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A mixed methods examination of the nature and frequency of medical error among junior doctors

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Abstract

Purpose of the study. To examining the experience and perceptions of junior doctors about medical errors to which they either made or contributed.

Study design. A mixed methods design consisting of an error survey and critical incident technique (CIT) interviews. The survey asked whether doctors in the first year of postgraduate training in Ireland had made a medical error that had 'played on (their) mind', and if so, identify factors that had contributed to the error. The participants in the CIT interviews were asked to describe a medical error in which they had been involved.

Results. A total of 201 out of 332 (60.5%) respondents to the survey reported making an error that 'played on their mind'. 'Individual factors' were the most commonly identified group of factors (188/201; 93.5%), with 'high workload' (145/201; 72.1%) the most commonly identified contributory factor. Of the 28 CIT interviews which met the criteria for analysis, 'situational factors' (team, staff, task characteristics, and service user factors) were the most commonly identified group of contributory factors (24/28; 85.7%). A total of eight of the interviews were judged by subject matter experts (n=8) to be of medium risk to patients, and 20 to be of high-risk to patients. A significantly larger proportion of high-risk scenarios were attributed to 'local working conditions' than the medium-risk scenarios.

Conclusions. There is a need to prepare junior doctors to manage, and cope with, medical error and to ensure that healthcare professionals are adequately supported throughout their careers.

INTRODUCTION

Reducing medical error is an ongoing challenge in healthcare. International research has identified that between 3% and 17% of hospital admissions are associated with an adverse event, with approximately half of these adverse events identified as preventable.[1] Medical error can occur across all specialties and grades of physicians.[2] However. junior doctors have historically been viewed as a 'high risk' group,[3] who are ill-prepared to perform their duties.[4] These doctors have been found to struggle with knowledge transfer, dealing with uncertainty, understanding their role and working as a member of the medical team.[4 5]

Although experience with error is common among junior doctors,[6] data on how junior doctors, view, and respond to error is limited.[7] It has been argued that junior doctors have a unique perspective on the delivery of healthcare, and possess a set of attributes that means they have valuable insights for how to improve patient safety.[3] These attributes include:

- 'a beginners' mind'- they are not yet immersed in the medical culture;
- heterogeneity of values - junior doctors are diverse in terms of gender, ethnicity, and age;[8]
- bringing skills from non-medical disciplines- there are an increasing number of junior doctors with experience of working in other domains;[8]
- the peripatetic nature of the role of a junior doctor- junior doctors work across different specialties, teams, and hospitals;
- their experience of delivering front-line care- junior doctors are often the first doctor called by a nurse for a sick patient;[4] and
- their non-threatening position within the hierarchy of healthcare teams.[3]

These attributes mean junior doctors may have a perspective on medical error that is valuable and provide insights on both the contributors to medical error, and how they can be prevented. Therefore, junior doctors are crucial in preventing, reporting and learning from errors, near misses and adverse events.[9] The aim of this study was to take a mixed-methods approach to examining the experience and perceptions of medical errors that were made, or contributed to, by interns (the first year of postgraduate training for a junior doctor in Ireland).

METHOD

The procedures for the error survey are described first, followed by the procedures for conducting the error interviews.

Ethical Approval

Ethical approval was obtained from the five participating hospitals.

Error survey

Participants

A total of 332 out of 601 interns (55.2% response rate) from five national intern training networks completed the questionnaire.

Survey development

The medical error survey was an adjunct survey completed as part of a larger study of burnout and error among Irish interns.[6] The medical error survey was only completed by those interns who reported making an error that 'played on your mind in the last 3 months'.

