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Health Care Provider Factors Associated with Patient-Reported Adverse Events and Harm

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Abstract

Background—Patients can provide valuable information missing from traditional sources of safety data and add insights on factors that lead to preventable harm. We determined associations between patient-reported contributory factors and harms they experienced after an adverse event.

Methods—We analyzed a national sample of patient-reported adverse events gathered through an online questionnaire between January 2010 and February 2016. We used generalized logit multivariable regression to assess the association between self-reported contributory factors and self-reported harms (grouped as no physical harm, physical harm only, physical harm and emotional or financial harm, and all three harms) and adjusted for patient and adverse event characteristics.

Results—In 351 patient reports with outcomes of physical, emotional, or financial harms, one-third of patients (32.6%) reported experiencing all three harms, 27.3% reported physical harms and one additional harm, 25.5% reported physical harms only, and 14.7% reported only non-physical harms. Patients who reported all three harms were 2.5 times more likely to have filed a report of their adverse event with a responsible authority (95% CI:1.23–5.01) and 3.3 times more likely to have also experienced a surgical complication (95% CI:1.42–7.51). The odds of reporting problems related to communication between clinician and patients/families or clinician-related behavioral issues was 13% higher in those experiencing all three harm types (95% CI:1.07–1.19).

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The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Transparency declaration

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Conclusions—Patients' experiences are important to identify safety issues and reduce harm and should be included in patient safety measurement and improvement activities. Our findings underscore the need for new policy and practice initiatives to identify, address, and support harmed patients.

Keywords

Adverse Events; Patient Experience; Patient Safety; Medical errors

Background

Despite heightened efforts to research and prevent medical errors,[1] adverse events (AEs) are common in medicine.[2] Estimates suggest that 1 in 9 hospitalized patients are harmed[3,4] and 2–3 patient safety incidents occur per 100 primary care consultations.[5] Methods to identify AEs are still evolving and no single method stands out as the best. Many AEs are either poorly documented in the medical record or not reported at all.[6–11] The integration of patients' perspective may lead to better understanding of events; patients experience the entire care episode, are able to identify preventable adverse events and are aware of additional information which the medical record does not capture.[6,7,12–19] Increasing our knowledge about AEs could lead to new opportunities for feedback, learning, and prevention. While there have been systematic efforts to improve patient safety and simultaneously a growing interest in improving the patient experience, there is no current standardized method to collect safety reports directly from patients.

Improving patient experience is an essential part of patient-centered care. As such, leveraging information from patients can fill in the gaps. A systematic review of patients' perceptions of AEs in the outpatient setting found that patients were able to identify technical medical aspects (e.g., errors in diagnosis, treatment, intervention, and medication) and quality issues that contribute to error (e.g., patient-physician relationship, coordination, communication).[17] Adverse event information may be captured via patient complaint data; however, there's little evidence that this type of data is being systematically collected and analyzed to identify how patient-identified issues contribute to AEs.

Adverse events usually result from a multitude of contributory factors that can lead to patient harm.[20] Currently, information about AEs relies on low-yield clinician and staff incident reporting, morbidity and mortality conferences, autopsy, root cause analyses, and 'triggers'. Error reports from patients, often left out of data collection, may provide new insights into safety-related problems and types of contributory factors that are most harmful and thus potential targets of interventions. We analyzed a large sample of error reports gathered by patient advocates to determine the association between patient-reported contributory factors and patient harm.

Methods

We conducted a secondary analysis of self-reported harms captured on a national online questionnaire. This voluntary questionnaire was developed by two patient advocates, Helen Haskell and Julia Hallisy, and posted on the Empowered Patient Coalition (EPC) website

from January 2010-present.[21] This study was approved by both the Baylor College of Medicine and Michael E. DeBakey VAMC Institutional Review Boards (IRB).

