What kind of behavioural intentions do students express when they participate in a case with a medical error?
2. How do these behavioural intentions depend on factors such as the consequences for the patient, the presence of witnesses, and their own role in committing error?

METHODS

Participants and Setting

The survey was conducted using the online survey system Unipark (<http://www.unipark.de/>). The participants were recruited via email. All 38 German medical student councils forwarded the link to an online questionnaire via their mailing lists. All data were collected anonymously and the students' agreement to analyze the data was obtained before starting with the questionnaire. Participation was voluntary and those who participated took part in a lottery for book vouchers (10 vouchers with a value of 20€). The online survey was filled out from a private computer and participants never came into personal contact with the researchers.

Each participant received one case scenario about a medical error, unaware that there were other versions. Six different cases (see paragraph Materials, Table 1) were randomly distributed among the participants. Participants received a short, written introduction and the instruction to answer one open question. Another completely independent part of the questionnaire contained demographic data and quantitative data that are published elsewhere[26].

The ethics committee of the responsible medical faculty approved this survey (Ethical Approval no. UE036-13). The study was partly funded by a Volkswagen foundation grant.

Materials

Six different scenarios of a case vignette about a hypothetical, but realistic situation dealing with a medical error were developed (see Table 1). The case vignette had been developed by the second author and an internist at Maastricht University Medical Centre and six scenarios were created based upon the original idea from Van Mierlo et al.[27] The six scenarios were tested in the Netherlands[28] and translated into German for the present study. The scenarios were then piloted within one week on n = 22 medical students, who commented on the functionality and comprehensibility of the scenarios. Data from piloting were not included in this study. The case vignette scenarios differed regarding three factors: the physician whose acts caused the error (*self* or *other*), the presence of witnesses (*present* or *absent*), and the consequences of the medical error for the patient (*negative outcomes* or *no effects*). By varying these factors, we ended-up with an overall number of six different

case vignette scenarios (see Table 1). After reading the randomly assigned case scenario, the participant was asked the open question: "What would you do?" The question was answered in a free text field.

Case for all participants:

An elderly woman arrives in the Emergency Room because she has fallen. She is having difficulties with the right hip, where a large hematoma is visible. Incorrectly, an X-Ray of the left hip is being taken.

Negative
patient
outcome

No consequences
for patient

What would you do?

I, myself caused the error and there were no witnesses

Scenario 1

Scenario 4

I, myself caused the error and a colleague was witness

Scenario 2

Scenario 5

I, myself am the witness and a colleague caused the error

Scenario 3

Scenario 6

Table 1: Case description and overview of the six possible scenarios.

Note. Example: Scenario 4 - *You are the attending physician who made this error. However, this was not witnessed by anyone. After one week, the patient comes in for a follow-up. This time the correct side is being X-rayed. The patient is pain-free and the X-ray does not indicate any pathology.*

Data analysis

To answer the first research question, data were analyzed using a descriptive qualitative content analysis approach according to Mayring[29]. This process is illustrated in Figure 1, showing the general step model of inductive category development.

Figure 1: Step model of inductive category development according to Mayring[30]

The coding process in our study was performed by all four authors and can be

described as follows: The raw material was defined as all written answers, the unit of analysis was defined as one answer. In terms of familiarisation with the raw material, all answers were read by three researchers (MK, IK and JK) as the first step. In the second step (paraphrasing), all passages that did not directly correspond to the research question were removed (e.g. decorating, repeating or clarifying utterances). One paraphrase was defined as a coding unit. Subsequently, all four researchers met and developed a coding scheme based on 25 percent of the data material. The passage of the text that best reflected the category was chosen as an anchor example. Exclusion and inclusion criteria for each category were specified as coding rules. After the development of the coding scheme, it was applied to the whole material by researcher MK. Thus, all passages of the text were coded into the coding system. To manage data, no specific software for qualitative data except Microsoft Word and Excel were used. To clarify the coding process, an excerpt of the coding scheme is shown in Table 2.

Unit of analysis/quote	Paraphrase	Category	Coding rules and anchor examples
Talk with a colleague and point out to him that an error has happened to him and ask him how it might have happened. I would also be more cautious, so that those things wouldn't happen to me. In this case I wouldn't disclose to the patient. (#28, scenario 5)	Point out to the colleague that an error has happened to him	Communication with colleagues	Statements are coded, if the error is directly addressed when speaking to colleagues/physicians. Statements are not coded, if there is no distinct contact person. Anchor example: "Talk with a colleague and indicate to him that an error has happened to him"
	Asking how the error occurred	Cause analysis	Statements are coded as soon as a search for an error, search for causes/causal relations is mentioned. Anchoring example. Anchor example: "Search the reason how this mix-up came to be... Deliberate the working process."
	I, myself am more cautious in the future	Personal learning	Statements are coded where a personal perspective resulting in a learning process is

		apparent. Anchor example: "I, myself am more cautious in the future."
Would conceal the error from the patient	Concealment	Statements are coded when it indicates concealment or not talking/reporting of the error to the patient. Anchor example: "I would not inform the patient."

