To Sue or Not to Sue? Virtual Reality Evidence of Physicians' Open versus Defensive Communication in Case of a Harmful Medical Incident

Authors

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Abstract

Using real-life Virtual Reality (VR) videos in an experiment, we analyse how being more open about a medical incident towards the patient influences patient's feelings and behavioural intentions. We showed economics, medicine, and physiotherapy students three VR videos in which a physician explains to a patient that there was a medical incident. Half of the participants sees the videos with open communication, while the other half sees the same videos (keeping constant physician nonverbal behaviour, what the patient says, clinical conditions, etc.) with defensive communication. The respondents are immersed in the real setting from the patient's perspective by using a VR headset, which is a unique design in this research area. Patients exposed to open disclosure seem to be significantly more likely to take further steps, such as contacting a lawyer to discuss options and complaining to the hospital. They also have more feelings of blame against the physician. Surprisingly, they do not rate the physician or the incident severity differently. Communication skills are evaluated better, and they are not more likely to change physician.

1. Introduction

Worldwide, an estimated 400,000 patients per year die as a consequence of unexpected harm caused by treatment or care, not directly related to a patient's illness or underlying condition (James, 2013). Although patients and their relatives expect transparency when confronted with a medical incident, actual clinical practice shows a rather defensive communication by physicians because they fear for the large potential financial, reputational, emotional and time costs related to the unfolding of a medical incident (Thomas H Gallagher, Studdert, & Levinson, 2007; Lamb, Studdert, Bohmer, Berwick, & Brennan, 2003; Mazor et al., 2004). Gallagher et al. (2006) indicate that, in general, more than half of the physicians choose to communicate in a defensive way. According to patients, defensive communication is even more prevalent, appearing in two third of the cases (Blendon et al., 2002).

Using physicians' audiotapes and their malpractice history, Levinson et al. (1997) and Ambady et al. (2002) show that sued and non-sued physicians communicate differently with patients, which raised the question whether physicians' communication style *drives* patients' intention to sue. Although multiple empirical studies suggest that open disclosure correlates negatively with patients' intention to sue, there may be some concerns about the representativeness of the study results. First, before-after analyses of

the incentive effects of open disclosure programs (e.g., (Kachalia et al., 2010; Kachalia et al., 2018; Kraman & Hamm, 1999) often do not control for other factors than the intervention, such as time trends and regional differences in intention to sue, which may drive the number of claims at the same time.

Second, although a randomised controlled experiment is the only way to completely eliminate confounding factors, experimental approaches in this domain commonly suffer from problems with both the size and composition of the sample or are unable to disentangle the effect of the verbal and nonverbal aspects of open disclosure. Mazor et al. (2006), for example, tried to establish causal relationships by showing insured people videos of hypothetical physician-patient dialogues after an adverse event and asking them about their willingness to sue. Although they show that open disclosure after an adverse event lower liability risk, they do not present a sufficient large sample to ensure high power of the study results regarding four design variables (existence of a positive prior relationship, severity of clinical outcome, level of disclosure, and an offer to waive costs). There are also sample concerns, as solely members of a health maintenance organization are included, and women are overrepresented. Similarly, Nazione et al. (2015) attempted to address the role of apology, empathy, corrective action and compensation in patients' intentions after error disclosure. The study made clear that apologies do not result in more responsiveness feelings against physicians and that empathy, in contrast to corrective action and compensation, leads to substantial less anger and negative behavioural intentions. The authors, however, were not able to report successful manipulation checks and the sample size is relatively small to ensure clear causal effects for the multiple manipulations in the study design. The same sample issues can be seen in the study of Wu et al. (2009), who suggest that full apology and responsibility result in significantly higher feelings of trust and referral intentions and no differences in intention to sue. In the same vein, Allan et al. (2015) showed that participants watching videos with a surgeon apologising for an adverse event focusing on patients' needs, evaluated the apology as more sincere and as denoting more sorriness than in case of a self-focused apology. Besides the fact that this study solely focuses on one aspect of open disclosure (i.e., apology formulation), the authors cannot guarantee that duration differences confounded the results.

Besides empirical research on the impact of open disclosure, plentiful authors focused on communication style as such (i.e., kindness, humour, eye contact). Using a randomized controlled trial, Hannawa et al. (2011, 2014), for example, proved the importance of nonverbal involvement in the open disclosure process, but focused on a specific sample. Using respectively video-taped and paper-based transcripts of hypothetical consultations, Lester et al. (1993) and Moore et al. (2000) found that a negative communication style during treatment increases the probability of a malpractice lawsuit. However, these studies are confronted with several methodological shortcomings, such as a lack of statistical power and potential sample selection bias. Moreover, the studies' scopes were limited to communication style during treatments before the occurrence of an adverse event and not during disclosing adverse events.

Besides the sample and design issues outlined above, a lack of external validity is a known problem with paper-based, and to a lesser extent, video vignette studies. Without representative evidence from a randomized controlled experiment, however, predicting how open disclosure relates to patients' thoughts, feelings, and behavioural intentions remains speculative, which may form a barrier for physicians to openly disclose what happened when confronted with a medical incident.

To examine the impact of open disclosure on patients' behaviour, this paper uses an experimental design in combination with virtual reality (VR) techniques to overcome the aforementioned shortcomings in three ways. First, generally, the external validity of experiments is low, but using VR technology mitigates the problem. We made use of 360° cameras to shoot hypothetical medical incident conversations with real physicians in a real hospital and manipulated the verbal aspects of open disclosure (hereafter called treatment). These videos were implemented in VR headsets (Oculus Rift headsets) so that, by putting on the headsets, participants were "immersed" to a consultation after the occurrence of a medical incident where they lie in a hospital bed. In this manner, as opposed to video-based experiments, they were not distracted with sensorial stimuli in the room and could easily imagine an environment when being in the PC lab. Because the camera was positioned at the patients' perspective (in the hospital bed), the participants could look around in the hospital room as real patients would do, feeling that they were really "present" in the hospital room and feeling part of the consultation. As studies have showed that perceived reality with VR is improved compared to 2D videos (Slater & Wilbur, 1997) and written scenarios (Van Gelder, De Vries, Demetriou, Van Sintemaartensdijk, & Donker, 2019), this technology enables to eliminate the trade-off between realism (external validity) and experimental control (internal validity) (Blascovich et al., 2002). Furthermore, research shows that VR enhances the focus (Patterson, Darbani, Rezaei, Zacharias, & Yazdizadeh, 2017) and decision-making of participants in choice experiments (Mokas, Lizin, Brijs, Witters, & Malina, 2021). To the best of our knowledge, VR has never been used before in this research area.

