When Bad Things Happen: Training Medical Students to Anticipate the Aftermath of Medical Errors

Swapna Musunur¹ · Eva Wainee¹ · Edward Walton¹ · Kathryn Deeds¹ · Diane Levine¹

Received: 19 January 2020 / Accepted: 22 June 2020 / Published online: 27 July 2020
© Academic Psychiatry 2020

Abstract

Objective Medical errors affect trainees. Existing curricula emphasize tenets of patient safety but rarely address the impact of medical errors on health care providers, particularly at the undergraduate level. The authors developed an interactive session exploring the professional and personal effects of medical errors for 300 second-year medical students.

Methods The session utilized case-based learning, small group discussion, and video vignettes. Physicians in multiple specialties were interviewed, sharing narrative accounts of their experience with medical errors and adverse events. Discussions were facilitated by local physicians, who delivered content and shared personal anecdotes. Surveys using a 5-point Likert scale were conducted before and after the session.

Results Pre- and post-test surveys resulted in 91 responses in 2016 and 174 in 2017. In 2016, results showed significant change in student responses by 0.34 units (SD 0.35 units; $p < 0.001$). Two survey items addressing student awareness and three items addressing confidence were significant. The domains assessing students' attitudes and knowledge regarding medical errors were not significant. In 2017, the overall mean change was 0.33 with a lower standard error, 0.03 ($p < 0.001$), showing significance in both years the session was delivered.

Conclusion A 1-h, small-group session increased medical students' understanding of the impact of medical errors and adverse events on providers and the supportive resources available. Recruitment of local faculty to facilitate discussions and share personal anecdotes enhanced the success of the session.

Keywords Undergraduate medical education · Burnout · Medical error · Small group learning · Reflection

Medical error and adverse patient outcomes affect trainees. Existing curricula focus primarily on improving the error disclosure process by utilizing educational tools such as standardized patient encounters and structured reflection but rarely address the psychological impact of error on healthcare providers, particularly at the undergraduate level [1]. Considering the prevalence of burnout in physicians and the impact of medical error on physician wellness [2], curricula on this topic to prepare future physicians are needed [3, 4].

According to the National Academy of Medicine (NAM), more than half of healthcare providers in the USA exhibit at least one symptom of burnout [5]. Burnout has been associated with increased medical errors and is linked to increased

medication errors, hospital infections, length of stay, and higher 30-day risk-adjusted mortality [6–8]. In response, the NAM has made clinician wellness a priority noting that “clinician well-being is essential for delivery of safe, high-quality patient care” [5].

Medical error seems to be both a result of burnout and a factor contributing to burnout. Studies have found that after a medical error, physicians report loss of well-being due to fear, shame, and loss of confidence, as well as reduced job satisfaction due to moral distress. In 2000, the term “second victim” was introduced to acknowledge the impact of an adverse event on healthcare providers and the need for support [9, 10]. The second victim phenomenon is a concern for medical students, as most are involved in a medical error before they graduate from medical school [11, 12].

Given the prevalence of medical error and its wide-ranging effects on all providers, education regarding the impact of medical error for undergraduate medical students is recommended. For this reason, we designed an educational session

✉ Swapna Musunur
smusunur@med.wayne.edu

¹ Wayne State University School of Medicine, Detroit, MI, USA

to allow students to discuss the impact of medical error with local physician-educators in their community and prepare them before the first adverse event occurs. This topic has gained further urgency in the light of the COVID-19 pandemic as healthcare providers across every border are faced with a wave of adverse patient outcomes. The full impact of these adverse outcomes on healthcare providers is yet to be determined. Understanding how to prepare healthcare providers to anticipate adverse outcomes can in turn prepare psychiatrists to support their colleagues.

Methods

An hour-long session addressing the impact of medical error on physicians was created for a class of 300 second year pre-clerkship medical students and delivered in the late fall of 2016 and 2017. This project was submitted to the Institutional Review Board and was deemed to be exempt from review. This curriculum was a mandatory but ungraded component of a broader longitudinal health systems curriculum at the Wayne State University School of Medicine (WSU SOM) that began with patient safety topics in the first year. The second-year curriculum included videos of local physicians sharing their own experiences with medical error along with a guided small group discussion. The session had the following objectives:

1. Students will appreciate the likelihood of being involved in a medical error in their future career through exposure to information regarding the prevalence and effects of medical error in a healthcare setting.
2. Students will recognize both the professional and personal impact of medical error through small group discussion and narrative storytelling.
3. Students will be able to identify both informational resources and individual personnel available locally if they or their colleagues struggle to cope with a medical error.