Table 2: Excerpt of the coding scheme.

To ensure quality of the coding process in terms of interrater reliability, a fifth researcher (TK, not part of the author team) independently coded 10 percent of the material. The interrater reliability for the categorical data was tested using the same coding scheme, resulting in a Fleiss $\kappa = .84$, indicating sufficient agreement[31]. At any time during the coding scheme's development and application none of the coders were aware to which case vignettes the unit of analysis belonged. Data saturation was discussed within the research team after development of the coding scheme, based on 25% of the data, and after finalization of the coding process of all data. As all of the text's passages could be allocated to at least one of the categories that were defined by the coding scheme and no new categories had emerged while analysing the remainder 75% of the data, the researchers agreed that a sufficient saturation of data was reached for the purpose of the present study. Efforts were directed to examine both positive and negative cases; within the developed coding schema we were able to code all data.

In order to answer the second research question, the results were analyzed distinguishing each case vignette scenario. The quantity of the categories that arose was counted, according to Wolcotts[32] procedure for transforming qualitative data. We explored differences between scenarios, which varied depending on patient outcome, error witness, and cause of error.

During the process of coding the data we tried to continually and critically self-evaluate our individual position and personality and we acknowledge that our position may affect the research process and outcome, as is common in qualitative research and discussed under the term reflectivity[33].

RESULTS

Description of the sample

Altogether $n=320$ students opened the online survey and $n=159$ students answered a case vignette. Due to drop-outs (i.e., students who opened the survey and thus got randomly allocated to a scenario but did not answer it) the distribution of participants to cases is uneven. Figure 2 shows the number of respondents per scenario and per factor.

Figure 2: Study design and number of participants according to the cases.

The participants were on average 24.6 years old ($SD=7.9$) and 110 of them (69%) were female. The majority of the participants were in the third, fourth, or fifth year of their studies ($n=107$). Other students ($n=27$) were in their first and second year and $n=21$ participants were in their final year; for $n=4$ no information was available*.

Categories

For answering the first research question, during the inductive coding process the following 19 categories emerged from the original data (see Table 2), clustered into four themes: (1) considering communication, (2) considering reporting, (3) considering consequences, and (4) emotional responsiveness.

1. Considering communication

Within the theme considering communication we subsumed nine categories. The categories *Apologize to the patient* and *Disclosure of an error to the patient* include quotes in which the student signals a strong intention to offer an apology or a disclosure to the patient:

“After the surgery, I inform the patient about the mistake and apologize.” (#92, scenario 4)

* German undergraduate medical education can be divided into three parts: first and second year (preclinical years), where the focus is on basic sciences and biomedical knowledge; third, fourth, and fifth year, where the focus is on knowledge regarding illnesses (clinical years); and the final year (practical year), which is a clinical rotation.

1
2
3 “...tell her [the patient], that an image of the other hip was taken by accident ...
4 and apologize.” (#13, scenario 2)
5
6

7 The category *Consideration to disclose* covers coding units in which the student only
8 considers disclosure or reflects upon the possibility of telling the patient about the
9 error, but is not sure of doing it.
10

11 “Ideally, the correct reaction would be to tell the patient about the error and the
12 resulting consequences in an explicit and understandable manner...” (#44,
13 scenario 4)
14
15

16 “If I would know better about the consequences for me and how I would deal
17 with them, I would be rather prepared to be honest with the patient.” (#269,
18 scenario 2)
19
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21

22 The category *Consideration to not disclose* contains statements where the student
23 reflects rather on not informing the patient about the committed error:
24

25 “I would not tell the patient about the mistake because it is no longer relevant.”
26 (#228, scenario 1)
27
28

29 “...I am not sure if I would do that in a real case because I would be afraid to
30 be sued.... [I would] rather try to find a plausible excuse for the error or try to
31 conceal it.” (#44, scenario 4)
32
33
34

35 “I can’t rule-out that - in a bad team status / team climate - I would cover up
36 the error.” (#65, scenario 4)
37
38
39

40 In the category *Concealment*, all the coding units in which the student is sure about
41 keeping his knowledge about the error for himself are subsumed:
42

43 “I shut my mouth and hope that no one notices.” (#22, scenario 1)
44
45

46 “I don’t have the balls to admit my error – sad actually!” (#122, scenario 1)
47
48

49 “I would not disclose this to the patient and I would ensure that I make less
50 errors.” (#139, scenario 1)
51
52
53

54 Note that the categories *disclosure of an error to the patient*, *considering disclosure*,
55 *considering no disclosure*, and *concealment* are mutually exclusive to each other.
56
57

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2
3 Within the following categories statements are consolidated, in which the student
4 describes that he intends to talk about the error with someone. The four categories
5 are not mutually exclusive: *communication with colleagues*, *communication with*
6 *nursing staff*, *communication with the superior/chief* and *communication with others*.
7