Second, the set-up allows us to hold everything but the treatment (e.g., body language, hospital room, clinical indications, etc.), constant. In other words, while the first participant watches the conversations where the physician communicates openly about the medical incidents, another participant was asked to watch the exact same consultations, with the same physicians, the same actions, the same medical incidents, except that the physicians communicate defensively in one specific part of the conversations. By creating arguably perfect counterfactuals based on the verbal aspects of open disclosure, this paper results in a clear answer on the question whether physicians' verbal communication drives patients' thoughts, feelings, and behavioural intentions.

Third, unlike some prior studies investigating the impact of open disclosure in an experimental design, each participant was randomly assigned to a sequence of three videos with the same communication style: either open or defensive. In this way, we avoid that participants would discover the purpose of the

study and introduce bias in the study results. The outcomes (such as intention to sue) of both groups are compared to assess the impact of verbal open disclosure on patients' behaviour.

The results reveal that open verbal communication, in contrast to what is expected in existing literature but consistent with physicians' point of view, may drive patients to take further (legal) steps against the physician. For example, patients in case of open disclosure blame more the physician and are, therefore, significantly more likely to contact a lawyer to discuss their options and to complain to the hospital. They are, however, not more likely to change physician and there is also no difference in trust in the physician and his competence and in the perceived incident severity. The rating of the general impression of the physician and his communication skills is even better than in the defensive counterpart. The fear for reputational damage, which is considered as a potential consequence of communicating openly about medical incidents, is, therefore, unjustified.

The rest of the paper is organised as follows. Section 2 discusses the multiple forms and prevalence of defensive communication and explains the literature behind the manipulations used in our experimental design. Section 3 describes in detail the experiment set-up, sample selection methods and the production and validation process of the VR videos. Our empirical results are presented in Section 4 and 5 and discussed in Section 6. Section 7 concludes.

2. Background

Multiple forms of physicians' defensive communication exist in practice. First of all, physicians confronted with a medical incident may describe the incident as a common complication, denying the suffering of patients (Southwick, Cranley, & Hallisy, 2015). Second, in about one third of the medical incidents, physicians simply refuse to talk to the patient and do not give follow-up explanations (Southwick et al., 2015). Third, of those physicians reporting medical incidents, 42% blame others for the harm to the patient and do not acknowledge personal responsibility (Cooper et al., 2017). In absence of a clear cause of the incident, patients may even blame themselves for the harm suffered (Allan & McKillop, 2010; Albert W. Wu, Boyle, Wallace, & Mazor, 2013).

In contrast to defensive communication, open disclosure is a process, not a single event, in order to, as Moore et al. (2017) argues: "acknowledge and redress emotional, physical, and financial harm, express an ethic of continuing care for the patient, and restore trust after a medical incident". The process commonly starts with an initial disclosure conversation between the physician and the patient and/or his/her relatives about what happened, possibly followed by discussions about resolution and/or compensation, according to the patient's needs (Mello et al., 2014; J. Moore et al., 2017). The initial conversation after the incident is considered as a crucial moment in the disclosure process, which determines the further physician-patient interactions and patients' behavioural intentions (J. Moore et al., 2017).

Patient interviews and revision of open disclosure programs revealed some key elements that malpractice victims expect during the open disclosure process (Allan & McKillop, 2010; Thomas H Gallagher et al., 2007; Annegret F. Hannawa, Beckman, Mazor, Paul, & Ramsey, 2013; Iedema et al., 2011; Levinson, 2009; Mello et al., 2014; J. Moore et al., 2017; Albert W. Wu et al., 2013). First, patients require an explanation for the event, including information about how the event occurred and which factors have led to the incident. Second, an apology or sincere regret may help patients to feel heard and acknowledged for their suffering. Important to note is that patients expect an expression of responsibility beyond sympathy for what happened, which malpractice insurers discourage because it may prove liability in court. Third, patients want to hear which steps physicians or institutions will take to prevent similar incidents in the future. They want to be sure that the parties involved will learn from the incident and that prevention measures will be implemented as acknowledgment for the harm that the incident have caused. Fourth, compensation for the estimated medical, emotional, and financial damages associated with the incident is frequently demanded by patients to recover from the incident and to relieve their potential emotional distress.

3. Experimental design

3.1. VR set-up

To investigate whether physicians' verbal open communication affects patients' thoughts, feelings, and behavioural intentions, scripted VR video vignettes were used. We choose for medical consultations based on scripts to avoid practical and ethical issues related to records of actual medical consultations and manipulations in clinical practice. Following the procedure prescribed by Hillen et al. (2013) and Van Vliet et al. (2013), three basic scenarios were created, each regarding a hypothetical follow-up consultation after a medical incident, involving the treating physician, the patient and friend or family member. Anaesthetics (2 videos) and general surgery (1 video) scenarios were included in the study, because these are high risk specialities (Jena, Seabury, Lakdawalla, & Chandra, 2011; Lawthers et al., 1992; Studdert et al., 2005). We choose to script and shoot only the initial conversation between the physician and the patient after the incident, as this is considered a crucial moment which determines the further course of the open disclosure process (J. Moore et al., 2017). Based on initial discussions with physicians, we know that such conversations normally last between 5 and 15 min. Our videos are no longer than 5 minutes for practical reasons. On average, it took 35 minutes for the participants to complete the experiment.

In order to investigate the importance of open disclosure in the daily clinical practice of physicians, the cases in this study were all related to harmful but frequent medical incidents. In consultation with physicians, lawyers, and ombudsmen we consciously chose for cases where uncertainty exists in the responsibility of the treating physician, as this reveals reality with initial disclosure conversations, which

is the focus of our research. In this way, we differ from existing literature in this domain, which mainly focuses on clear physician mistakes.