Eligibility criteria

We selected patients who self-reported any harm as an outcome from an adverse event between January 2010 and January 2016 and who also answered at least one of the thirteen potential questions about contributory factors (See Supplemental Table 1) related to their self-reported harm. Harms were classified as physical [brain damage, chronic pain, need for additional surgery, readmission to the hospital within 30 days, loss of bowel or bladder control, disfigurement, short-term loss of function (< 3 months), long term loss of function (> 3 months), and permanent loss of function or disability], emotional (post-traumatic stress or emotional trauma), and financial loss. Based on questionnaire structure, participants were able to select multiple harms; therefore, participants were separated into four outcome harm groups for analysis (no physical harm, physical harm only, physical harm and emotional or financial harm, and all three harms) to ensure the categories were mutually exclusive and exhaustive.

The questionnaire collected patients' demographic data (age, location, gender, year of event, size of community), whether the patient officially filed a report of the AE to a responsible authority [e.g., health care delivery organization where the AE occurred, or any type of licensing, accreditation, disciplinary or other regulatory authority (such as state medical boards, Joint Commission)], type of adverse event (surgical events, hospital acquired infection, diagnostic error) and type of harm. Respondents were also asked to indicate which of 13 contributory factors were involved (see Supplementary Table 1 for full list) and how they affected outcomes (did not occur or not applicable; occurred, but not a serious problem; serious problem in patient's care; or major factor affecting patient outcome).

Contributory factor selection

We were interested in determining how perceived contributory factors related to health care personnel (HCP) communication, HCP behavior, HCP medical knowledge, and HCP monitoring and response to patients were associated with the four harm outcome groups. Therefore, we selected 13 of the 19 items from the scale that listed 'Contributing factors to the adverse event' and excluded all questions related to the health care facility discharge and sanitation. Each item on the scale ranged from "No response or Factor did not occur or NA", "Occurred, but was not a serious problem", "Serious problem in patient's care", to "Major factor affecting patient outcome" and we assessed 0–3 points for each response. Patients were instructed to 'Choose as many as apply' of the 13 items from the scale of contributing factors (See Supplementary Table 1 for the 13 contributory factors). We measured scale internal consistency and reliability using Cronbach's Alpha.[22]

Data analysis

Exploratory factor analysis of contributory factors

We conducted an exploratory factor analysis (EFA) on the contributory factors to identify the underlying relationships and their association with the reported four harm groupings.[23,24] We used EFA because it is appropriate for the interval measurement structure for the 13 questions. Item-item correlations were assessed to investigate multicollinearity and construct. Factor solutions were rotated using Varimax rotation orthogonally to assess each contributory factor independent of each other. Since respondents were instructed to skip questions that did not apply to them, we included all adverse event respondents in the analysis if they answered at least one of the 13 questions. Any skipped questions among the remaining 12 items were weighted as 0= “No response or Factor did not occur or NA”. We discarded items with lower factors scores and remaining contributory factors were summed together according to resulting high factor groupings (≥0.40). We dropped all eigenvalues under one and Scree plots were used to confirm the number of contributory factors to retain in the EFA. We then compared the resultant contributory factor groupings, patient factors (gender, community size, and participant age at event), and adverse event-related factors (time since adverse event, diagnostic error, adverse medication event, hospital acquired infection, and surgical complication, and whether they filed a report of the AE to a responsible authority or not) for significant differences (P <0.05) across the four harm groups. Categorical variables were first assessed using the Chi-square test and continuous variables using the student’s t-test. Variables with p-values < 0.10 in univariate analysis were entered into a generalized logit multivariable stepwise logistic regression model with “no physical injury” as the reference. We used SAS 9.4 to conduct all statistical analysis.