8
9 “Most likely, I would try to discuss this medical error with a superior or
10 colleague (regarding the further course of action).” (#6, scenario 1)
11

12
13 “I go to the respective colleague and discuss with him what we should do
14 further; that is, first speaking with the senior physician or speaking directly to
15 the team.” (#55, scenario 6)
16

17
18 “Discuss with colleagues and Boss (depending on the boss...)” (#88, scenario
19 2)
20

21
22 “Whether I would explain it to my boss, depends on my expectation of his
23 reaction.” (#228, scenario 1)
24

25
26 “I would admit my error ... [and] tell the nurses, X-ray technicians and other
27 physicians that they should bring it to my attention when they notice one of my
28 errors.” (#18, scenario 1)
29

30
31 “Discuss with all of those involved and superiors.” (#124, scenario 4)
32

33
34 “Call-in a team meeting.” (#255, scenario 4)
35

36 37 38 (2) Considering reporting

39 The theme considering reporting contains an overall number of two categories. They
40 differ from those in the first theme by including statements about reporting the error in
41 a written format instead of oral communication. The category *reporting in general*
42 covers statements in which the student explains that he would report the error but
43 does not specify how they would do it, where they would report it, or to whom they
44 would report it:
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51 “Then one must officially report this, I just don’t know where.” (#58, scenario 2)
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53
54 If, additionally to the intention to report the error, the statement mentions a reporting
55 system or equivalent structures, it is subsumed under the category *reporting to an*
56 *incident reporting system*:
57
58

1
2
3 “Report in the potentially existing error reporting system (i.e. Critical Incident
4 Reporting System).” (#220, scenario 3)
5

6
7 “Report in anonymous system.” (#4, scenario 2)
8

9 “[Give] info to the error management of the clinic.” (#206, scenario 3)
10

11 (3) Considering consequences

12 The theme considering consequences consists of five categories describing the
13 consequences of the error or the next steps that one will undertake. The category
14 *actions resulting from the error* includes statements that pictures concrete actions
15 that has to follow the error from the students’ perspective, such as:
16
17
18
19
20

21 “Initiate respective therapy.” (#48, scenario 4)
22

23 “Immediately, when the error was noticed, I would call the patient back into the
24 practice/clinic and x-ray the correct side.” (#75, scenario 3)
25
26
27

28 “Presumably, from now on, together with the patient, I would mark the
29 extremity that I am supposed to x-ray with a marker.” (#2, scenario 1)
30
31
32

33 If consequences other than a direct action were named or if the student reflects upon
34 a strategy for future prevention, the quote was assigned to the category
35 *Consequences in general / Prevention*:
36
37
38

39 “I would...see how to avoid it [the error] in the future. Then a solution strategy
40 should be found and discussed with all involved wards.” (#40, scenario 1)
41
42

43 “...mention catastrophic state of the ER and, through the top supervisor,
44 insist on better controls.” (#90, scenario 2)
45
46
47

48 “...it is about everyone learning from errors and reducing them, and reinforcing
49 teamwork without any punishment. Employees should be encouraged to admit
50 errors without any fear.” (#155, scenario 2)
51
52

53 “...revisit the case later and discuss in quality management so that colleagues
54 can learn more from it.” (#246, scenario 6)
55
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3 The category *personal learning* covers statements that mention the conclusions that
4 the student draws on for his or her own future actions:
5
6

7 “I...am more sensitive towards this topic in the future so that such an error will
8 not happen to me once again.” (#132, scenario 3)
9

10
11 “The learning effect would probably be really big for me and I would learn from
12 this error.” (#228, scenario 1)
13
14

15
16 If the search for causes leading to the error was described, quotations are subsumed
17 to the category *cause analysis*:
18
19

20
21 “I’d deliberate on how this error could have happened. Was it me making a
22 wrong request? If so, why? Or, an incorrect execution by the X-ray nurse? If
23 so, why?” (#2, scenario 1)
24
25

26 “I would conduct an error search and, firstly, see where the error occurred.”
27 (#40, scenario 1)
28
29

30
31 “Talk with my colleague and ask him how this could have taken place.” (#28,
32 scenario 5)
33
34

35 “Search the reason how this mix-up came to be... Deliberate the working
36 process.” (#117, scenario 3)
37
38

39 If students mentioned legal aspects or considered a special documentation,
40 statements were subsumed in the category *Legal aspects / Documentation*:
41

42 “I would inform her about her rights, even if this would be to my disadvantage.”
43 (#175, scenario 4)
44
45