Students were anonymously polled before and after the 1-h curriculum to assess their knowledge and attitudes regarding this topic.

Medical students in the WSU chapter of the Institute for Healthcare Improvement (IHI) developed this curriculum under the guided mentorship of faculty members. Drawing heavily from research by Edrees, White, and Scott, students elected to focus on the impact of errors, the natural history of recovery, and local resources available after an error or adverse event [13–18].

The session consisted of video vignettes of local physician experiences with medical error interwoven into a didactic presentation that guided the small group discussion. Vignettes were collected by students through brief structured interviews

with faculty physicians during which physicians reflected on an experience with medical error in their career. The interview guide was developed through a collaboration between faculty and students. Three faculty (an internist, medicine/pediatrics physician, and psychiatrist) were chosen due to their significant interactions with students and their willingness to share personal stories. Physicians signed a consent form developed by the legal department to allow recording of faculty discussing patient stories. Videos were reviewed to remove any patient protected information and embedded into a presentation containing information regarding the prevalence of adverse outcomes, impact of error on the physician, coping strategies, and available resources. This information was generated from published literature, the IHI Open School, and the Agency for Healthcare Research and Quality.

Physician faculty from internal medicine, family medicine, pediatrics, psychiatry, and surgery were invited to facilitate a small group discussion of 15–20 students. Facilitators were provided with a facilitator's guide, PowerPoint presentation, and video recordings. All facilitators were given the option to attend a 30-min briefing before the session; most elected to do so. Facilitators were encouraged to share personal anecdotes and experiences with medical error and identify sources of support.

To assess the impact of this curriculum, we utilized a pre-post-test survey design. An online platform (Qualtrics) was used to deliver the survey before and after the educational session. The survey assessed student responses on 14 items relating to the learning objectives of the session with a 5-point Likert scale ranging from strongly agree to strongly disagree.

We assessed knowledge and attitudes as this curriculum did not allow for evaluation of skills. We also chose to evaluate confidence. Awareness of local resources was an objective of the session and therefore an important measure of success. Items were written by students and faculty and reviewed by the SOM's patient safety course director for content validity, clarity, and relevance. Cognitive interviews and pilot testing were conducted with student members of IHI to ensure usability. Based on these validation steps, questions were refined and the survey finalized. The pre-test was delivered to students prior to the session, and the post-test was emailed to students for completion immediately after the session.

In 2016, the survey was distributed while the students were physically in the classroom prior to beginning the session. In 2017, the pre-test was emailed to students a few days prior to the session. The change in distribution methods was implemented to decrease the response shift bias present from the pre-post-test method.

Results

To match anonymous pre-post data responses, unique identifiers were utilized. Stata 15 was used to conduct the statistical

