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RUNNING HEAD: IMPACT OF ADVERSE EVENTS

# What is the impact of adverse events on surgeons in the UK?

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**SHORT REPORT**

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## Introduction

Surgeons are negatively affected when things go wrong. They may experience guilt, anxiety, and reduced confidence following adverse events (1-4), which may lead to formal investigation and sanction. Medical errors have been linked with burnout, depression, suicidal ideation, and reduced quality of life (3, 5).

The literature has typically grouped adverse events together and viewed doctors as one group (2, 6). This may be problematic because doctors might be affected differently by errors and complications. Whilst errors are preventable events arising from shortfalls in the standard of care expected (7), complications are an acknowledged risk of surgical care (8, 9). Some aspects of medical practice are unique to, or predominant aspects of, surgery (e.g. rapid decision making), highlighting the importance of focusing on the impact of adverse events on surgeons.

This research explores the impact of adverse events on UK surgeons' health and wellbeing. Surgeons completed an online survey that involved recalling an error-based or complication-based event and answering questions regarding health, wellbeing and support-seeking. Given that impaired wellbeing is associated with surgeons making errors (10), it was hypothesized that the impact on health and wellbeing will be greater for errors compared with complications.

## Methods

Ethical approval was secured from Bournemouth University's Ethics Panel (reference: 12613). Surgeons from the UK were invited for an online survey through the Qualtrics platform (Provo, Utah, USA). An opportunistic sampling strategy was used, involving organisations such as the Royal College of Surgeons of England and appeals at surgeons' events. Participants were randomly allocated to the complication or error version of the survey upon accessing the survey URL. Errors and complications were defined at the start of the survey based on definitions in the literature (7-9), and each participant recalled a suitable surgical event consistent with the survey version to which they were allocated. A single-factor (event: error or complication) between-groups design was used. Participants briefly described a complication or error they had experienced in the previous three months or recently before then. The Clavien-Dindo Scale (11) was used to gauge event severity. The remaining survey items addressed participants' experience of the event, including its impact on their health and wellbeing. The Primary Care Post Traumatic Stress Disorder Screen (PC-PTSD) was used to assess post-traumatic stress (PTS) symptoms (12). Comparisons

between groups were analysed using Pearson's chi-square tests and analysis of covariance (ANCOVA).

## Results

Some 445 surgeons (315 male), median age 47 years (IQR 15.0), completed the survey with 79.1 per cent of participants describing an elective rather than emergency event. Participants worked across different grades, surgical specialities, and settings (Table S1). Some 302 of 445 participants (67.9 per cent) reported an event of grade III-a or above severity (Table S2).

### Impact of event and type of event on health and wellbeing

Following the recalled event, 48.3 per cent of participants reported increased anxiety, 42.5 per cent reported sleep problems, 32.1 per cent reported anger or irritability, 11.7 per cent reported increased depression, and 10.6 per cent reported increased alcohol consumption. The impact of the event on physical health was generally low (see Table 1).

The error group was more likely to experience sleep problems than the complication group, ($\chi^2(1) = 7.37$, p = 0.007). The error group was also more likely to experience anxiety following the event ($\chi^2(1) = 4.24$, p = 0.040). Additionally, alcohol consumption was greater in the error group ($\chi^2(1) = 5.62$, p = 0.018). There was no significant association between event type and depression, anger/irritability or health difficulties (see Table 1).

When controlling for event severity, there was a difference in PTS symptom score following the event, according to event type, $F(1, 420) = 8.95$, p = 0.003. Scores were higher for the error group (M=1.3, SD=1.2) than complication group (M=1.0, SD=1.1). 35.7 per cent of the error group met the scale threshold for indicating possible clinically relevant levels of symptomatology compared with 26.6 per cent of the complication group. Severity was a significant covariate in the ANCOVA, $F(1, 420) = 18.11$, p = <0.001, indicating that event severity influenced preparedness scores.