46 “Inform [her] about rights for damage compensation.” (#177, scenario 4)
47
48

49 “Because she [the patient] would lose a lot of time and nerves in a lawsuit, I
50 would advise her to really ask herself whether that’s what she wants in the
51 case that she has this idea [to go to court] on her own. I am not a supporter of
52 immediate lawsuits after errors in a medical procedure.” (#232, scenario 6)
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3 “...if it must be, I would apologize. (Note: Of course it must be but I would be
4 worried, for example, to then be sued.)” (#269, scenario 2)
5
6

7 (4) Emotional responsiveness

8 The theme emotional responsiveness contains four categories that cover a range of
9 emotional reactions to the error. The category *Meaning for the patient / Patients’*
10 *perspective* covers statements in which the student reflects on the meaning of the
11 error or possible consequences for the patient or mentions the patient’s perspective:
12
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15
16 “I think I would in this case first discuss with my senior physician before I
17 would inform the patient and possibly unnecessarily worry [her].” (#7, scenario
18 1)
19
20

21
22 “Make sure that my error really has no effect or damage with the patient. If this
23 should be, I wouldn’t tell the patient in order to not unnecessarily concern [the
24 patient].” (#32, scenario 3)
25
26

27
28 “I would explain the incident to the patient and point-out that this has really
29 negative consequences for her. I would hope for the patient’s understanding of
30 the stress in the hospital.” (#112, scenario 2)
31
32

33
34 “The lady could die if I do not monitor the right hip (and if the kind lady is older,
35 the additional radiation exposure is justifiable.” (#118, scenario 1)
36
37

38 “...ask her [the patient] whether she wants to continue to be treated by me or
39 another physician, or go to another clinic.” (#161, scenario 4)
40
41

42
43 The category *Being emotionally touched* subsumes statements in which the student
44 expresses his own emotions or feelings towards the situation:
45
46

47 “I am happy that my error had no consequences for the patient.” (#119,
48 scenario 3)
49
50

51 “I am relieved that there is no pathological finding in the right hip.” (#122,
52 scenario 1)
53
54

55 “How lucky. I shut my mouth and hope that no one notices.” (#22, scenario 1)
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If the question of guilt is raised, the quote was grouped to the category *guilt*:

“Obviously, I myself am guilty.” (#188, scenario 4)

“If my colleague notices an error but didn’t say anything, he is also guilty.”
(#203, scenario 4)

Statements that describe the uncertainty and doubts of the student about how to handle the situation were arranged in the category *Uncertainty / doubts*:

“Quite honestly, I can – as I am at the beginning of my studies and have no patient or clinical experience whatsoever – not exactly imagine how I would react in this type of situation.” (#21, scenario 2)

“...so really I don’t know what I should do.” (#114, scenario 6)

“If I know better about the consequences for me and the handling of it, I would be prepared to be honest with the patient. Admitting to an error is essential – but at what price?” (#269, scenario 2)

“Currently, I don’t know how one should handle errors – to whom to report?”
(#116, scenario 3)

“...if she would not like to be operated by me and nobody else is on duty or available, I would be at a loss.” (#110, scenario 2)

Transformed qualitative data

Regarding the overall frequency of codes, it showed that in total 406 quotes were coded (see Table 2). Categories containing the largest numbers of quotes were *disclosure of an error to the patient* (n=47; 30%), *communication with the superior/chef* (n=46; 29%), *communication with colleagues* (n=45; 28%), and *actions resulting from the error* (n=42; 42%). Many students wrote quotes that were subsumed into categories considering communication with somebody else, rather than with the patient (n=107). About half of the students made statements regarding the issue of disclosure of the error: overall n=77 (56%) quotes were subsumed to one of the four categories comprising the topic (*disclosure of an error to the patient, considering disclosure, considering no disclosure, concealment*). Only a minority of