Results

Of 449 patient self-reports, 351 (78.2%) mentioned physical, emotional, or financial harms and responded to at least one question about contributory factors for the adverse event. One-third (32.6%) indicated experiencing all three harms, 27.3% reported physical harms and one additional harm, 25.5% reported physical harms only, and 14.7% reported only non-physical harms. Most respondents (69.5%) were female and experienced the adverse event in-hospital (69.2%), although gender and setting did not differ among harm groups (p>0.05). Age at event (p=0.01), years since event (p=0.02), presence of a diagnostic error (p=0.01), medication error (p=0.01), hospital acquired infection (p=0.01), surgical complication (p<0.0001), and whether the patient filed a report with a responsible authority (p<0.0001) were significantly different among the four harm groups (Table 1). There was an increasing trend (p<.0001) for the following types of physical harms to occur as the number of harm groups increased: chronic pain (30% physical only; 53% physical harm +1, 62% all harms); loss of bladder control (5% physical only, 7% physical harm +1, 22% all harms), long term loss of function (20% physical only, 29% physical harm +1, 55% all harms), and permanent loss of function (23% physical only, 34% physical harm +1, 49% all harms)(data not shown in table). There were few reports of brain damage or disfigurement.

Contributory Factors and Harm

None of the thirteen contributory factor items had correlations >.90 to suggest multicollinearity; however, there were several correlations >.60 which suggested that an exploratory factor analysis (EFA) was appropriate. Scale reliability was relatively high (α=0.87). We identified three interpretable groupings of the original thirteen contributory factors (Factor 1: Communication and Healthcare Personnel Behaviors, Factor 2: Healthcare Personnel Fatigue, and Factor 3: Healthcare personnel response time to patients) (Table 2). Examination of the scree plot of eigenvalues indicated that factors 3 and 4 appeared to be identical; factor 4 was dropped because it explained very little of the variance. Only Factor 1 met the Kaiser criterion of an eigenvalue above one suggesting that it was the only one that explained an above average amount of the variance from the 13 variables. The second item, Factor 2, was .85 and cumulatively explained 91.6% of the variance so it was retained for analysis. Factor 3 resulted in a modest improvement of 8.41% of explained variance. The resulting extracted factor solution average communality estimates, which reflect each item's variance explained by each model factor, were moderately improved from .45 to .50. Four of the thirteen contributory factor items loaded onto Factor 1, Communication and HCP Behavior and included interpersonal and communication issues: 1) HCP did not seem concerned about the patient, 2) HCP did not listen to the patient or family, 3) HCP did not seem familiar with the patient's case, and 4) HCP did not communicate important information to the patient. Two of the thirteen items about patients' perceptions of the providers' physical/mental state loaded onto factor 2, HCP Fatigue and included: 1) HCP seemed overtired or fatigued and 2) HCP seemed overworked, rushed, or behind schedule. Factor 3 focused on HCP response time to patients: nurse did not respond quickly to the call button and doctor was slow to arrive. All three factors were used in the subsequent univariate logistic regression with harm as the outcome.

In univariate analysis, nine of the ten adverse event characteristics and harm outcomes met the inclusion threshold (p=.10) for assessment in the multivariable stepwise model (Table 3). After adjustment, only hospital acquired infection, surgical complication, patient filed a report of their AE to a responsible authority, and communication and HCP behavior (Factor 1) were significantly (p<.05) related to harm outcomes. The presence of a diagnostic error was close to statistical significance in multivariable analysis (p=.06), most likely because it was highly documented by those with physical harm (data not shown). Compared to patients who only indicated experiencing physical harm, patients who experienced all three harms were 2.5 times more likely to have officially filed a report of their AE to a responsible authority (adjusted OR: 2.49, 95% CI 1.23–5.01, p=0.01) and 3.3 times more likely to have also experienced a surgical complication (adjusted OR 3.27, 95% CI 1.43–7.51, p=0.05). The odds of problems related to communication and HCP behavior (Factor 1) as contributing to adverse event were 13% higher in those experiencing all three harms and 8% higher in patients with more than physical harm (physical plus one) compared to patients who experienced physical harm alone (adjusted OR: 1.13, 95% CI 1.07–1.19, p<.0001; adjusted OR: 1.08, 95% CI 1.02–1.14, p=.01, respectively). After adjustment, those reporting only financial and/or emotional harm were significantly less likely to also report

surgical complications (p=.01) and hospital acquired infections (p=.02) as these odds were 67.2% and 78.6% lower in these groups than those reporting physical harm, respectively.