For each of the three basic scenarios (2 about anaesthetics, 1 about general surgery), two versions were made: one where the physician communicates openly and another one where he communicates defensively. Important to note is that manipulations were made in the content of one specific part of the conversations (i.e., what the physician says) and not in elements such as physician's tone of voice and other nonverbal behaviour. Everything else is kept constant, including patients' health status, care path and adverse outcome. In other words, while the first participant watches the conversations where the physician communicates openly about the medical incidents, another participant was asked to watch the exact same consultations, with the same physicians, the same actions, the same medical incidents, except that the physicians communicate defensively in one specific part of the conversations. In this manner, arguably perfect counterfactuals were created. We were able doing that by directing closely physician moves during recording, so that the technician could cut and paste the manipulated part of the conversation in the same beginning and ending of the videos. Analyses in fact show that participants did not perceive physician characteristics such as movements and facial impressions differently in the open versus defensive scenarios. Consequently, a more open verbal communication causes the effect, rather than other physician characteristics that are likely to be correlated with communication style in real life (for example, one could argue that physicians that engage in more defensive communication, also come across more arrogant or aggressive in his or her nonverbal behaviour).

The scripts and manipulations were based on a qualitative study of prior scripted studies in open disclosure/communication literature (Allan & McKillop, 2010; Allan et al., 2015; Thomas H Gallagher et al., 2007; Annegret F Hannawa, 2012; Annegret F. Hannawa et al., 2013; Iedema et al., 2011; Levinson, 2009; Mazor et al., 2004; Mello et al., 2014; J. Moore et al., 2017; Albert W. Wu et al., 2013), and the expertise of 34 field experts[1] (hereafter expert panel). This resulted in the manipulation of the following elements of physicians' verbal communication in case of a medical incident: (1) responsibility, (2) empathy, (3) information, (4) honesty/sincerity, (5) corrective action, (6) communication skills, (7) compensation, and (8) openness for further questions. These elements were manipulated simultaneously, given that they are together considered as the most important differences between open and defensive communication. The aim of this paper is not to disentangle the effect of these different aspects of communication, but rather to analyse the impact of a more open communication more generally (in terms of all eight communication characteristics) versus a more defensive communication. Table 1 summarizes the manipulations for the scenario where a hole in the patients' spinal cord is formed after placing epidural anaesthesia.

[1] We closely collaborated with 10 physicians, 3 nurses, 2 health care managers, 7 scholars, 3 lawyers, 1 patient, 1 member of the Flemish Patient Platform, 1 health insurance expert, 3 ombudsmen, and 2 quality coordinators.

Table 1:Manipulations scenario hole in the spinal cord of the patient after placing epidural anaesthesia

Manipulated element	Defensive communication	Open communication
Responsibility	Patient's responsibility *E.g., In your case, it was very difficult to puncture for epidural anaesthesia because you were moving while the needle was inserted.*	Summary of objective potential causes of the incident *E.g., Factors that may contribute to such an event include a back disorder such as osteoarthritis, or movement, that makes puncturing more difficult.*
Empathy	Little empathy *E.g., You now have more pain than expected, but that is a known risk of anaesthesia.*	More empathy *E.g., It is very unfortunate that this has happened and we understand that this causes you more trouble than expected, for which we would like to apologize.*
Information	Limited information about what happened *E.g., In your case, it was very difficult to puncture for epidural anaesthesia and therefore the puncture was too deep. This causes a severe headache.*	Extensive information about the incident as such *E.g., Because the puncture was too deep, a hole has formed in the membrane around the spinal cord. This causes some fluid to leak into the cavity between the membrane and the vertebrae. Therefore, there is a change in pressure at that place, which causes a severe headache.*
Honesty/sincerity	Self-assured *E.g., Of course, everything is done to avoid this, but that was not possible in your case.*	Expression of uncertainty *E.g., However, we are not sure how this could have happened to you.*
Corrective action	No intention for corrective action mentioned	Intention for corrective action mentioned *E.g., We will do everything we can to resolve this problem as soon as possible and investigate how we can avoid such event in the future.*
Communication skills	Limited *E.g., We are going to solve this quickly, so you don't have to worry.*	Elaborated *E.g., I would like to give you more information about the incident if that's okay for you.*
Compensation	No offer for compensation mentioned	Offer for compensation mentioned *E.g., We have already notified our insurance about this incident.*
Openness for further questions	No openness for further questions showed	Openness for further questions showed *E.g., Of course, you can always contact me if you have any questions.*

A professional VR production firm was hired to shoot the scripted scenarios with high quality sound and vision. The videos were shot with a static 360° camera. Therefore, the technicians were not allowed in the hospital room and followed the footages and the accompanying sound on iPads with headsets in the corridor. The camera perspective was the patients' point-of-view, namely the head of a hospital bed. To achieve this, the camera was positioned on the top of a mannequin (i.e., instead of the head), lying in a hospital bed. Male physicians were asked to play the role of the physicians, as the majority of all specialists in Belgium are male. An actor performed as the patient's visitor. The videos were recorded in a real hospital room in Lanaken, Belgium. We chose to limit the interactions in the VR videos to a few questions posed by the patient's visitor (same questions for the open and defensive videos), to avoid identification issues of the participant with the patient (e.g., tone of voice).

3.2. Pilot testing

Following the recommendations of Van Vliet et al. (2013), the written scenarios as well as the VR videos were pilot-tested by, on the one hand, our expert panel and, on the other hand, respectively 90 and 30 random people to ensure both internal and external validity. Both media (text and videos) were validated because the medium through which information is given, may alter participants' perceptions. Furthermore, a double pilot test allows us to check whether changes in the written scenarios after the first pilot round were successful. Survey items from literature were, after a validated translation following the method of Cha et al. (2007), used to check all manipulations on 7-point Likert scales (*1 = completely disagree to 7 = completely agree*): (1) feelings of blame and fault (12 items)(Coombs & Holladay, 2002; P. J. Moore et al., 2000; Nazione & Pace, 2015), (2) empathy (5-items)(Coke, Batson, & McDavis, 1978; Annegret F. Hannawa, Shigemoto, & Little, 2016), (3) information (6-items)(Schoenfeld et al., 2019), (4) honesty/sincerity (4 items)(Brugel, Postma-Nilsenová, & Tates, 2015), (5) communication skills (12 items)(Gerbert et al., 2003; Jonas, Etzel, & Barzansky, 1992; Rollnick, Mason, & Butler, 1999; Schulman et al., 1999; Albert W. Wu et al., 2009), (6) compensation (2 items)(Nazione & Pace, 2015), (7) corrective action (2 items)(Annegret F. Hannawa, 2011; Nazione & Pace, 2015), and (8) openness for further questions (2 items). All manipulations were perceived as intended at the 5% significance level. That is, participants who saw the open communication videos blame less the patient for the incident, experienced more empathy, more information, more honesty/sincerity, better communication skills of the physician, a belief for compensation, corrective actions, and openness for further questions. As expected, perceived differences between the open and defensive conversations were more pronounced in the VR videos than in the written scenarios because of the immersiveness related to VR.