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2
3 the students (n=25; 16%) considered reporting the error, and only a few (n=5; 3%)
4 mentioned to report it in an incident reporting system. Categories considering
5 emotional responsiveness contained proportionally few quotes (n=66; 41%) within
6 *meaning for the patient* (n=27; 17%) was counted the most frequent.
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	Case vignette scenario						
	Overall	Outcome		Witness		Cause of error	
		Not Negative	Negative	No Witness	Witness	Self causes error	Colleague causes error
1. Categories considering communication							
<i>excuse to the patient</i>	32 (20%)	9 (14%)	23 (24%)	11 (18%)	16 (27%)	27 (22%)	5 (14%)
<i>disclosure of an error to the patient</i>	47 (30%)	14 (22%)	33 (35%)	13 (21%)	24 (40%)	37 (30%)	10 (27%)
<i>considering disclosure</i>	16 (10%)	6 (9%)	10 (11%)	7 (11%)	8 (13%)	15 (12%)	1 (3%)
<i>considering no disclosure</i>	16 (10%)	10 (16%)	6 (6%)	5 (8%)	8 (13%)	13 (11%)	3 (8%)
<i>Concealment</i>	9 (6%)	6 (9%)	3 (3%)	8 (13%)	0 (0%)	8 (7%)	1 (3%)
<i>communication with colleagues</i>	45 (28%)	18 (28%)	27 (29%)	2 (3%)	14 (23%)	16 (13%)	29 (78%)
<i>communication with nursing staff</i>	1 (1%)	1 (2%)	0 (0%)	0 (0%)	1 (2%)	1 (1%)	0 (0%)
<i>communication with the superior/chief</i>	46 (29%)	14 (22%)	32 (34%)	20 (32%)	15 (25%)	35 (29%)	11 (30%)
<i>communication with others</i>	15 (9%)	3 (5%)	12 (13%)	4 (6%)	7 (12%)	11 (9%)	4 (11%)
2. Categories considering reporting							
<i>reporting in general</i>	20 (13%)	5 (8%)	15 (16%)	7 (11%)	6 (10%)	13 (11%)	7 (19%)
<i>reporting to an incident reporting system</i>	5 (3%)	2 (3%)	3 (3%)	2 (3%)	3 (5%)	5 (4%)	0 (0%)
3. Categories considering consequences							
<i>actions resulting from the error</i>	42 (27%)	13 (20%)	29 (31%)	18 (29%)	14 (23%)	32 (26%)	10 (27%)
<i>consequences in general / prevention</i>	17 (11%)	12 (19%)	5 (5%)	7 (11%)	4 (7%)	11 (9%)	6 (16%)
<i>personal learning</i>	5 (3%)	5 (8%)	0 (0%)	2 (3%)	2 (3%)	4 (3%)	1 (3%)
<i>cause analysis</i>	15 (9%)	10 (16%)	5 (5%)	6 (10%)	6 (10%)	12 (10%)	3 (8%)
<i>legal aspects/ documentation</i>	9 (6%)	3 (5%)	6 (6%)	3 (5%)	4 (7%)	7 (6%)	2 (5%)
4. Categories considering emotional responsiveness							
<i>meaning for the patient / patients perspective</i>	27 (17%)	15 (23%)	12 (13%)	7 (11%)	13 (22%)	20 (16%)	7 (19%)
<i>being emotionally touched</i>	8 (5%)	4 (6%)	4 (4%)	3 (5%)	4 (7%)	7 (6%)	1 (3%)
<i>guilt</i>	7 (4%)	2 (3%)	5 (5%)	2 (3%)	5 (8%)	7 (6%)	0 (0%)
<i>uncertainty / doubts</i>	24 (15%)	9 (14%)	15 (16%)	15 (24%)	6 (10%)	21 (17%)	3 (8%)

Table 3: Descriptive overview of the categories in all the cases; Percentage comparison refers to the proportion of participants who mentioned that category in reply to the characteristic of the case vignette scenarios

Comparison of the Case vignette scenarios

In order to answer the second research question, how (A) cause of error, (B) error witness and (C) patient outcome affect students' behavioural intentions, we consider Table 3 and present the most outstanding results below. Table 3 shows a descriptive overview of the distribution the categories over all the case scenarios. Percentages refer to the proportion of participants that mentioned the particular category in reply to the characteristic of the case vignette scenarios.

(A) Error cause

When a colleague caused the error in the case vignette scenario, more students would communicate with the colleague (78% vs. 13%), take preventive action in general (16% vs. 9%), and report the error (19% vs. 11%) than when the student caused the error him/herself. For the scenarios in which the student caused the error himself, guilt (6% vs. 0%), uncertainty/doubts (17% vs. 8%), and excuse to the patient (22% vs. 14%) was reported more frequently than when a colleague caused the error.

(B) Error witness

Scenarios in which a witness observed the error evoked more quotes concerning both disclosure to the patient (40% vs. 21%) and emotional responsiveness towards the meaning for the patient (22% vs. 11%) than those scenarios without a witness. Additionally, the categories concealment (0% vs. 13%) and uncertainty/doubts about how to deal with the error (10% vs. 24%) appeared less frequently in scenarios involving a witness than without a witness.

(C) Patient outcome

If the outcome of the scenario was negative for the patient, more students mentioned disclosure of the error to the patient (35% vs. 22%), communication to the superior/chief (34% vs. 22%), reporting of the error in general (16% vs. 8%), and actions resulting from the error (31% vs. 20%) than when there were no negative outcomes for the patient.

In the scenarios in which the error did not have negative outcomes for the patient, students mentioned more often the consequences in general (19% vs. 5%), personal

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3 learning (8% vs. 0%), cause analysis (15% vs. 5%), and meaning for the patient /
4 patient's perspective (23% vs. 13%) than when the patient suffered from the error.
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DISCUSSION

This study aimed at obtaining insight into medical students' behavioural intentions after having observed or having caused a hypothetical medical error. The qualitative analysis of students' written answers on how they would deal with a hypothetical error case scenario revealed four main themes: communication, reporting, consequences, and emotional responsiveness.

We explored how students' behavioural intentions are influenced by three fundamental characteristics of the setting in which the error took place.