Discussion

We analyzed a large sample of patient-reported adverse events gathered by patient advocates to determine the association between self-reported contributory factors and experienced harms. Our analysis of 334 adverse events found that more than half of the patients in our sample experienced multiple harms - emotional, physical, and financial or some combination. Patients who experienced all three harms were more likely to have experienced a surgical AE, filed a report of the AE to a responsible authority, and experienced problems related to HCP communication and HCP behavior.

AEs can have a significant impact on patients' lives[25–27] and our analysis shows that following an adverse event, patients may experience multiple harms – beyond physical harm. Patients can experience a myriad of emotions following an AE: guilt, fear, humiliation, helplessness.[28] A 2019 report on medical error impact on patients living in US State of Massachusetts found that medical errors were associated with long-lasting emotional impact, loss of trust in health care,[17] and financial harm (i.e. decrease in income, increase in medical expenses, and increase in household expenses).[29] They also found that 62,000 medical errors were responsible for $617 million in excess health care insurance claims.[29] While there has been a push to encourage patients to speak up about patient safety issues, only about half feel comfortable speaking to their care team about a mistake.[30] Patients' emotional harm may be exacerbated if a patient feels they should have spoken up but did not or did speak up and was ignored. Open communication on the part of the clinician about the AE may reduce emotional harm following the event.[29] Non-physical harms, though less visible and harder to measure, are gaining attention. Recently, Bell et.al. convened a stakeholder panel to establish a research agenda to address emotional harm and identified four research priorities: patient-centered taxonomy of harm and healing, epidemiology of emotional harm, awareness-raising, and best practices development and dissemination.[31]

Purely non-physical harms were experienced by 49 patients (14.7%). Upon reviewing open-ended responses, some of the respondents may not have categorized their harm as physical because they felt it was temporary or minor. For example, some respondents described dealing with a post-surgical infection and/or pain but did not select one of the physical harm categories. This suggests that respondents may not have felt that their experience and/or pain rose to the level of the physical injury options listed in the questionnaire. While details in these cases were not always available, some of these respondents selected "no injury" or "no serious injury" despite including a comment describing excruciating pain or an infection that required multiple rounds of antibiotics. Finally, in some of the cases of patients who selected emotional and financial harm only, there is no detailed information about the AE and we cannot speculate on these patients' experiences. Future questionnaires should account for short-term physical harm and include more nuanced harm categories to represent a broad range of experiences.

Because patients may not necessarily have access to or knowledge of a patient-reporting mechanism at the time of the event, some patients in our sample sought out an opportunity to officially file reports on their own, such as contacting their HCP's state licensing board or the Joint Commission. Patients who indicated they officially filed a report of their AE were more likely to have experienced multiple types of harm. Experiencing the combination of harms may have motivated these patients to report the event despite no systematic, national or global efforts encouraging patients or outlining how patients should do so. However, the burden of ensuring these events are not repeated should not be placed on patients. Opportunities to report AEs as close to real time as possible should be made publicly available to patients in all health care systems to ensure feedback, learning, and system accountability. Additionally, health care systems should be held accountable by organizations such as the Joint Commission for collecting and addressing patient reports of safety incidents and resultant harm.

Patient reporting of events provides valuable data that can contribute to organizational learning.[32,33] Next steps in patient safety improvement should prioritize developing and testing methods to engage patients in error reporting. AHRQ and RAND Corporation developed and implemented a prototype consumer reporting system from 2011 and 2015 to capture patient reported safety events, the Health Care Safety Hotline.[34,35] Though the system generated fewer patient reports than expected, the project evaluation identified important challenges to consumer reporting: the causes of safety events are complex and may complicate structured data collection; the system must meet the needs of its users (e.g. timing of reporting, 'opt-in' vs solicited, and method of reporting); and the system must respect legal and regulatory requirements about confidentiality and data protection.[34,35] These challenges will need to be addressed to gather reports that offer more complete data from patients and family/caregivers about their experiences from before, during, and after the clinician-patient encounter.[36] This will enable health care organizations to develop and use systematic methods to collect patient reports of adverse events and provide opportunities to measure patient-identified factors that contribute to adverse events. Additionally, health care organizations will need to develop a safety culture that encourages patient reporting.