To assess external validity of both the written scripts and the VR videos, participants were asked to rate the realism on 7-point Likert scales (*completely disagree = 1 to completely agree = 7*) of (1) the physician, (2) the patient's visitor, (3) the conversation, (4) the medical consultation, (5) the medical

incident, (6) the hospital room, and (7) the length of the conversation (Aruguete & Roberts, 2000, 2002; BRADLEY, SPARKS, & NESDALE, 2001; Hillen et al., 2013; C. A. Roberts & Aruguete, 2000; Schoenfeld et al., 2019; Shapiro, Boggs, Melamed, & Graham-Pole, 1992; Strasser et al., 2005; Verheul, Sanders, & Bensing, 2010; Willson & McNamara, 1982). Participants rated the realism of all elements, except the patient's visitor, significantly higher than the scale centre of four (5% significance level). In general, scores are higher for the VR videos than for the written scenarios (probably because of the immersiveness related to VR), except for the patient's visitor and the length of the vignettes. Additional remarks in the pilot-study indicated that participants expected more interaction with the patients' visitor. However, in agreement with the field experts, we decided to keep the interaction low to increase participants' involvement and ensure objective assessment of the videos by the participants.

Besides realism, the same 7-point Likert scale was used to assess participants' ability to empathize with the patient (Green & Brock, 2000; Hillen et al., 2013), and the understandability and clarity of the scripts and the videos. All of them were found to be higher than the scale centre of four (5% significance level). A content check with three open questions was also successful. Based on additional open-ended remarks on the written scenarios, we included more information about the recovery process and the reporting of the incident to the insurance company in the VR videos.

3.3. Sample & procedure

Random economics, medicine and physiotherapy students at Hasselt University participated in the final experiment. We did not use names, gender, age, and other demographics for the patients in the scenarios in order to assure involvement of each participant in the patient's role in the videos. Furthermore, we choose general cases (e.g., no gynaecological cases only applicable to women). The participants were not aware of the goal of the study and did not need to have had experience with the conditions in the scenarios. Several studies indicate that answers of analogue patients are representative for those of real patients and that they are equally engaged in watching video vignettes (Liesbeth M Van Vliet et al., 2012; Visser et al., 2016). By querying students, we were able to ensure a sufficiently large sample and investigate various patient characteristics, such as incident history, education and other socio-demographics which are possibly related to patients' behavioural intentions and feelings.

Based on a power analysis with a desired statistical power level of 90% and a probability level of 0.05, we aimed for a sample size of at least 120 participants. In order to obtain a sufficiently large sample, an announcement via mail was spread via Hasselt University, and a voucher of €10 or a movie ticket was given to the participants.

Participants were showed three different videos, each regarding a hypothetical follow-up consultation by the treating physician after a medical incident, by using Oculus Rift headsets in a PC-lab[2]. Each participant was randomly assigned to a sequence of three videos with the same communication style: open or defensive. Randomization happened at the participant level and a between-design was premised for the data analysis. We varied the order of the videos to avoid bias due to order effects. There was no interaction between the participants during the experiment.

After watching each video, participants were asked to fill out a short online questionnaire about their thoughts, feelings and behavioural intentions. At the end of the experiment, questions were posed about socio-demographics and background. A website was created to guide participants through the process.

3.4. Key Variables

Table *2* provides definitions of the key variables. As the table shows, we combined multiple items into five dummy outcomes for interpretational reasons. Cronbach's alphas for these constructs were all equal or above 0.8. Our primary outcome is the variable *Intention to Take Further Steps*, which is based on discussions with the field experts and literature (Grégoire, Tripp, & Legoux, 2009; Mazor et al., 2006; Mazor et al., 2004; Nazione & Pace, 2015; Schoenfeld et al., 2019). Furthermore, we followed the study of Coombs & Holladay (2002) to measure participants' feelings of blame and fault against the physician. A shorted form of the Trust in Physician Scale (5-items) was used to assess participants' trust in the treating physician after the incident disclosure (Anderson & Dedrick, 1990). More specifically, participants were asked to rate items such as *"I doubt that the doctor would really care about me as a person"*, and *"I would trust that doctor to tell me if a mistake was made about my treatment"*. Together with participants' general impression of how the physician handles the incident (Albert W. Wu et al., 2009) and physician's competence (2 items)(Saha & Beach, 2011), this construct forms the variable *Physician Ratings*. The variable *Physician Communication skills* is constructed of physician's empathy (4 items) and sincerity (2 items)(Brugel et al., 2015; Coke et al., 1978). Two items were used to assess perceived incident severity (Grégoire et al., 2009; Joireman, Grégoire, Devezer, & Tripp, 2013; Nazione & Pace, 2015). All those items were measured on a 7-point Likert scale (*completely disagree/very bad = 1 to completely agree/very good = 7*). Preliminary analyses resulted in different cut-offs to create dummy variables with enough variety.

Questions were also included to control for participants' socio demographics, legal and health background.

[2] Important to note is that the experiment took place in times of the Corona pandemic. Therefore, there was a limited number of students allowed per test round.

Table 2: Variable Definitions

Variable Name	Description
Outcomes	
Intention to Take Further Steps	Dummy equal to 1 if the mean of 5 behavioural intentions (i.e., intentions to file a lawsuit, to contact a lawyer to discuss options, to complain to the hospital, to discuss the situation with a general practitioner and to change physician) is equal or higher than 4 on a 7-point Likert scale.
Feelings of Blame Physician	Dummy equal to 1 if feelings of blame against physician are equal or higher than 6 on a 7-point Likert scale.
Physician Ratings	Dummy equal to 1 if the mean of trust in physician, general impression of the physician and physician competence is equal or higher than 5 on a 7-point Likert scale.
Incident Severity	Dummy equal to 1 if incident severity is equal or higher than 5 on a 7-point Likert scale.
Physician Communication Skills	Dummy equal to 1 if the mean of physician empathy and sincerity is equal or higher than 5 on a 7-point Likert scale.
Treatment Variable	
Open Disclosure	Dummy equal to 1 if student saw open disclosure videos.
Student Characteristics	
Male	Dummy equal to 1 if student is male.
Health	General health measured on a 7-point Likert scale from 1 = Very Bad to 7 = Very Good.
Med/Physio Student	Dummy equal to 1 if student follows a medicine of physiotherapist education.
Parent in Health/Law	Dummy equal to 1 if parent(s) works/ever worked in healthcare/law.
Incident Experience	Dummy equal to 1 if student is ever confronted with a medical incident.