The participants were asked to identify which of 13 potential contributory factors were causal to the error (see Table 1). The factors were derived from those identified in the human factors analysis and classification system (HFACS)[10] and the Yorkshire Contributory Factors Framework (YCFF).[11] The HFACS is a human error framework of 19 categories that describes human error at each of four levels of failure: unsafe acts of operators, preconditions for unsafe acts, unsafe supervision, and, organisational influences.[10] The YCFF has 19 factors divided into five domains active failures, situational factors, local working conditions, latent/organisational factors, and latent/external factors.[11] Communication systems and safety culture issues are addressed in all of these domains. The rationale for not using one of these frameworks was that feedback from pilot testing of the questionnaire with five junior doctors suggested that they were too complex for interns to apply without training. Therefore, a simplified structure of factors was derived based upon HFACS and the YCFF (see Table 1).

Table 1. Frequency of error contributing factors (n= 201)

Contributing factors	N	%
INDIVIDUAL FACTORS	**188**	**93.5**
• Stress or burnout	87	43.3
• Fatigue	127	63.2
• High workload	145	72.1
• Failure of memory	71	35.3
• Lack of knowledge	72	35.8
• Inadequate training/prior experience	72	35.8
COMMUNICATION	**104**	**51.7**
SUPERVISIORY FACTORS	**122**	**60.7**
• Inadequate supervision	106	52.7
• Deficiencies with team members, equipment, training that are known to the supervisor yet are allowed to continue	47	23.4
• Directed to perform inappropriate tasks by supervisor	39	19.4
ORGANISATIONAL FACTORS	**139**	**69.2**
• Lack of resources	48	23.9
• Poor organisational processes	93	46.3
• Poor organisational climate	47	23.4
• Poor working conditions	79	39.3

Data collection

The anonymous questionnaire was distributed, either electronically via e-mail or in paper form, at teaching sessions to interns from five national intern training networks in April and May 2016. Reminder emails were sent two and four weeks after the initial email request. Participation was incentivised by giving the participants the opportunity to enter a prize draw.

Data analysis

Descriptive analysis of the frequencies of the errors made in each category was carried out.

Error Interviews

Participants

The participants were 32 interns working in Irish hospitals (male, n= 14 and female, n= 18) in their first year of clinical practice. None of the interview participants had participated in the error survey. The interns had a mean of 8.2 months of experience (SD = 1.0 months). The mean time of the interview was 15 minutes and 5 seconds (st dev= 6 minutes 53 seconds). A total of 24 of the interviews described an incident that occurred on a day shift (75%), six on a night shift (18.8%), and two on a weekend shift (6.3%).

Interview design

A Critical Incident Technique (CIT) approach was used to conduct the interviews. The participants were asked to describe an error in patient care, in which they had been involved, that had occurred within the previous six months. CIT interviews enable the researcher to understand the knowledge, skills and attitudes of the respondents by asking them to describe a challenging incident.[12] The CIT interview process has four stages: (i) selecting an appropriate incident; (ii) developing a detailed description of the specific events, using

probing questions to understand the reasoning; (iii) exploring cues and rationales for the actions taken; and (iv) identifying the root causes of the incident.[12] Probing questions used the YCFF[11] were used to identify the contributing factors to the incident, and the role the interviewee believe they played in the error.

Data collection

CIT interviews were carried out from February to June 2017. The interviews were recorded using a digital audio recorder. Recruitment was carried out by the interviewers using a combination of judgemental and snowball sampling strategies.[13] The rationale for the use of these strategies was largely pragmatic in that we were attempting to recruit a very specific sample of participants (i.e. interns who had experienced an error in the last six months that they were willing to discuss). Initially, judgmental sampling was used by the interviewers to identify potential participants. The recruitment strategy then shifted to a snowball sampling technique in which participants recommended other interns that they thought may be willing to be interviewed.

The interviewing continued until new categories, themes or explanations stopped emerging from the data and the research team determined that data saturation had been reached. This required an iterative approach to sampling, data collection, analysis and interpretation. Four doctors and two healthcare researchers were trained to conduct CIT interviews by a psychologist (POC) practised in using the CIT methodology.