### Preparedness and support seeking

42.5 per cent of participants did not talk to anyone following the event. Of those participants who did speak to someone, several talked to a colleague (85.5 per cent) or their partner or friends (57.8 per cent). Only 2.7 per cent of participants indicated they had accessed a support service (see Table 2). On a scale from 1 ('not at all prepared') to 7 ('well prepared'),

participants felt ill-prepared by their training for the impact of adverse events (M=2.9, SD=1.8).

Impact of event type on preparedness and support seeking

When controlling for severity of the event, preparedness scores differed depending on whether the event was due to an error or a complication ($F(1, 431) = 5.26$, $p = 0.022$). Scores were lower (indicating participants reported training had prepared them less well for the event) in the error group (M=2.7, SD 1.7) than the complication group (M=3.0, SD 1.9). Severity was a significant covariate in the ANCOVA ($F(1, 431) = 4.14$, $p = 0.042$), indicating that event severity influenced preparedness scores. There was no association between event type and likelihood of talking about the eventm ($\chi 2(1) = 3.72$, $p = 0.054$).

**Discussion**

Contrary to existing work (13), the present study distinguishes error from complication, includes a measure of event severity, and explores the impact of adverse events across a range of outcomes.

The extent to which surgeons feel negative following adverse events is striking: nearly half of participants reported becoming more anxious, 40 per cent sleeping worse, a third struggling to cope with anger or irritability, and over 10 per cent reporting depression. The frequency of PTS symptomatology illustrates the profound impact of adverse events.

The study suggests surgeons do not feel prepared for the impact of adverse events. It also indicates failings in how surgeons are supported after an adverse event. Talking about the impact of an event is helpful (14), yet over 40 per cent of participants talked to no one about it. Despite high levels of mental health symptomology, participants reported very little engagement with formal support services. This may be because surgeons perceive barriers to talking about adverse events (1, 14) and surgeon-specific support programmes are lacking.

There was some support for our hypothesis that the impact on health and wellbeing would be greater among surgeons who recalled a surgical error. Although there were no differences in reported health problems or depression, errors were more likely to result in sleep problems, anxiety, and increased alcohol consumption. Participants recalling an error were more likely to report PTS symptomatology, regardless of event severity. Errors therefore appear to affect surgeons more than complications. The reality is that errors and complications lie at opposite ends of a continuum of adverse surgical events and the literature recognises the difficulty of definitions (15). It might benefit surgeons,

psychologically, to consider whether there are aspects of complications in events they had regarded as errors.

The present study is limited by retrospective analysis of events by participants, which could have led to recall errors. Additionally, whilst randomly assigning participants to the error or complication survey versions is methodologically robust, randomisation might have prevented surgeons from sharing an event that had impacted them substantially. Finally, it is possible that event severity was a confounding factor in some analyses comparing the effect of errors and complications. Severity was controlled for where possible, but future research examining the differential impact of errors and complications on surgeons should consider this.

Nonetheless, this study suggests that UK surgeons are negatively affected by adverse events, but ill prepared to deal with them. Barriers to engagement with support services should be explored and novel solutions developed. One approach is to help surgeons develop psychological resilience and preparedness in anticipation of adverse events. Initial reports of such interventions for surgeons in training are encouraging in terms of acceptability and efficacy (16, 17). There is a need, too, to support surgeons effectively in the aftermath of adverse events (18). Structured support programmes exist in the United States and are viewed as popular and efficacious by surgeons (19). Recommendations have been made for similar programmes in the UK (20). Our findings highlight that a sizeable proportion of surgeons talk to no-one after an adverse event. Whatever novel approaches are developed, surgical culture will need to change to normalise engagement with support.