Table 1 Pre–post-test scores separated by domain

Domain	Survey item	2016					2017				
		Pre <i>n</i> = 158	Post <i>n</i> = 103	Change <i>n</i> = 91	<i>t</i> value	<i>p</i> value	Pre <i>n</i> = 258	Post <i>n</i> = 214	Change <i>n</i> = 174	<i>t</i> value	<i>p</i> value
Attitudes	I believe that acknowledging my responsibility in performing a medical error is healthy	4.323	4.467	0.096	3.290	0.001*	4.336	4.462	0.126	2.030	0.044
	I believe that everyone in the medical error process is impacted, not just the patient	4.525	4.750	0.207	1.180	0.240	4.517	4.573	0.056	1.360	0.175
	I believe that the culture of medicine or the workplace environment impacts a physician's ability to cope with medical error	4.380	4.524	0.085	1.450	0.151	4.378	4.481	0.103	1.470	0.144
Resource awareness	I am aware of resources that I can use to cope with performing a medical error	2.241	3.612	1.315	10.730	< 0.001*	2.564	3.799	1.235	13.140	< 0.001*
	I am aware of the avenues I can go through to report a medical error I witness	2.428	3.552	1.043	8.430	< 0.001*	2.656	3.621	0.965	11.260	< 0.001
Confidence	I am confident in my ability to cope with medical error in your future career	3.176	3.771	0.585	5.740	< 0.001*	3.255	3.874	0.619	8.444	< 0.001
	I am confident in my ability to recognize that a colleague is struggling to cope with performing a medical error	3.411	3.876	0.473	5.420	< 0.001*	3.364	3.948	0.584	7.830	< 0.001
Knowledge	I have an understanding of the caring for the caregiver concept	3.177	4.308	1.141	9.900	< 0.001*	3.637	4.519	0.882	11.290	< 0.000*
	A close call does not have an effect on the team or how members of a team will feel.	4.201	4.269	− 0.032	− 0.190	0.849	4.178	4.164	− 0.014	− 0.810	0.419
	Medical errors will not have an effect on my practice of medicine	4.377	4.400	− 0.128	3.140	0.002*	4.243	4.206	− 0.037	0.000	1.000
	Admitting to a medical error will cause me to get sued.	2.994	3.210	0.191	− 0.250	0.802	3.008	3.248	0.24	3.450	< 0.001*
	It is important to practice full disclosure for errors that have led to harm in contrast to those that have not	2.595	2.486	− 0.333	− 1.090	0.280	2.772	2.561	− 0.211	− 2.250	0.026
	There are multiple ways that a team can be affected by a medical error	4.646	4.660	− 0.011	1.920	0.057	4.533	4.643	0.11	2.010	0.046
	Medical error can lead to physician burnout	4.354	4.638	0.258	− 2.170	0.033	4.344	4.556	0.212	3.500	< 0.001*
Overall		3.630	4.037	0.348	9.680	0.000*	3.699	4.046	0.325	11.420	< 0.001*

* Statistically significant

analysis. Responses with no matches were excluded from the sample resulting in an $n = 91$ in 2016 and $n = 174$ in 2017. Means for pre–post-test responses were calculated in addition to mean change for each respective year as demonstrated in Table 1. The 14 survey items were grouped into four domain-specific learning objectives including attitudes, awareness, confidence, and knowledge. A t test was utilized to assess the impact of the curriculum.

In 2016, results showed a significant change ($p < 0.001$) in student responses by 0.34 units of mean change with a standard deviation of 0.35 units, implying that this curriculum impacted

students. The items that addressed student awareness (2 questions) and confidence (3 questions) regarding how to cope with medical error were both significant. Items which assessed students' attitudes and knowledge regarding medical error showed statistical significance ($p < 0.01$) for 1 out of 3 items in 2016 for attitudes and 2 out of 6 and then 3 out of 6 items for knowledge, respectively, in 2016 and 2017. Items not significant had higher mean responses initially. The attitudes domain had an average pre-test mean of 4.40 and the knowledge domain had an average pre-test mean of 4.00. Changes from pre-test means to post-test means are demonstrated in Fig. 1.

Fig. 1 Average pre–post-survey responses, after conduction of a 5-point Likert scale survey, divided into 4 core measures assessing the impact of medical error curriculum on medical students in 2016 and 2017

The highest pre–post-test mean changes were found in the awareness domain. Students’ responses to the items gauging their awareness of resources to cope with and report a medical error after the session increased by more than 1 unit in both items. Both items in the confidence domain also showed statistical significance. Students’ confidence in their ability to recognize and cope with a medical error increased by 0.5 units in both items. Within the attitudes domain, the item which measured students’ perceptions of the impact of medical error on stake holders showed significant results in 2016. The items which assessed students’ attitudes towards the impact of workplace culture and the importance of taking responsibility for medical error did not show significant change. However, the pre-test means for these two items were 4.38 and 4.32 initially corresponding to “Somewhat Agree” and “Agree.” The item assessing students’ knowledge of medical error leading to physician burnout showed significant change. However, the other 4 items assessing knowledge did not, though they did have higher pre-test means.

In the 2017 iteration of the session, due to a change in distribution methods, a higher response rate was received and the $n = 174$. The overall change in scores was 0.33 and the standard error even lower, 0.03. Additionally, the survey results remained largely the same. The awareness and confidence domains showed significance once again. The attitude items did not show significance and the knowledge domain showed significance in certain survey items and not others, similar to 2016. Specifically, the knowledge item of “Medical error can lead to physician burnout” once again showed significance in 2017 as well as 2016. The pre-test scores remained relatively the same in 2017.