Data analysis

Two types of analysis were carried out on the interviews: analysis of the risk to the patients associated with each scenario; and content analysis of the interviews.

Risk rating analysis

Eight Subject Matter Experts (SMEs) rated the risk to patients associated with each scenario. The SMEs were doctors with a mean of 12.1 years of experience (st dev = 8.7 years). Four of the SME had also conducted the CIT interviews. The scenarios were presented to the SMEs in a random order using on-line survey software. The Irish Health Services Executive's (HSE) risk assessment tool[14] was used to generate the risk rating. For each scenario, the SMEs were asked to rate the potential impact of the event on patient safety from 'negligible' (1) to 'extreme' (5).

The SMEs were also asked to rate the likelihood of other interns encountering a similar situation from 'rare/remote' (1) to 'almost certain' (5). The 'impact' and 'likelihood of occurrence' ratings from each SME for each scenario were then multiplied together to give an overall risk score. A mean risk score based on the ratings of the eight SMEs was then calculated for each scenario. A risk rating of less than 5 was considered 'low-risk', between 5 and 12 'medium-risk' and greater than >12 'high-risk'.[14] Finally, the SMEs were asked to rate the level of intern involvement in the scenario from 'extremely low' (1) to 'extremely high' (5). These ratings were carried out independently.

Content analysis

Two psychologists (POC, SL) with backgrounds in occupational health psychology carried out the analysis. A deductive content analysis approach was taken to organising and analysing the data.[15] Of the 32 scenarios collected, four scenarios were discarded from further analysis because the modal rating of the intern involvement by the SMEs was 'low' or 'very low'.

The YCFF[11] was used to code each of the contributing factors to the error identified by the interviewee during the CIT interviews. Each contributing factor was only coded using one of the YCFF domains. If a contributing factor was judged by the raters to apply to more than one domain, then the coders made a decision about which domain was most applicable. The YCFF domains and definitions are shown in Table 2. In order to ensure that the categories were sufficiently internally homogenous and externally heterogeneous, the factors and definitions were illustrated with exemplar behaviours and quotes from the interview data (see Table 2). The selection of the quotes was carried out by consensus between the researchers.

Each of the scenarios was discussed between the two researchers, and consensus reached about which contributing factors were applicable. Causal factors were selected based on whether they were representative of the specific YCFF domains. Graneheim and Lundman[16] have previously emphasised the value of dialogue among coders in order to produce agreement on the way in which qualitative data should be coded. The risk ratings and the content analysis were carried out independently. The Fisher's exact test was used to compare the frequency with which contributory factors were identified based upon level of risk. A similar approach has been used to examine the causes of poor teamwork between junior doctors and nurses.[12]

Table 2. YCFF[23] factors, definitions from with exemplars and interview quotes for each error factor.

Factor	Definition	Identified examples	Exemplar quotes
SITUATIONAL FACTORS 85.7% (24/28)			
Team 50.0% (14/28)	Any factor related to the working of different professionals within a group which they may be able to change to improve patient safety.	• Lack of respect from colleagues • Delegation to inappropriate staff • Lack of shared mental model • Lack of support for juniors • Conflict within the team • Conflicting goals within the team	"*All I was getting were one word answers which I felt were passive aggressive*." (P2) "*We in the team all knew this probably wasn't the right thing to do*." (P9) "*They stated that they wished I hadn't done that* [carried out a particular task]" (P21) "*I reacted angrily saying- I don't care where you graduated or trained, you're not giving medication and this is not good enough*" (P26)
Individual staff 57.1% (16/28)	Characteristics of the person delivering care that may contribute in some way to active failure.	• Inexperience • High individual workload • Stress • Fatigue • Rushed	"*I just broke down from the stress and left the ward for 15 minutes to recover.*" (P7) "*At the time, I felt as if I was extremely out of my depth.*" (P7) "*I had never seen a really sick, near dead person before"* (P14) "*I was very fatigued and just looking forward to going home*" (P19)
Task characteristics 28.6% (8/28)	Specific patient related tasks which may make individuals vulnerable to error	• Unfamiliar with task • Monotonous task	"*I had never given platelets before*" (P10) **"***The tasks itself becomes quite monotonous as it was quite a common job so staff members can become complacent*" (P4)
Service user 46.4% (13/28)	Features of the patient the make caring for them more difficult and prone to error.	• Language barriers • Complex patient (e.g. age, multi-morbidity)	"*The patient was Polish and did not speak English*" (P16) "*She was a psych patient who was being treated for a medical condition*" (P8)