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Table 1. Impact of Adverse Event on Mental and Physical Health and Substance Use.

| **Problems started or increased following the event** | Whole sample | Error sub-sample | Complication sub-sample | p-value |
|---|---|---|---|---|
| Cardiovascular problems | 18 (4.0) | 8 (4.1) | 10 (4.0) | 0.925 |
| Gastrointestinal problems | 36 (8.1) | 21 (10.9) | 15 (6.0) | 0.059 |
| Headaches | 42 (9.4) | 18 (9.3) | 24 (9.5) | 0.944 |
| Minor illnesses | 28 (6.3) | 11 (5.7) | 17 (6.7) | 0.652 |
| Sleep problems | 189 (42.5) | 96 (49.7) | 93 (36.9) | 0.007 |
| Depression | 52 (11.7) | 25 (13.0) | 27 (10.7) | 0.466 |
| Anxiety | 215 (48.3) | 104 (53.9) | 111 (44.0) | 0.040 |
| Anger or irritability | 143 (32.1) | 68 (35.2) | 75 (29.8) | 0.221 |
| Relationship problems | 65 (14.6) | 33 (17.1) | 32 (12.7) | 0.193 |
| Alcohol consumption | 47 (10.6) | 28 (14.5) | 19 (7.5) | 0.018 |
| PTS scores (ranging 0-4 symptoms) | 1.1 (1.2)# | 1.3 (1.2)# | 1.0 (1.1)# | 0.003 |

Values are number of participants (%) unless otherwise stated; # values are mean (SD);

Table 2. Preparedness and Support Seeking Following an Adverse Event.

| | Whole sample | Error sub-sample | Complication sub-sample | p-value |
|---|---|---|---|---|
| Training prepared you for the personal impact of this event? (1-7 scale) | 2.9 (1.8) # | 2.7 (1.7) # | 3.0 (1.9) # | 0.022 |
| Training should prepare surgeons better for dealing with the personal impact of adverse events (1-7 scale) | 6.2 (1.2) # | 6.2 (1.2) # | 6.1 (1.2) # | 0.456 |
| Talk to someone: Yes? | 256 (57.5) | 121 (62.7) | 135 (53.6) | 0.054 |
| Of those who reported talking about the event: who did you speak to? | | | | |
| Spouse/partner/friends | 148 (57.8) | 67 (55.4) | 81 (60.0) | 0.454 |
| Colleagues in my hospital | 219 (85.5) | 104 (86.0) | 115 (85.2) | 0.862 |
| Colleagues in another hospital | 48 (18.8) | 23 (19.0) | 25 (18.5) | 0.920 |
| Local/national support service | 7 (2.7) | 3 (2.5) | 4 (3.0) | 0.813 |
| Other | 14 (5.5) | 7 (5.8) | 7 (5.2) | 0.833 |
| Of those who reported talking about the event: how useful was talking? (1-7 scale) | 2.3 (1.3)# | 2.2 (1.2)# | 2.4 (1.4)# | 0.457 |

Values are number of participants (%) unless otherwise stated; # values are mean (SD);

**Supplementary material**

Table S1. Demographic Information

| Demographic | Whole sample | Error sub-sample | Complication sub-sample |
|---|---|---|---|
| Age[#] | 46.7 (27-69) | 47.9 (28-68) | 45.7 (27-69) |
| Gender | 315 (70.8) | 145(75.1) | 170 (67.5) |
| Principal place of work | | | |
| District General Hospital | 188 (42.2) | 76 (39.4) | 112 (44.4) |
| University Teaching Hospital | 243 (54.6) | 110 (57.0) | 133 (52.8) |
| Private Practice | 14 (3.1) | 7 (3.6) | 7 (2.8) |
| Surgical Specialty | | | |
| Academic surgery | 20 (4.5) | 9 (4.7) | 11 (4.4) |
| Cardiothoracic surgery | 3 (0.7) | 3 (1.6) | 0 (0.0) |
| General surgery | 130 (29.2) | 60 (31.1) | 70 (27.8) |
| Neurosurgery | 8 (1.8) | 4 (2.1) | 4 (1.6) |
| Oral and maxillofacial surgery | 12 (2.7) | 3 (1.6) | 9 (3.6) |
| Ophthalmology | 20 (4.5) | 10 (5.2) | 10 (4.0) |
| Otolaryngology | 18 (4.0) | 5 (2.6) | 13 (5.2) |
| Paediatric surgery | 34 (7.6) | 12 (6.2) | 22 (8.7) |
| Plastic surgery | 18 (4.0) | 11 (5.7) | 7 (2.8) |
| Trauma and orthopaedic surgery | 72 (16.2) | 31 (16.1) | 41 (16.3) |