Notes: The table provides variable definitions.

4. Descriptive Statistics

140 students participated in the experiment, generating a sample of 420 observations. Table *3* shows descriptive statistics of the outcomes and student characteristics. Most of the participants are female (63%) and have a relatively good general health (mean of 6.06 on a 7-point Likert scale). Almost half of the sample follows a medical or physiotherapist education (46%), and so is educated to deal with patients. About one third of the participants has a parent who is currently or have been working in health or law (31%). Consistent with existing research (Annegret F. Hannawa, 2014; Mazor et al., 2004), almost one third indicated that they were ever confronted with a medical incident (31%). Our primary outcome is *Intention to Take Further Steps*. 37% of the sample is intended to take further steps after incident disclosure.

Table 3: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Outcomes					
Intention to Take Further Steps	420	0.37	0.48	0	1
Feelings of Blame Physician	420	0.27	0.45	0	1
Physician Ratings	420	0.38	0.49	0	1
Physician Communication Skills	420	0.27	0.45	0	1
Incident Severity	420	0.37	0.48	0	1
Student Characteristics					
Male	140	0.37	0.48	0	1
Health	140	6.06	0.84	3	7
Med/Physio Student	140	0.46	0.50	0	1
Parent in Health/Law	140	0.31	0.46	0	1

Incident Experience	140	0.31	0.46	0	1

Notes: The table reports the descriptive statistics for the key variables.

Because participants are randomly assigned to groups, there should be no systematic differences between participants in the control and treatment group which may influence the outcomes at the same time as the treatment (e.g., participants who ever experience a medical incident, may be more likely to take further steps after hearing about an incident, given the communication style). Nevertheless, to ensure that the treatment is causing the effect, we performed a series of ordinary-least-squared (OLS) regressions, one per student characteristic, with as explanatory variable a dummy equal to one if the student saw the open communication style. Table *4* indicates that these balance checks reveal no significant differences between the treatment and control group on the characteristics.

Table 4: Results on Tests of Covariate Balance

	Mean		
	Control group mean	Treatment group mean	OLS Difference
	(1)	(2)	(3)
Demographic Characteristics			
Male	0.39	0.35	0.04 (0.663)
Health/Law Background			
Health	5.96	6.18	0.22 (0.126)
Med/Physio Student	0.47	0.44	0.03 (0.715)
Parent in Health/Law	0.32	0.29	0.03 (0.747)
Incident Experience	0.29	0.32	0.03 (0.686)
N	72	68	140

Notes: The table reports the results based on tests of covariate balance. Columns (1) and (2) contain means for respectively the control and the treatment group. Column (3) reports the coefficients from an OLS regression with Open Disclosure as the explanatory variable, with corresponding *p*-values shown in (parentheses).

Table 5 presents the descriptive statistics of the outcomes by communication style in the videos (defensive vs. open). Row (1), for example, indicates that intentions to take further steps are 10 percent points higher in case of open disclosure (0.42 vs. 0.32) and that the difference is statistically significant from zero. A possible explanation for this is the significant greater feelings of blame against the physician for the treatment group in Row (2) (0.35 vs. 0.20). Interestingly, there is no significant difference in physician ratings [Row (3)]. That is, patients do keep the trust in their physician and his competence. They even rate physician communication skills significantly higher (0.31 vs. 0.23), as can be seen in Row (4). The incident is also not perceived as more or less severe as a result of open communication [Row (5)].

Table 5: Descriptive Statistics Outcomes

	Defensive Communication (1)	Open Communication (2)
(1) Intention to Take Further Steps	0.32**	0.42**
	(0.47)	(0.49)
(2) Feelings of Blame Physician	0.20***	0.35***
	(0.40)	(0.48)
(3) Physician Ratings	0.37	0.40
	(0.48)	(0.49)
(4) Physician Communication Skills	0.23*	0.31*
	(0.42)	(0.47)
(5) Incident Severity	0.35	0.39
	(0.48)	(0.49)
N	216	204

Notes: Cells contain means and (standard errors). The table further reports significance from OLS regressions with Open Disclosure as the explanatory variable. *** p<0.01, ** p<0.05, * p<0.1

5. Econometric Analysis and Results

5.1. Empirical Strategy

To examine the impact of open disclosure on patients' thoughts, feelings and behavioural intentions, we estimated the following equation.

$$(1)\ Y_{ic} = \alpha_i + \beta C_{ic} + \partial_i X_i + \varphi_c + \varepsilon_{ic}$$

where Y_{ic} is one of the various indicators of the thoughts, feelings and intentions of participant *i* in case *c* (i.e., intentions to take further steps, feelings of blame and fault, and physician ratings). We control for participant characteristics (X_i). In observational data-analysis, it would be important to do so since participants may embody attributes that confound the results such as gender and adverse event experience. This should not be a concern in our research because, by design, physicians' communication type (open vs defensive) is orthogonal to participant characteristics. Nevertheless, we control for some. φ_c are case fixed effects. The variable of interest C_{ic} is a dummy that equals one if participant *i* has seen the version with open communication of case *c*. Hence, β measures the impact of the formulated open communication by the field experts and literature on behavioural intentions, thoughts and feelings of participant *i* in case *c*, all else equal. Standard errors are clustered at the participant level. Although each respondent saw the same three cases with a different communication style, we randomly assigned respondents to a different order of the videos. We control for the order in which the videos are watched and so avoid bias of the results because of order effects.