Factor	Definition	Identified examples	Exemplar quotes
LOCAL WORKING CONDITIONS 57.1% (16/28)			
Workload & staffing issues 28.6% (8/28)	Level of activity and pressures on time on a shift	• High unit workload • Unable to contact staff • Lack of senior staff	It was "*a very busy and fast paced unit*" (P4) "*This was always the busiest day for the team*" (P7) "*I found it very difficult to get in contact with my team that day for advice*." (P2)
Leadership, supervision, & role 42.9% (12/28)	The availability and quality of direct and local supervision and leadership	• Remote supervision • Unavailable of seniors • Unclear responsibilities • Role ambiguity	"*I felt that it was more appropriate that a senior member of the team would deal with them*." (P2) "*There has been no formal review* [of the patient] *by a consultant …* we [intern and Senior House Officer] *may have missed something in terms of his* [the patient's] *risk*" (P6) "*I did not know if I had any authority*" (P14)
Drug, equipment & supplies 7.1% (2/28)	Availability and functioning of drugs, equipment and supplies	• Equipment missing • Equipment faulty	"*The psych ward was in a bit of a mess at the time; they did not currently have any hand sanitiser because patients were drinking it*." (P8) "*When I went to print the ECG the message said 'cannot print'…. I asked the healthcare assistant to get an ECG from an adjacent ward only to see the exact same issue occur*." (P19)

Factor	Definition	Identified examples	Exemplar quotes
LATENT/ORGANISATIONAL FACTORS 57.1% (16/28)			

Physical environment 3.6% (1/28)	Features of the physical environment that hinders safe practice.	• Ward not appropriate for patient	"*The ward itself was not set up as a general medical, or even acute or HDU ward, which is what this patient really needed.*" (P8)
Support from other departments 10.7% (3/28)	Availability and support from other departments.	• Unwillingness to take responsibility for a patient. • Lack of support from another unit.	"*He refused to take the consultation*" (P11) "*We felt the technicians failed to see the urgency of the situation*" (P18) "*They refused* [to take the deteriorating patient] *stating that a Reg would have to make the call*" (P23)
Scheduling & bed management 10.7% (3/28)	Adequate scheduling to manage patient throughput minimising delays and excessive workload.	• Too many patients scheduled	"*This was double the normal amount of patients being admitted*" (P25)
Staff training & education 21.4% (6/28)	Access to correct, timely, and appropriate training.	• Staff were not trained to perform the task • Staff did not know the correct protocol • Staff did not know the correct chain of command	"*I had never given platelets before and had never been educated in how to give platelets to a patient.*" (P10) "*I went to the radiology system, a system I had not yet been appropriately trained on*" (P12)
Local policies, protocols, & procedures 14.3% (4/28)	The existence of local formal and written guidance for the appropriate conduct of work tasks and processes.	• No handover protocol	"*The introduction of a formalised handover procedure is something that would reduce these types of errors.*" (P4)