| | | | |
|---|---|---|---|
| Urology | 89 (20.0) | 35 (18.1) | 54 (21.4) |
| Vascular surgery | 21 (4.7) | 10 (5.2) | 11 (4.4) |
| Grade | | | |
| ST3* | 13 (2.9) | 5 (3.1) | 7 (2.8) |
| ST4 | 5 (1.1) | 4 (2.1) | 1 (0.4) |
| ST5 | 13 (2.9) | 2 (1.0) | 11 (4.4) |
| ST6 | 11 (2.5) | 3 (1.6) | 8 (3.2) |
| ST7/8 | 28 (6.3) | 10 (5.2) | 18 (7.1) |
| Staff grade/associate specialist | 26 (5.8) | 15 (7.8) | 11 (4.4) |
| Consultant | 348 (78.2) | 152 (78.8) | 196 (77.8) |
| Number of years at current grade (for consultants and non-training grades) | | | |
| 0-5 years | 95 (21.3) | 38 (19.7) | 57 (22.6) |
| 6-10 years | 91 (20.4) | 39 (20.2) | 52 (20.6) |
| 11-20 years | 118 (26.5) | 49 (25.4) | 69 (27.4) |
| 21-30 years | 56 (12.6) | 35 (18.1) | 21 (8.3) |
| Over 30 years | 3 (0.7) | 2 (1.0) | 1 (0.4) |

Values are number of participants (%) unless otherwise stated; # values are mean (range); * The ST3 grade is the beginning of specialist surgical training in the UK. This continues for 5/6 years (i.e. to grade ST7/8), at which point trainees apply for permanent consultant posts.

Table S2. Adverse Event Information

| Event information | Whole sample (n = 445) | Error sub-sample (n = 193) | Complication sub-sample (n = 252) |
|---|---|---|---|
| Nature of event | | | |
| Elective | 352 (79.1) | 151 (78.2) | 201 (79.8) |
| Emergency | 89 (20.0) | 41 (21.2) | 48 (19.0) |
| Severity rating* | | | |
| Low (0-grade II) | 139 (31.2) | 78 (40.4) | 61 (24.2) |
| High (grade III-a and above) | 302 (67.9) | 113 (58.5) | 189 (75.0) |
| Feelings about event# | 2.3; 1.07 (1-7) | 2.3 (1-6) | 2.4 (1-7) |
| Contributing factors | | | |
| Fatigue | 52 (11.7) | 40 (20.7) | 12 (4.8) |
| Lack of knowledge/experience | 54 (12.1) | 32 (16.6) | 22 (8.7) |
| Lack of resources | 31 (7.0) | 24 (12.4) | 7 (2.8) |
| Lapse in judgement by you | 139 (31.2) | 101 (52.3) | 38 (15.1) |
| Poor communication | 44 (9.9) | 31 (16.1) | 13 (5.2) |
| Stress/depression/burnout | 27 (6.1) | 18 (9.3) | 9 (3.6) |
| Recognised risk of procedure | 228 (51.2) | 61 (31.6) | 167 (66.3) |
| System issue outside of your control | 55 (12.4) | 30 (15.5) | 25 (9.9) |
| Other (not specified) | 75 (16.9) | 38 (19.7) | 37 (14.7) |

Values are number of participants (%) unless otherwise stated; # values are mean; SD (range)

* according to Clavien-Dindo Scale (11)