5.2. Main Results

Table *6* provides the results obtained from Equation (1) for the impact of open disclosure on participant behavioural intentions, thoughts, and feelings. This effect is shown by the coefficient of the variable

Open Disclosure, which is a dummy equal to one when exposed to open communication. As the table indicates, the coefficients of intention to take further steps and feelings of blame physicians are positive and significantly different from zero. This means that being open may result in a higher intention for patients to take further (legal) steps regarding the incident they are confronted with, which can be explained by the significant greater feelings of blame against the physician. More specifically, participants exposed to open disclosure are more than 10 percent points more likely to take further steps, given the incident details, physician non-verbal behaviour and the patient's attitude in the videos. As participants in the open case also blame the physician about 16 percent points more, we can expect that these feelings of blame may drive patients' behavioural intentions. Interestingly regard to this finding is that open disclosure does not lead to different physician ratings or different perception of the severity of the incident. Physician communication skills are even rated almost 8 percent point better than in the defensive counterpart.

These findings provide insight in what really drives patients' behavioural intentions, which the results show is not a worser general impression and trust of the physician and his competence or a worser perception of the incident severity, but the greater feelings of responsibility they lay with the physician. Patients in case of open disclosure received an enumeration of possible objective causes for the incident, leaving open the discussion whether the physician made a mistake. In contrary to the defensive counterpart, in which the physician says that the incident is occurred due to the patient's medical condition or behaviour. As proving physicians' responsibility in unfolding procedures is a decisive factor for getting indemnified, the higher intentions to take further steps of patients in the treatment group may be declared by a higher faith in a successful indemnity payment as a result of this manipulation. Furthermore, in the open videos, the physician mentions that they will further investigate the incident and that the insurance is already notified about the incident, just as the physician shows more empathy and says that they stand open for further questions. As this was not the case in the defensive videos, this might have further raised patients perceived winning chances and declare their higher intentions to take further steps. Manipulation checks of the videos show that patients in the treatment group indeed say more that the physician told them the insurance will cover future costs related to the incident.

Further important to note is that men have significant better perceptions of physicians' communication skills and that participants with parents working or have been working in health or law cherish less feelings of blame against the physician. This is not surprisingly, as women might be more sensitive, and therefore pickier, for physician's communication style and children of health care or law workers may associate their physician with their own parents, for which they consequently show more respect and credit.

Table 6: Main Results

	(1) Intention to Take Further Steps	(2) Feelings of Blame Physician	(3) Physician Ratings	(4) Physician Communication Skills	(5) Incident Severity
Open Disclosure	0.105*	0.156***	0.024	0.078*	0.021
	(0.058)	(0.048)	(0.046)	(0.043)	(0.043)
Male	0.084	0.074	0.039	0.116**	0.014
	(0.060)	(0.050)	(0.048)	(0.047)	(0.052)
Health	-0.009	0.010	0.045	0.040	0.030
	(0.038)	(0.026)	(0.030)	(0.025)	(0.027)
Med/Physio Student	-0.053	-0.037	0.070	0.010	-0.073
	(0.055)	(0.048)	(0.047)	(0.045)	(0.047)
Parent in Health/Law	-0.035	-0.119**	-0.018	-0.037	0.044
	(0.064)	(0.052)	(0.051)	(0.044)	(0.054)
Incident Experience	0.018	-0.021	-0.050	-0.076	-0.027
	(0.061)	(0.049)	(0.052)	(0.046)	(0.046)
Observations	420	420	420	420	420
Case FE	Yes	Yes	Yes	Yes	Yes
Order FE	Yes	Yes	Yes	Yes	Yes

Notes: The table reports OLS results. Heteroskedasticity robust standard errors in parentheses are clustered at the participant level. *** p<0.01, ** p<0.05, * p<0.1

5.3. Interaction Effects

As student characteristics may alter the treatment effect, we also test some interactions. These are presented in Table *7*. We hypothesize, for example, that participants with incident experience, may be influenced by their own experiences, which may result in certain expectations or comparisons and consequently a different reaction on open disclosure. We expect the same for medicine or physiotherapist students, as they are educated about patient communication. As in practice especially woman deemed to be sensitive about communication style, we also test gender interactions. As Table *7* shows, however, none of these interaction effects were significant.

Table 7: Results with Interaction Terms

	(1) Intention to Take Further Steps	(2) Intention to Take Further Steps	(3) Intention to Take Further Steps	(4) Feelings of Blame Physician	(5) Feelings of Blame Physician	(6) Feelings of Blame Physician	(7) Physician Ratings	(8) Physician Ratings	(9) Physician Ratings	(10) Physician Communication Skills	(11) Physician Communication Skills	(12) Physician Communication Skills	(13) Incident Severity	(14) Incident Severity	(15) Incident Severity
Open Disclosure	0.131*	0.092	0.083	0.119**	0.198***	0.169***	-0.011	0.008	0.031	0.076	0.062	0.114**	0.020	0.017	0.002
	(0.069)	(0.084)	(0.070)	(0.060)	(0.065)	(0.062)	(0.057)	(0.061)	(0.056)	(0.050)	(0.056)	(0.055)	(0.051)	(0.060)	(0.054)
Male	0.119	0.084	0.081	0.025	0.076	0.076	-0.006	0.038	0.040	0.114*	0.116**	0.121**	0.012	0.014	0.011
	(0.082)	(0.060)	(0.060)	(0.062)	(0.050)	(0.050)	(0.062)	(0.048)	(0.047)	(0.060)	(0.047)	(0.047)	(0.080)	(0.052)	(0.051)
Health	-0.009	-0.009	-0.007	0.010	0.011	0.009	0.045	0.045	0.044	0.040	0.040	0.037	0.030	0.030	0.032
	(0.038)	(0.038)	(0.039)	(0.026)	(0.025)	(0.026)	(0.029)	(0.030)	(0.030)	(0.026)	(0.026)	(0.026)	(0.027)	(0.027)	(0.027)
Med/Physio Student	-0.052	-0.066	-0.054	-0.038	0.008	-0.037	0.068	0.053	0.070	0.010	-0.008	0.011	-0.073	-0.078	-0.074
	(0.055)	(0.073)	(0.055)	(0.048)	(0.060)	(0.048)	(0.047)	(0.061)	(0.048)	(0.045)	(0.055)	(0.045)	(0.047)	(0.071)	(0.046)
Parent in Health/Law	-0.026	-0.034	-0.032	-0.132**	-0.120**	-0.120**	-0.030	-0.018	-0.019	-0.038	-0.037	-0.041	0.043	0.044	0.046
	(0.065)	(0.064)	(0.065)	(0.052)	(0.051)	(0.053)	(0.053)	(0.051)	(0.052)	(0.046)	(0.044)	(0.045)	(0.058)	(0.054)	(0.053)
Incident Experience	0.021	0.018	-0.016	-0.025	-0.020	-0.001	-0.054	-0.051	-0.040	-0.077*	-0.077	-0.021	-0.027	-0.027	-0.057
	(0.061)	(0.061)	(0.078)	(0.048)	(0.049)	(0.061)	(0.052)	(0.052)	(0.063)	(0.046)	(0.046)	(0.055)	(0.046)	(0.046)	(0.068)
Open Disclosure x Male	-0.072			0.102			0.095			0.005			0.004		
	(0.118)			(0.098)			(0.097)			(0.102)			(0.100)		
Open Disclosure x Med/Physio Student		0.028			-0.092			0.034			0.035			0.009	
		(0.109)			(0.095)			(0.091)			(0.089)			(0.088)	
Open Disclosure x Incident Experience			0.070			-0.041			-0.022			-0.114			0.062
			(0.122)			(0.092)			(0.100)			(0.090)			(0.087)
Observations	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420
Case FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Order FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports OLS results. Heteroskedasticity robust standard errors in parentheses are clustered at the participant level. *** p<0.01, ** p<0.05, * p<0.1