Factor	Definition	Identified examples	Exemplar quotes
LATENT/EXTERNAL FACTORS 0% (0/28)			
Design of equipment, supplies, and drugs 0% (0/28)	The design of equipment and supplies to overcome physical and performance limitations.	Not identified	Not identified
National policies 0% (0/28)	The existence of national formal and written guidance for the appropriate conduct of work tasks and processes.	Not identified	Not identified
GENERAL FACTORS 71.4 %(20/28)			
Safety culture 7.1% (2/28)	Organisational values, beliefs, and practices surrounding the management of safety and learning from error.	• Poor attitude to risk assessment • Appropriate protocol not used	"*There were no fulltime consultants, only locums coming in about two or three times a week and the patients were reviewed by myself, an intern, and an SHO.*" (P6)
Communication systems 67.9% (19/28)	Effectiveness of the processes and systems in place for the exchange of information.	• Poor handover • Lack of effective communication within the team • Incorrect information added to patient notes • Lack of information in patient notes	" [The patient] *had been under the care of a separate consultant whose handwriting I couldn't read properly*" (P2) "*Quite often the handover between these jobs is very grey; jobs are often forgotten*" (P4) "*There should have been a better quality handover*" (P15)

RESULTS

Error survey

A total of 201 out of 332 responses (60.5%) reported making an error that 'played on their mind'. A high number of those reporting making an error (52.2%; 105/201) were male than female. The majority of respondents (79.1%; 159/201) were between 21 and 28 years old.

Table 1 provides the frequency with which the contributing factors were identified by the participants. 'Individual factors' were the most commonly identified group of contributing factors, with 'high workload' and 'fatigue' the most commonly identified contributing factors.

Error interviews

The eight SMEs read each of the scenarios and rated the potential impact on safety, likelihood of occurrence, and involvement of the intern. The resulting data is shown in Table 3. None of the scenarios emerged as low-risk, with eight scenarios emerged as medium-risk and 20 scenarios emerged as high-risk. The inter-rater reliability of the risk rating was a free-marginal kappa of 0.29 (fair agreement).

Table 3. Distribution of SME impact on safety, likelihood of occurrence, and intern involvement ratings for the 28 scenarios.

Impact	**Percentage (proportion of ratings)**	**Likelihood**	**Percentage (proportion of ratings)**	**Involvement**	**Percentage (proportion of ratings)**
Negligible	0 % (0/224)	Rare/remote	0.4 % (1/224)	Extremely low	2.7% (6/224)
Minor	5.4% (12/224)	Unlikely	4.0% (9/224)	Low	6.3% (14/224)
Moderate	25.4% (57/224)	Possible	25.9% (58/224)	Moderate	13.4% (30/224)
Major	37.5% (84/224)	Likely	33.0% (74/224)	High	27.2% (61/224)
Extreme	31.7% (71/224)	Almost certain	36.6% (82/224)	Extremely high	20.4% (113/224)

*The denominator is derived from the 8 SME ratings for each of the 28 scenarios.

The initial error, or active failure, in the 28 scenarios can be described as a decision error. Decision errors "*represent intentional behaviour that proceeds as planned, yet the plan itself proves inadequate or inappropriate for the situation*" (p.53).[10] Table 4 provides an overview of the initial active failure that led to the patient safety incident. It can be seen that 15 out of the 28 (53.4%) of the incidents described in the CIT interviews were concerned with a delay in the treatment, diagnosis, or escalation of care.

Table 4. Active failure (n=28)

Active failure	N	%
Delay in escalation of care	7	25.0
Incorrect treatment	5	17.9
Delayed diagnosis	5	17.9
Delayed treatment	3	10.7
Treated incorrect patient	3	10.7
Inappropriate discharge	2	7.1
Failure to discharge	1	3.6
Missed diagnosis	1	3.6
Fail to inform patient of diagnosis	1	3.6

As can be seen from Table 2, 'situational factors' was the most commonly identified domain when describing error, with 'individual staff' the most commonly identified factor within this domain. However, 'communication systems' was the most commonly identified contributing factor identified in the content analysis (see Table 2).

High- and medium-risk scenarios were compared to ascertain if there were differences in the identified domain of contributory factors. It emerged that a significantly larger proportion of high-risk scenarios were attributed to 'local working conditions' than the medium-risk scenarios (see Table 5). There were no other significant differences.