Patients report communication breakdowns and behavioral issues as a major contributing factor leading to harm. Even after adjustment for all other factors, patients with multiple types of harms were more likely to report problems related to HCP communication and behavior as contributing factors. Growing evidence suggests that patients and their caregivers recognize miscommunication and unprofessional clinician behaviors as threats to their safety.[37] Communication issues continue to be a frequent contributing factor to adverse events in the literature.[17,33,38] A recent systematic review of patients' perspectives of adverse events found that patients highlight the role of communication problems between clinicians and patients (e.g. use of medical jargon without explanation, lack of explanation of test results) and deficits in the patient-clinician relationship (e.g. lack of respect, lack of time) in adverse events.[17] These unprofessional behaviors, or disrespect, can have far reaching consequences for patients such as loss of trust and negative health outcomes.[39] In another study, patients identified lack of communication between clinicians and a general lack of patient-centered communication towards patients as problematic[37] (e.g. patients are aware they are not receiving the best care if their care team is not effectively communicating

issues/symptoms, care plans, or test results, among the team members or to the patients in a meaningful way).

Based on our results, there appears to be an increased risk of multiple harms among patients who experienced a surgical AE. The prospect of surgical procedures may cause patients to experience anxiety and stress, leaving them "psychologically vulnerable"[40] – which may exacerbate emotional harm. Financial harm may include need for additional care and/or additional surgical procedures that may not be covered by the clinician or health care system where the surgical AE occurred.[29] It can also result when a patient is disabled as a result of the AE and is no longer able to work. Loss of employment also impacts health care insurance benefits which can have devastating impacts on harmed patients. Despite ongoing surgical safety initiatives, surgical AEs are still significant and occur despite surgical safety checklists and team-based care approaches.[41] Additionally, of the surgical interventions that have been shown to reduce harm, few quality studies show benefit.[42] Recent evidence suggests that cognitive error may play an important role in surgical AEs that will require new quality improvement initiatives incorporating cognitive training to mitigate human error in surgery.[41]

Strengths and limitations

Our study has several limitations. While our sample was national, it does not reflect all types of patients' experience of adverse events. Experiences are also not representative of all patients who experience health care. Voluntary patient surveys are inherently biased because respondents are a self-reporting, self-selected population willing to share their experience via an online questionnaire. This analysis does not shed light on frequency of events or inform any epidemiologic assessment and we did not have access to the medical record or clinicians involved. The outcome variable of harm was broken into four categories based on the data. Participants were able to select any category of harm resulting in significant overlap among the categories. To ensure the harm outcome categories were exhaustive and exclusive, we categorized them based on the data rather than how they would make sense conceptually. It could be that patients who experienced physical and emotional harm are very different from those who experienced physical and financial harm. Despite these limitations, we believe our study is the first to evaluate the association between patient-identified factors that contribute to AEs and harm and highlights that patients who experience an AE are likely to be experiencing multiple harms, and not just physical harm.

Conclusion

Our study highlights the multiple harms that patients may experience following an AE and patient-identified factors that contribute to those harms. Patients' experiences are important to identify safety issues and should be part of the patient safety measurement and improvement activities. The findings underscore the need for new policy and practice initiatives to identify, address, and support harmed patient. More systematic collection of patient event reports will help advance the science of reducing preventable harm in health care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Characteristics of Patients and Patient-Reported Adverse Events Across Categories of Self-Reported Harms (N=334)