5.4. Robustness Checks and Further Results

To further understand the impact of open disclosure in the physician-patient relationship, we executed a series of robustness checks and alternative models, presented in Table *8*. In Panel A, we adjusted *p*-values for multiple hypothesis testing by means of the Bonferonni method. The adjusted *p*-values are shown in parentheses. The coefficient of the variable *Open Disclosure* remains solely significant for feelings of blame against the physician at the 5% significance level.

Panel B shows the main results for the original Likert outcomes instead of dummy variables. As you can see, these results are completely consistent with the results presented in Table *6*. That is a significant positive impact of open disclosure on intention to take further steps, feelings of blame against physician and physician communication skills, and no effect on physician ratings and incident severity.

In Panel C and D, we execute separate OLS regressions for each dummy outcome instead of combined constructs. These results help us to understand which behavioural intentions participants exactly pursue after open disclosure, and which thoughts and feelings may influence these intentions. For example, participants exposed to open disclosure seem to be more than 15 percent points more likely to contact a lawyer to discuss their options regarding to the medical incident and more than 13 percent points more intended to complain to the hospital. Although the coefficients for other behavioural intentions such as filing a lawsuit, contacting general practitioner, and changing physician are positive, they are not significant. Panel D indicates that open disclosure leads to a significant better general impression of the physician. No significant effects are found for the trust in physician, physician competence, sincerity and empathy. The fact that participants are not significantly more likely to change physician, but they are for complaining to the hospital or contacting a lawyer, supports our hypothesis that open disclosure does not damage physician's reputation. However, it increases feelings of responsibility they lay with the physician, which consequently may increase patients' belief in a successful indemnity procedure.

To check the robustness of the cut-offs we premised for the main analyses, we performed OLS regressions on dummies created with cut-offs of one point lower on a 7-point Likert scale in Panel E. In comparison with Table *6*, you can see consistent results, except for the feelings of blame against physician. A potential explanation for that is the fact that these feelings of blame are rated relatively high (mean of 4.65 on a 7-point Likert scale) so that a lower cut-off leads to less variation for the dummy variable.

Table 8: Robustness Checks

	Panel A: Main Results with *p*-values Adjusted for Multiple Hypothesis Testing (Bonferonni Method)				
	(1) Intention to Take Further Steps	(2) Feelings of Blame Physician	(3) Physician Ratings	(4) Physician Communication Skills	(5) Incident Severity
Open Disclosure	0.105 (0.35)	0.156** (0.01)	0.024 (1.00)	0.078 (0.36)	0.021 (1.00)
Observations	420	420	420	420	420
Case FE	Yes	Yes	Yes	Yes	Yes
Order FE	Yes	Yes	Yes	Yes	Yes
	Panel B: Main Results with Likert Outcomes				
	(6) Intention to Take Further Steps	(7) Feelings of Blame Physician	(8) Physician Ratings	(9) Physician Communication Skills	(10) Incident Severity
Open Disclosure	0.343** (0.143)	0.369** (0.161)	-0.005 (0.119)	0.262*** (0.098)	0.098 (0.131)
Observations	420	420	420	420	420
Case FE	Yes	Yes	Yes	Yes	Yes
Order FE	Yes	Yes	Yes	Yes	Yes
	Panel C: Regression Results of Open Disclosure on Separate Dummy Behavioural Intentions				
	(11) Filing a Lawsuit	(12) Discussing Options with Lawyer	(13) Complaining to the Hospital	(14) Contacting General Practitioner	(15) Changing Physician
Open Disclosure	0.061 (0.051)	0.155*** (0.059)	0.135** (0.058)	0.063 (0.058)	0.050 (0.051)
Observations	420	420	420	420	420
Case FE	Yes	Yes	Yes	Yes	Yes
Order FE	Yes	Yes	Yes	Yes	Yes
	Panel D: Regression Results of Open Disclosure on Separate Dummy Thoughts and Feelings				
	(1) Trust in Physician	(2) General Impression of Physician	(3) Physician Competence	(4) Physician Sincerity	(5) Physician Empathy
Open Disclosure	-0.050 (0.052)	0.089** (0.043)	-0.035 (0.038)	0.063 (0.050)	0.053 (0.043)
Observations	420	420	420	420	420
Case FE	Yes	Yes	Yes	Yes	Yes
Order FE	Yes	Yes	Yes	Yes	Yes

Panel E: Main Results with 1-Point Lower Cutoff for Dummy Outcomes

	(1) Intention to Take Further Steps	(2) Feelings of Blame Physician	(3) Physician Ratings	(4) Physician Communication Skills	(5) Incident Severity
Open Disclosure	0.125**	0.072	0.015	0.077*	-0.028
	(0.051)	(0.052)	(0.048)	(0.043)	(0.041)
Observations	420	420	420	420	420
Case FE	Yes	Yes	Yes	Yes	Yes
Order FE	Yes	Yes	Yes	Yes	Yes

Notes: The table reports OLS results. Heteroskedasticity robust standard errors in parentheses are clustered at the participant level. In Panel A, *p*-values adjusted for multiple hypothesis testing (Bonferonni Method) instead of standard errors are mentioned in parentheses. *** p<0.01, ** p<0.05, * p<0.1

6. Discussion and Limitations

This study set out with the aim of assessing the importance of physician's communication in case of a medical incident. Our findings suggest that verbal open disclosure may lead patients to take further steps against the concerned physician such as contacting a lawyer to discuss options and complaining to the hospital, which might be explained by higher reported feelings of blame against the physician. This finding is contrary to previous studies which have suggested that open disclosure correlates negatively with the number of claims and positively influences patients' thoughts and feelings. However, this study does support the finding that open communication leads to a better general impression of the concerned physician and physician communication skills. Furthermore, we found that patients keep the trust in their physician and his competence in case of open disclosure and are not more intended to change physician than in the defensive counterpart. Also, the incident is not perceived as more or less severe.