Table 5. Frequency and Fisher's exact test comparison of factors based upon level of risk.

Factors	**Medium** (n= 8)	**High** (n= 20)	P-**value**
Situational factors	6 (75%)	18 (90.0%)	0.55
Local working conditions	1 (12.5%)	15 (75.0%)	<0.001
Organisational factors	5 (62.5%)	11 (52.4%)	1.00
External factors	0 (0%)	0 (0%)	N/A
General factors	5 (62.5%)	16 (80.0%)	0.37

DISCUSSION

Although lacking in experience, it has been argued that junior doctors have a unique perspective on the delivery of healthcare, and can provide insights on medical error and how patient safety and quality of care can be improved.[3] This study used a mixed-methods approach to examining the experience and perceptions of medical errors that were made, or

contributed to, by junior doctors in Ireland. Our data showed that many junior doctors have been involved in a medical error, with the errors attributed to a range of contributing factors.

Individual and situational factors were described with greater frequency than supervisory or organisational factors in both the error survey and CIT interviews. These factors are arguably more salient and 'closer' to the individual either identifying the causes or describing the incident. It may be an availability bias as it is easier to identify these causes. This finding is also consistent with a systematic review of factors contributing to patient safety incidents. This review found that, even with frameworks to encourage the consideration of latent failures, people still tend to focus on active failures or individual factors.[11] Similarly, it has been argued that investigators of incidents in healthcare tend to focus on administrative solutions (e.g. reminders) rather than those solutions addressing factors more distal from the incident such as organisational contributory factors.[17] This may be particularly true of the interns who participated in our study who have limited experience and knowledge of the healthcare system from an organisational context.

That stress/burnout, fatigue, and high workload were identified as contributory factors from the error survey is consistent with other research that has directly examined these issues with junior doctors. In the interviews, these factors were also identified as common contributors (in the YCFF they are classified as 'individual staff' and were identified in 57% of the interviews). In a previous study it was found that around 70% of Irish junior doctors were burned out,[6] and in another study with the same population approximately half of the respondents were determined to be experiencing psychological distress.[5] Although a diary study of Irish interns appeared to indicate that interns were obtaining sufficient hours of sleep, it was common for them to work longer than their shift, with the medical intern on

nightshift reporting particularly high levels of workload.[18] Therefore, not only are these issues commonplace, they are also viewed by junior doctors as contributory to errors.

The role of a junior doctor is ill-defined, and they receive limited support from more senior doctors.[19] A reflection of this may be the relatively high proportion of contributory factors attributed to inadequate training/prior experience and inadequate supervision identified from the error survey, and team and leadership factors identified in the CIT interviews. Also, the incidents in the CIT interviews that were identified as high risk had significantly more local working conditions factors than those incidents identified as medium risk. Despite the fact that collaboration and mutual respect are critical to effective patient care,[20] poor teamwork has been found to be common and places patients at considerable risk.[5] Ineffective team performance is related to patient outcomes such as patient mortality,[21] duration of patient stay,[22] and medication errors.[23]

Communication was a commonly identified contributory factor in both the error survey and CIT interviews. Many studies carried out in different countries, and domains of healthcare, have found that junior personnel are often unwilling to speak up or question more senior personnel.[24] Although speaking up is important for patient safety and teamwork, that juniors are unwilling to raise concerns is something of which many senior personnel are largely unaware.[25]

In almost half of the CIT interviews, features of the patient were identified that made caring for them more difficult. These were language barriers and complexity in terms of age and/or co-morbidities. Language barriers have been found to be associated with serious medical events in

paediatric patients.[26] Older patients [1] and multimorbidity, polypharmacy patients[27] have also been found to be more at risk of an adverse event.