In 2017, two more items were added to the survey including a scale and comments portion. Students were asked to rate whether they found the session helpful to their future work as physicians, and 90% of students responded in agreement with

this statement. Common themes also emerged in student comments and included positive experiences with hearing faculty they know, and respect share their experiences. Students also requested more detail on the reporting of medical errors. One student stated “I was most impressed by the willingness of our clinical professors to share with us and be vulnerable. We admire them so much and their honesty and sharing their experiences only enhances that. This message was more impactful coming from clinicians we interact with daily. Had it been delivered by someone else I don’t know that I would have been able to attach so much to the experience.”

Overall the results for this session showed statistical significance in 2016 and 2017 with a Likert scale increase of 0.34 and 0.33 units, respectively. The improvement in the confidence and awareness domains was significant in both years while the pre-existing attitudes and knowledge stayed consistent.

Discussion

Findings show that an hour-long session delivered to second-year medical students on the impact of medical error and adverse events is feasible and effective in increasing self-reported confidence and awareness. After the session, students expressed both increased awareness of resources available in coping with medical errors and increased confidence in detecting and coping with medical error in their future careers.

The current state of healthcare in the USA calls for innovative approaches to train students to deal with systemic challenges in clinical practice. Coping with medical errors is a particularly relevant topic in the context of increasing physician burnout. A recent study found strong interest among medical students in education on this topic, especially in the

format of small group discussions led by senior physicians sharing their experiences [19].

There are limitations to this study. The long-term impact of this curriculum is unknown as students were surveyed directly following the session. We plan to survey students during their clerkship to see the longer-term impact of the session. The pre–post-test design also confounds the survey impact, though in the second iteration of the curriculum, students were sent the survey in advance to mitigate this effect. Pre-existing knowledge from the broader longitudinal curriculum and the wording of the attitude and knowledge items in the survey may have guided students to the presumed correct answer, diluting the study results. Finally, though validated tools addressing trainee attitudes towards medical error exist [20], we opted to create our own survey to specifically address institution specific objectives of our tailored curriculum.

Despite these limitations, this curriculum is feasible, effective, and easily generalizable. This curriculum was delivered to 300 students utilizing limited resources and time. Inviting local faculty whom students know personally contextualizes medical errors and their impact for students. The curriculum gives facilitators an opportunity to model the strategies they teach beyond the classroom. Faculty likewise showed great interest in participating in the event, which is key to the success of this curriculum. After the first year, multiple faculty requested to participate. It seemed that this session was impactful for both faculty and students, and further investigation into the faculty perspective presents a future opportunity for research.

Overall, a 1-h session delivered by local faculty to a large class of medical students in their preclinical years regarding the impact of medical error and coping strategies is feasible, generalizable, and effective in increasing both student confidence and awareness of resources regarding the topic. It is hoped that training medical students to be aware of the impact of error will allow them to utilize available resources and mitigate the impact of adverse events on these potential second victims.

Compliance with Ethical Standards

The Wayne State University Institutional Review Board deemed this project to be exempt from IRB review.