Patient Characteristic					
	No Physical Harm n=49(14.7)	**Physical Harm Only n=85(25.5)**	**Physical Harm & Emotional or Financial Harm n=91 (27.3)**	**Physical, Emotional, and Financial Harm n=109 (32.6)**	***P* Value**
Sex[§]					0.40
Female	34 (70.8)	50 (61.7)	65 (72.2)	83 (77.6)	
Male	14 (29.2)	31 (38.3)	25 (27.8)	24 (22.4)	
Age AE occurred[§] Mean (STD)	51.3 (14.8)	53.4 (13.5)	49.8 (13.5)	48.6 (10.4)	0.01*
Years between event and report[+§] Mean (STD)	2.8 (4.2)	6.5 (9.4)	6.8 (7.9)	6.4 (6.7)	0.02*
Event Location					0.78
Not a hospital	14 (29.2)	22 (26.8)	24 (27.0)	35 (32.7)	
Hospital	34 (70.8)	60 (73.2)	65 (73.0)	72 (67.3)	
Community size at event location[§]					0.26
≤500,000 population	22 (47.8)	39 (49.4)	50 (56.8)	66 (61.7)	
>500,000 population	24 (52.2)	40 (50.6)	38 (43.2)	41 (38.3)	
Adverse Event Characteristics					
Diagnostic Error[+]					0.023*
No	32 (65.3)	44 (51.8)	45 (49.5)	34 (31.2)	
Yes	17 (34.7)	41 (48.2)	46 (50.5)	75 (68.8)	
Adverse Medication Event					0.01*
No	20 (40.8)	55 (64.7)	46 (50.5)	50 (45.9)	
Yes	29 (59.2)	30 (35.3)	45 (49.5)	59 (54.1)	
Hospital Acquired Infection					0.01*
No	37 (75.5)	40 (47.1)	51 (56.0)	55 (50.5)	
Yes	12 (24.5)	45 (52.9)	40 (44.0)	54 (49.5)	
Surgical Complication					<.0001*
No	32 (65.3)	28 (32.9)	30 (33.0)	23 (21.1)	
Yes	17 (34.7)	57 (67.1)	61 (67.0)	86 (78.9)	
Patient Reporting to appropriate authority					0.01*
No	26 (53.1)	48 (56.5)	41 (45.1)	34 (31.5)	
Yes	23 (46.9)	37 (43.5)	50 (54.9)	74 (68.5)	

For categorical variables, the number of participants with the characteristic and the percentage of persons in the outcome harm group with the characteristic are presented.

[*] Significant at 0.05

[+] The category of diagnostic error included: misdiagnosis, laboratory or pathology error, delay in diagnosis or treatment, proper tests not ordered, and test results being lost or misplaced

[§] Missing data.

Table 2.

Unstandardized Factor Loadings and Item Descriptions of Contributory Factors (Questions 1–13) (N=334)*

	Factor 1	Factor 2	Factor 3	Mean	Standard Deviation
Contributory Factors					
Communication and Health care Personnel Behavior					
13. Health care personnel did not seem concerned about the patient	**0.78**	0.15	0.14	1.62	1.32
2. Health care personnel did not listen to patient or family	**0.72**	0.10	0.17	1.82	1.33
12. Health care personnel did not seem familiar with the patient's case	**0.60**	0.25	0.19	1.16	1.31
11. Health care personnel did not communicate important information to patient	**0.56**	0.11	0.20	1.67	1.36
Health care Personnel Fatigue					
9.Health care personnel seemed overtired or fatigued	0.09	**0.83**	0.19	0.57	1.03
10.Health care personnel seemed overworked, rushed, or behind schedule	0.27	**0.68**	0.15	0.95	1.23
Health care Personnel Response					
4. Nurse did not respond quickly to the call button	0.19	0.18	**0.78**	0.57	1.00
5. Doctor was slow to arrive	0.39	0.22	**0.52**	0.72	1.15

* Items appear in order of importance. Factor loadings are unstandardized. Factor loadings in boldface type represent the factor onto which the item loaded the strongest (Factor 1 = Communication and Health Care Personnel [HCP] Behavior; Factor 2 = HCP Fatigue; Factor 3 = Timeliness of HCP Response). Rotated factor with loadings < 0.4 were considered unimportant and removed, while factor loadings > 0.50 were used as a first step for grouping. Grouped factors were listed in order of how much variation they explain.