Recommendations

More than half of the respondents to the survey reported making an error that 'played on their mind', and there is evidence of an association between self-reported error and burnout.[6] Therefore, there is a need to prepare junior doctors to be able to deal with errors in patient care and avoid becoming a 'second victim'. This should take the form of education and training that begins in medical school, but also support from healthcare institutions and colleagues.[28] It is further suggested that education on the organisational aspects of patient safety should be incorporated into curricula for medical students and junior doctors in order to help them understand how errors occur within the sociotechnological system.[9]

It is recommended that efforts are made to support junior doctors in order to make them feel part of a care team, and consideration should be made to how shifts can be organised such that interns are working with members of the team to which they have been assigned and better supported when on-call. It is also suggested that interns should be equipped with the assertive skills necessary to advocate for themselves and their patients.[24]

Healthcare incident reporting systems have been shown to be of limited effectiveness for a range of reasons.[29] Certainly the error survey is arguably no more than a 'wet finger' to indicate which direction the wind is coming from. However, perhaps used in combination with a CIT approach, this methodology could provide a method of targeting specific issues identified from the questionnaire (e.g. supervision), and using a CIT approach to subject these

issues to deeper investigation. This would allow a targeted approach to be taken to identifying specific patient safety issues.

Limitations

Although there is evidence to support the construct validity, as the questionnaire was derived from models of human error in complex systems, there are limitations with the data derived from the questionnaire. The data on the contributory factors of the incident collected from the questionnaire was provided by interns who had received no training in how to identify the causes of the incidents. This may have resulted in a bias in identifying causes that are more salient. Moreover, even experienced, and trained, individuals are challenged in reliably identify the causes of incidents.[30]

The error questionnaire, and to an even greater extent the CIT interview, are a subjective and partial view of a complex clinical and organisational situation and contain numerous biases. For example, hindsight bias has been identified as an issue when investigating an adverse event, and is also relevant to our study. His bias refers to the tendency to see the event as having been predictable, when it may not be, as the outcome of the event is known.[31] This bias can be further compounded by attribution error. As discussed above, there is a tendency for people to attribute errors to individual factors rather than system, organisational, or system related factors.[11,17,31] However, Macrae[29] argues that although these biases are a weakness in terms of epidemiological measurement, they can be a strength in terms of safety management by allowing specific issues to be subjected to increased scrutiny.

It is also possible to criticise the subjectivity in the analysis. In order to mitigate these issues, a rigorous approach was taken to both the collection and analysis of the data. The number of

interviews that were carried out was based upon qualitative, as opposed to quantitative sampling principles. Therefore, it may be that the interview sample is not representative of the broader population of interns. Nevertheless, the findings from the CIT are broadly similar to the findings from the error survey, and consistent with other research that has been carried out with junior doctors.

Conclusion

Medical errors are ubiquitous and inevitable. Our research has demonstrated junior doctors within a year of completing medical school are likely to be involved in medical error. As such, there is a need to prepare junior doctors to deal with error, and support healthcare professionals throughout their careers. Junior doctors have a unique perspective on the delivery of healthcare, and have valuable insights for where improvements can be made to patient safety.

Contributors. POC, SL, and DB planned the study. OM, AM, LM, FC, and DB recruited participants for the questionnaire survey and interviews, and conducted the interviews. FC transcribed the interviews. POC and SL analysed the data. POC, SL, and DB prepared to initial draft of the manuscript. OM, AM, LM, and FC commented on the initial draft of the manuscript. All authors approved the final manuscript for submission.

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Ethics approval . Ethical approval was obtained from the five participating hospitals.

Main messages

- Junior doctors are likely to be involved in medical errors.
- Junior doctors have valuable insights for the improvement of patient safety.
- There is a need to prepare junior doctors to deal with error made during their career.

Current research questions

- Can junior doctors provide useful insights on medical errors?
- What are the experiences of junior doctors with medical errors?
- What are the factors that contribute to the medical errors experienced by junior doctors?

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