Disclosure On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

1. Stroud L, Wong B, Hollenberg E, Levinson W. Teaching medical error disclosure to physicians-in-training: a scoping review. *Acad Med*. 2013;88(6):884–92. <https://doi.org/10.1097/ACM.0b013e31828f898f>.
2. Robertson JJ, Long B. Suffering in silence: medical error and its impact on health care providers. *J Emergency Med*. 2018;54(4):402–9. <https://doi.org/10.1016/j.jemermed.2017.12.001>.
3. Kieseewetter I, Könings KD, Kager M, Kieseewetter J. Undergraduate medical students' behavioural intentions towards medical errors and how to handle them: a qualitative vignette study. *BMJ Open*. 2018;8(3):e019500. <https://doi.org/10.1136/bmjopen-2017-019500>.
4. Ryder HF, Huntington JT, West A, Ogrinc G. What do I do when something goes wrong? Teaching medical students to identify, understand, and engage in reporting medical errors. *Acad Med*. 2019;94(12):1910–5. <https://doi.org/10.1097/ACM.0000000000002872>.
5. Clinician resilience and well-being. *National Academy of Medicine*. <https://nam.edu/initiatives/clinician-resilience-and-well-being/>. Accessed March 26, 2019.
6. Fahrenkopf AM, Sectish TC, Barger LK, Sharek PJ, Lewin D, Chiang VW, et al. Rates of medication errors among depressed and burnt out residents: prospective cohort study. *BMJ*. 2008;336(7642):488–91. <https://doi.org/10.1136/bmj.39469.763218.BE>.
7. Cimiotti JP, Aiken LH, Sloane DM, Wu ES. Nurse staffing, burn-out, and health care-associated infection. *Am J Infect Control*. 2012;40(6):486–90. <https://doi.org/10.1016/j.ajic.2012.02.029>.
8. Welp A, Meier LL, Manser T. Emotional exhaustion and workload predict clinician-rated and objective patient safety. *Front Psychol*. 2015;5. <https://doi.org/10.3389/fpsyg.2014.01573>.
9. Burlison JD, Scott SD, Browne EK, Thompson SG, Hoffman JM. The second victim experience and support tool: validation of an organizational resource for assessing second victim effects and the quality of support resources. *J Patient Saf*. 2017;13(2):93–102. <https://doi.org/10.1097/PTS.0000000000000129>.
10. Mira JJ, Carrillo I, Guilabert M, Lorenzo S, Pérez-Pérez P, Silvestre C, et al. The second victim phenomenon after a clinical error: the design and evaluation of a website to reduce caregivers' emotional responses after a clinical error. *J Med Internet Res*. 2017;19(6):e203. <https://doi.org/10.2196/jmir.7840>.
11. Fischer MA, Mazor KM, Baril J, Alper E, DeMarco D, Pugnaire M. Learning from mistakes. Factors that influence how students and residents learn from medical errors. *J Gen Intern Med*. 2006;21(5):419–23. <https://doi.org/10.1111/j.1525-1497.2006.00420.x>.
12. White AA, Bell SK, Krauss MJ, Garbutt J, Dunagan WC, Fraser VJ, et al. How trainees would disclose medical errors: educational implications for training programmes. *Med Educ*. 2011;45(4):372–80. <https://doi.org/10.1111/j.1365-2923.2010.03875.x>.
13. Edrees H, Brock DM, Wu AW, McCotter PI, Hofeldt R, Shannon SE, et al. The experiences of risk managers in providing emotional support for health care workers after adverse events. *J Healthc Risk Manag*. 2016;35(4):14–21. <https://doi.org/10.1002/jhrm.21219>.
14. Edrees H, Connors C, Paine L, Norvell M, Taylor H, Wu AW. Implementing the RISE second victim support programme at the Johns Hopkins Hospital: a case study. *BMJ Open*. 2016;6(9):e011708. <https://doi.org/10.1136/bmjopen-2016-011708>.
15. Edrees H, Federico F. Supporting clinicians after medical error. *BMJ*. 2015;350:h1982. <https://doi.org/10.1136/bmj.h1982>.
16. Edrees HH, Paine LA, Feroli ER, Wu AW. Health care workers as second victims of medical errors. *Pol Arch Med Wewn*. 2011;121(4):101–8.
17. Scott SD, Hirschinger LE, Cox KR, McCoig M, Brandt J, Hall LW. The natural history of recovery for the healthcare provider “second victim” after adverse patient events. *Qual Saf Health Care*. 2009;18(5):325–30. <https://doi.org/10.1136/qshe.2009.032870>.
18. White AA, Brock DM, McCotter PI, et al. Risk managers' descriptions of programs to support second victims after adverse events. *J Healthc Risk Manag*. 2015;34(4):30–40. <https://doi.org/10.1002/jhrm.21169>.

19. Kim CW, Myung SJ, Eo EK, Chang Y. Improving disclosure of medical error through educational program as a first step toward patient safety. *BMC Med Educ*. 2017;17(1):52. <https://doi.org/10.1186/s12909-017-0880-9>.
20. Carruthers S, Lawton R, Sandars J, Howe A, Perry M. Attitudes to patient safety amongst medical students and tutors: developing a

reliable and valid measure. *Med Teach*. 2009;31(8):e370–6. <https://doi.org/10.1080/01421590802650142>.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.