First, it showed that the behavioural intentions might be influenced by whether the error was made by oneself or not. When the student him/herself caused the error, the emotional responsiveness was more dominant, whereas when a colleague caused the error, students felt more inclined to communicate, to report the error, and to take preventive actions. Second, our data suggest that the presence or absence of a witness influenced the students' intentions to communicate about the error, and also their emotional responsiveness. Students showed more empathy with the patients and more often intended to inform the patient about the error if a witness was present. With a witness present, students also were also more certain about how to deal with the error compared to situations in which nobody saw the error. Third, the outcomes of the error for the patient appeared to influence students' behavioural intentions. In the case of negative outcomes, attention was directed towards communication with the patient or the superior/chief, reporting the error, and actions to limit the harm caused by error. Meanwhile, in cases in which the patient was not harmed, students used the error as a chance to improve the healthcare system and their own competences by analysing the causes of the error, reflecting on options for prevention and the meaning for the patient, as well as using the error for personal learning.

Our findings suggest students consider different ways to handle errors: There are those who react emotionally and are uncertain what to do, and those who were able to express behavioural intentions targeting preventive actions. It seems that when students are involved in the generation of errors, the existing cognitively driven behavioural intentions become dominated by the emotional responsiveness. In this case the students anticipate an emotional response, considering the meaning for a patient, are emotionally touched, even feel guilt and experience uncertainty. This ties

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3 to early work of William Osler who proposed that good physicians are somewhat
4 detached from their patient's suffering in order to function well [34].

5
6 This highlights the importance of establishing educational approaches for practically
7 dealing with errors, while also coping with emotions caused by these special
8 situations, preferably in the undergraduate medical education. The scarce evidence
9 on patient safety courses shows that while protocols, algorithms and knowledge have
10 an important part in preventing an error, they cannot prepare for the emotional
11 response that comes with involuntarily harming a patient or being involved in an error
12 [35]. In this line, Patey and colleagues [36] did not find a difference after a training for
13 medical students about feelings when making errors. It seems that thus far, medical
14 educators are not equipped in how to stimulate, teach, or test emotional
15 preparedness when facing negative consequences for the patient. In medical
16 practice the need for emotional preparedness becomes even more imperative. In a
17 survey of over three thousand physicians in internal medicine, a majority had anxiety
18 about future errors and their job-related stress increased, even when involved only in
19 near misses [35]. Apart from offering training approaches, the call for organizational
20 accountability due to emotional impact on physicians has been emphasised [37].
21 Even if emotional reactions in terms of empathy can be considered as important skill
22 for a physician, especially in those incidents where patients have suffered, changing
23 protocols and taking actions for safer healthcare should be of high importance[7].
24 Thus, both issues are important aspects that, according to the authors' opinion, have
25 to be integrated and trained in patient safety curricula.
26
27

28
29 Students in our study also emphasised the importance of communication to the
30 patient involved (ranging from disclosing to the patient, to considering not to disclose,
31 to concealment), as well as talking about the error with colleagues, nurses, the
32 superiors, or others. This finding highlights the importance of courses including error
33 disclosure for medical students [36, 38], and team communication courses [39-41].
34 Hypothetical cases, like in the vignettes, or one's own cases could be discussed
35 within group coaching sessions, to enhance deep learning on (near) errors [42]. The
36 inclusion of the students' consideration of if and when to speak to their superiors
37 depending on the (imagined) atmosphere within the team was especially interesting.
38 In the literature, this resembles the construct of psychological safety, shown to be
39 important for leader inclusiveness in healthcare [43]. In his second assessment of
40 progress in ten key patient safety domains called "Patient Safety At Ten:
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Unmistakable Progress, Troubling Gaps”, Wachter [44] states a drop in implementation rates of training initiatives, as only few organizations adopt robust teamwork, culture change or simulation programs [i.e. 45, 46]. Some students intended to report the error to an incident reporting system, or otherwise in terms of sharing the error experience with the healthcare organisation, but did not know how to do so. This is in line with the finding of Toenessen, Swart and Marx [47], who have shown the need for more information concerning patient safety reporting. Further, it ties to findings of Martinez et al. [22], who showed that students who witnessed physicians take responsibility for errors and disclose errors to patients said that they aspired to these standards.

The various consequences of the error and of the actions students would intend to take included extra medical care for the patient and informing the patient about legal aspects, as well as learning from the error for future improvement. The latter contains cause analysis to better understand how the error could happen, plans or thoughts how the error could be prevented, and personal learning about individual knowledge and skills that may need improvement [48-50].

Our results are in line with findings that students generally have a positive attitude towards patient safety and are generally willing to participate in patient safety initiatives [11, 19, 20]. Our results underline that knowledge of what to do in the case of an error is limited for most students [cf. 11]. We were able to gain more insight into the findings by Muller [24], who has shown that the more students were emotionally involved in the error, the more they were afraid of litigations. Our results add to this result that students generally have some knowledge on how to handle errors and have ideas whom to communicate to and did express the wish to disclose the error to the patient, as well as the wish to let the organization and team learn from the error.