Overall, these study results confirm that the fear of physicians to be pursued after open incident disclosure is justified, helping to understand physicians' defensive behaviour in practice. This paper addresses the need to find explanations and solutions for this 'dread' fear, and so boost open disclosure in practice. This is important for several reasons. First, besides defensive communication, physicians' medical liability risk may drive physicians to perform more tests and procedures than strictly medically necessary, or to what is called defensive medicine in literature (D. Kessler & McClellan, 1996; Klingman et al., 1996; OTA, 1994). Multiple studies already investigated various drivers of physician's defensive medicine in attempt to approach an efficient spending of the limited health care budget (Amaral-Garcia, Bertoli, & Grembi, 2015; Avraham & Schanzenbach, 2015; Bradford, 1995; D. P. Kessler, Sage, & Becker, 2005; B. Roberts & Hoch, 2007; Shurtz, 2013; Sloan & Shadle, 2009). However, the interplay with incident disclosure, and how this may create a vicious circle needs more attention. Second, defensive communication about medical incidents may enlarge the suffering of physicians as a second victim, as being open towards colleagues, family, friends, patients and their relatives may be a strategy for physicians to restore trust and self-confidence (Coughlan, Powell, &

Higgins, 2017; Annegret F. Hannawa et al., 2013; Seys et al., 2013; Ullström, Sachs, Hansson, Øvretveit, & Brommels, 2014). At least as important, in absence of open disclosure, there will be no learning opportunities for institutions and physicians to improve their processes and avoid future recurrences (Seys et al., 2013; Albert W Wu & Steckelberg, 2012). As medical incidents and their unfolding are associated with large financial and emotional costs (Bielen, Grajzl, & Marneffe, 2019; Carey & Stefos, 2011) and increasing health care costs are a concern in developed countries (OECD, 2015), reducing medical incidents and related physician defensive behaviour, should be a primary focus of policy makers.

Although the study results confirm physicians' fear for malpractice claims after open disclosure, they refute physician's fear for reputational damage, as open communication seems to even improve participants' general impression of the physician and no differences are found in the trust and competence ratings between the treatment and control groups. Patients are also not more likely to change physician. As physicians' reputation is safeguarded during unfolding procedures, the question raises what especially complicates malpractice procedures like it is in practice, and further declare physicians' dread fear for malpractice procedures. The results in this paper suggest that patients' intention to engage in further procedures is driven by their faith for successful indemnities, which manipulation checks show is higher in the open videos. While providing adequate compensation and information to malpractice victims is one of the main goals of the medical malpractice system, open disclosure may create a battlefield with the pursuit of insurance companies to pay the lowest amount of malpractice indemnifications. This raises the question whether we do not better shed light on the role of insurance companies in medical malpractice procedures and consequently physician communication style, instead of keeping our eyes closely on the formation of the medical liability system and blaming physicians. This paper, therefore, further addresses the need for an optimal compensation system in Belgium and a safe reporting system for medical incidents besides the duality with insurance companies, to create learning opportunities and avoid future recurrences. The establishment of the Funds for Medical Incidents in Belgium in 2012 was a good starting point but misses efficiency and effectivity nowadays in practice. This research shows that, even after the reform, physician's fear for malpractice claims may drive them to defensive communication. Future work is required to elaborate on that.

Furthermore, these findings raise intriguing questions regarding the specific elements of verbal incident disclosure driving patient behaviour. Examining these elements (e.g., offering compensation, saying sorry) separately is an important issue for future research. Just like more insight is needed in the impact of open disclosure in the further steps of the unfolding of a medical incident (i.e., not only the first step in the open disclosure process like investigated here). Seeking answers to questions such as: may open disclosure eventually lead to more indemnity payments or not, would be very important to assess the global impact of open disclosure and further declare dualities and inefficiencies in the system with various stakeholders.

Although this research guarantees high internal and external validity of the study results because of the experimental design and virtual reality techniques, we must set out some limitations. First, this study only addresses intentions so no real patient behaviour. Therefore, further research should be undertaken to examine whether intentions match real behaviour for this research question. Second, these findings cannot be extrapolated to all patients since only students at Hasselt University participated and the health and law context of Belgium might be quite different from other countries than premised in previous or further research. Third, it is also possible that participants' relationship with their own physicians influenced their perceptions of the videos. Although we controlled for health status and incident experience, we cannot fully monitor the extent to which the results are influenced by participants' own experiences.

7. Conclusion

This study is the first that uses real-life virtual reality techniques in combination with an experimental design to examine the impact of physician open incident disclosure on patients' thoughts, feelings, and behavioural intentions. More specifically, we shot 360° videos of hypothetical physician-patient conversations after the occurrence of a medical incident. For each of the three cases, two versions were made: one where the physician communicates openly about the incident and a defensive counterpart. Important to note is that everything else is kept constant, such as physician nonverbal behaviour and patient symptoms, ensuring that solely physician verbal communication is driving the effect. With our design and the use of virtual reality techniques, we overcome omitted variable bias and external validity problems, which are common in existing literature in this domain.

140 random economics, medicine and physiotherapy students evaluated each three videos with the same communication style (open vs. defensive). The results show, in contrast to existing studies, that open disclosure may drive patients to engage in further steps. A possible explanation might be the fact that participants in the open videos blame more the physician. We, however, found no difference in physician ratings and the perceived incident severity between the two groups. Participants' general impression of how the physician handles the incident and his communication skills is even better than in the defensive counterpart.

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