Table 3.

Univariate and Multivariable Logistic Regression for Patient and Adverse Event Characteristics and Harm Outcomes (N=334) *Reference group: Physical Harm Only

	Univariate				Multivariable			
	OR	**95% CI low**	**95% CI high**	***P* Value**	**OR**	**95% CI low**	**95% CI high**	***P* Value**
Age at occurrence of event				0.04*				0.37
All 3 Harms	0.97	0.94	0.99	0.01*				
No Physical Harm	0.99	0.96	1.01	0.32				
Physical & 1 other harm	0.98	0.95	1.00	0.04*				
Years between event and report				0.01*				0.10
All 3 Harms	1.00	0.96	1.04	0.92	1.00	0.95	1.04	0.87
No Physical Harm	0.85	0.77	0.94	0.01*	0.98	0.81	0.98	0.02*
Physical & 1 other harm	1.00	0.97	1.04	0.93	1.00	0.96	1.05	0.88
Diagnostic Error				0.01*				0.06
All 3 Harms	2.71	1.52	4.83	0.01*	1.29	0.62	2.70	0.49
No Physical Harm	0.65	0.32	1.32	0.24	0.44	0.18	1.11	0.08
Physical & 1 other harm	1.06	0.60	1.88	0.85	0.61	0.30	1.26	0.18
Patient Infection				0.01*				0.05
All 3 Harms	0.85	0.49	1.48	0.56	1.22	0.61	2.44	0.58
No Physical Harm	0.28	0.13	0.59	0.01*	0.33	0.13	0.82	0.02*
Physical & 1 other harm	0.67	0.38	1.19	0.17	0.84	0.42	1.67	0.61
Surgical Complication				<.0001*				<.0001*
All 3 Harms	1.98	1.05	3.72	0.03*	3.27	1.43	7.51	0.01*
No Physical Harm	0.26	0.13	0.53	0.01*	0.21	0.08	0.55	0.01*
Physical & 1 other harm	1.02	0.56	1.86	0.95	1.19	0.55	2.59	0.66
Adverse Medication Event				0.01*				0.37
All 3 Harms	2.25	1.27	3.98	0.01*				
No Physical Harm	2.86	1.41	5.80	0.01*				
Physical & 1 other harm	1.84	1.03	3.31	0.04*				
Patient Reporting				0.01*				0.02*
All 3 Harms	2.74	1.54	4.87	0.01*	2.49	1.23	5.01	0.01*
No Physical Harm	1.10	0.55	2.18	0.80	0.72	0.31	1.70	0.45
Physical & 1 other harm	1.57	0.88	2.79	0.12	1.43	0.72	2.84	0.31
Communication and Health care Personnel Behavior				<.0001*				<.0001*
All 3 Harms	1.13	1.09	1.18	<.0001*	1.13	1.07	1.19	<.0001*

	Univariate				Multivariable			
	OR	**95% CI low**	**95% CI high**	***P* Value**	**OR**	**95% CI low**	**95% CI high**	***P* Value**
No Physical Harm	1.03	0.98	1.08	0.25	0.99	0.92	1.06	0.69
Physical & 1 other harm	1.06	1.02	1.11	0.01*	1.08	1.02	1.14	0.01*
Health care Personnel Fatigue				0.77				--
All 3 Harms	1.06	0.92	1.13	0.40				
No Physical Harm	0.98	0.82	1.17	0.84				
Physical & 1 other harm	1.02	0.88	1.18	0.82				
Health care Personnel Response				<.0001*				0.20
All 3 Harms	1.31	1.16	1.47	<.0001*	1.04	0.81	1.35	0.75
No Physical Harm	1.07	0.92	1.24	0.3732	1.01	0.75	1.37	0.94
Physical & 1 other harm	1.17	1.04	1.31	0.0110*	0.82	0.63	1.06	0.13

OR, Odds Ratio; CI Confidence Interval

*Significant at 0.05