Limitations

One limitation of the study might be the transferability of our results, as our sample included German medical students only and only German and Dutch researchers coded the data. Thus, there could be a cultural bias resulting from our sample and the cultural background of our research team so that our findings should be confirmed in other countries and cultural settings before drawing conclusions in other cultural settings.

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3 Recruitment might have impacted our data as participation was voluntary and
4 compensation was only small. Compensation might also have influenced the
5 recruitment, but compensation was so limited that potentially only students interested
6 in the subject participated.
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9 Furthermore, not all participants were exposed to the same scenario, what might
10 potentially reduce the richness of data. However, we chose our study design to
11 expose differences in medical students' behavioural intentions through the different
12 scenarios. The scenarios were originally developed for residents, but we piloted the
13 scenarios on a smaller sample and given the richness of the data we do believe they
14 can also be used with medical students. In our sample, we neither differentiated
15 between the year of study nor did we investigate behavioural intentions of residents.
16 There is a possibility that the final semester students' professionalism increases and
17 more students would handle errors appropriately once the medical education
18 program is finished. Investigating the differences in behavioural intentions throughout
19 the years of study would be an interesting focus for future research.
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27 Although behavioural intention is more closely linked to behaviour than attitude, it is
28 still not the actual behaviour and the link between both needs to be studied more
29 deeply. However, if medical students do not know what to do and do not have any
30 intention to perform a certain way in case of an error, the probability of showing
31 appropriate behaviour is seen as highly unlikely [51]. Further studies could potentially
32 utilize the methodology of case vignettes with errors and give adaptive feedback
33 depending on their free-text answers [52] i.e. in order to convey norms of reporting,
34 error disclosure and communication.
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40 Last, we chose to do a quantitative transformation of the qualitative data to compare
41 the influencing factors. Our conclusions are to be seen as observations from
42 qualitative data and not confused with statistically sound comparisons of interval-
43 scaled data.
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48 **CONCLUSION**

49 By using standardized case vignettes and qualitative research methods we are
50 beginning to better understand the driving forces between anonymous reporting,
51 error disclosure, and concealment. Students need to understand that dealing with
52 errors is part of being a physician. Medical educators need to understand that it is
53 necessary to educate students in a way that they know exactly what to do when
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3 dealing with an error, *and* are equipped with effective coping strategies for dealing
4 with strong emotions, so that they are enabled to adequately handle the situation.
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For peer review only

Author's contribution statement

Dr. Isabel Kiesewetter had the idea and took part in the design of the study, the data coding and analysis and the drafting of the manuscript.

Dr. Karen Könings took part in the data coding and analysis and the drafting of the manuscript.

Dr. Moritz Kager took part in the design of the study, the data acquisition, coding and analysis of data and the revision of the manuscript.

Dr. Jan Kiesewetter took part in the design of the study, the data coding and analysis and the drafting of the manuscript.

Competing interests statement

All authors have declared no conflicts of interest.

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Data sharing statement

No additional data available.

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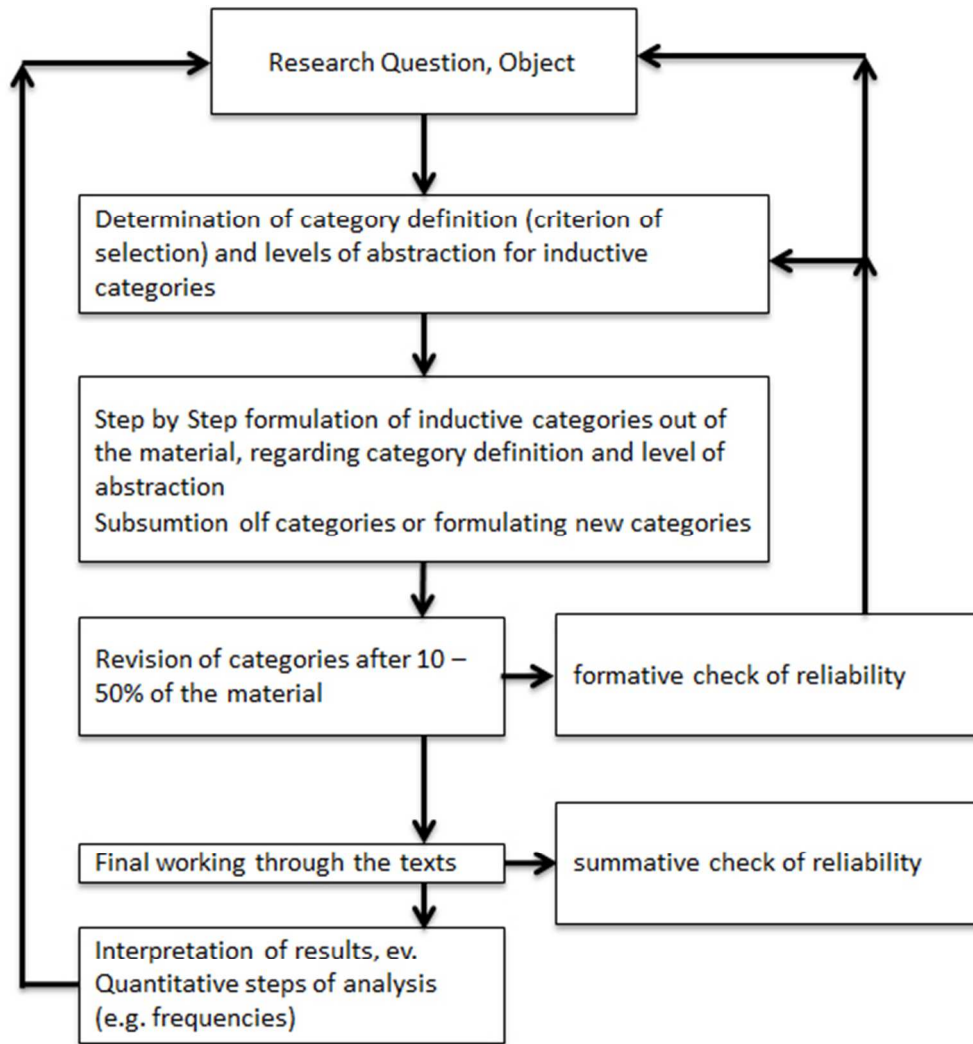


Figure 1: Step model of inductive category development according to Mayring[30]

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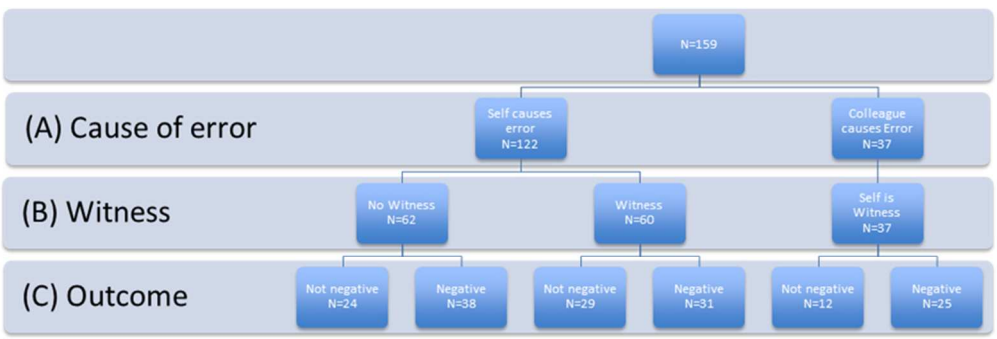


Figure 2: Study design and number of participants according to the cases.

79x26mm (300 x 300 DPI)

peer review only

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

According to:

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

N/A IF NOT APPLICABLE

No.	Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity			
<i>Personal Characteristics</i>			
1.	Inter viewer/facilitator	Which author/s conducted the interview or focus group?	N/A
2.	Credentials	What were the researcher's credentials? E.g. PhD, MD	N/A
3.	Occupation	What was their occupation at the time of the study?	N/A
4.	Gender	Was the researcher male or female?	N/A
5.	Experience and training	What experience or training did the researcher have?	N/A
<i>Relationship with participants</i>			
6.	Relationship established	Was a relationship established prior to study commencement?	Page 6
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	Page 6
8.	Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Page 6
Domain 2: study design			
<i>Theoretical framework</i>			
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Page 7
<i>Participant selection</i>			
10.	Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Page 6
11.	Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Page 6
12.	Sample size	How many participants were in the study?	Page 9
13.	Non-participation	How many people refused to participate or	Page 9

	dropped out? Reasons?	
<i>Setting</i>		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Page 6
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	Page 6
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Page 9
<i>Data collection</i>		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Page 6/7
18. Repeat interviews	Were repeat inter views carried out? If yes, how many?	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	N/A
20. Field notes	Were field notes made during and/or after the inter view or focus group?	N/A
21. Duration	What was the duration of the inter views or focus group?	N/A
22. Data saturation	Was data saturation discussed?	Page 8
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	
Domain 3: analysis and findings		
<i>Data analysis</i>		
24. Number of data coders	How many data coders coded the data?	Page 8/9
25. Description of the coding tree	Did authors provide a description of the coding tree?	Page 8/9
26. Derivation of themes	Were themes identified in advance or derived from the data?	Page 8
27. Software	What software, if applicable, was used to manage the data?	Page 8
28. Participant checking	Did participants provide feedback on the findings?	N/A
<i>Reporting</i>		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Page 11-17
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Page 11-17
31. Clarity of major themes	Were major themes clearly presented in the findings?	Page 11
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Page 11-17