Incidence of Wrong-Site Surgery List Errors for a 2-Year Period in a Single National Health Service Board

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Introduction: Wrong-site/side surgical “never events” continue to cause considerable harm to patients, healthcare professionals, and organizations within the United Kingdom. Incidence has remained static despite the mandatory introduction of surgical checklists. Operating theater list errors have been identified as a regular contributor to these never events. The aims of the study were to identify and to learn from the incidence of wrong-site/side list errors in a single National Health Service board.

Methods: The study was conducted in a single National Health Service board serving a population of approximately 300,000. All theater teams systematically recorded errors identified at the morning theater brief or checklist pause as part of a board-wide quality improvement project. Data were reviewed for a 2-year period from May 2013 to April 2015, and all episodes of wrong-site/side list errors were identified for analysis.

Results: No episodes of wrong-site/side surgery were recorded for the study period. A total of 86 wrong-site/side list errors were identified in 29,480 cases (0.29%). There was considerable variation in incidence between surgical specialties with ophthalmology recording the largest proportion of errors per number of surgical cases performed (1 in 87 cases) and gynecology recording the smallest proportion (1 in 2671 cases). The commonest errors to occur were “wrong-side” list errors (62/86, 72.1%).

Discussion: This is the first study to identify incidence of wrong-site/side list errors in the United Kingdom. Reducing list errors should form part of a wider risk reduction strategy to reduce wrong-site/side never events. Human factors barrier management analysis may help identify the most effective checks and controls to reduce list errors incidence, whereas resilience engineering approaches should help develop understanding of how to best capture and neutralize errors.

Key Words: surgery, never events, human factors

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Under UK “Governance Arrangements for Research Ethics Committees,”

ethical research committee review is not required for service evaluation or research which, for example, seeks to elicit the views, experiences, and knowledge of health care professionals on a given subject area.

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of wrong-side, wrong-site, or wrong-procedure (WSSP) theater list errors by surgical specialty in a UK hospital.

**METHODS**

**Setting and Context**

The study was conducted in a single National Health Service (NHS) board, which serves a population of approximately 300,000. It includes an 860-bed district general hospital containing 16 operating theaters and a smaller satellite hospital with a day case ophthalmology theater. Included surgical specialties are ear, nose and throat (ENT), general surgery, gynecology, ophthalmology, oral and maxillofacial surgery (OMFS), orthopedics, urology, and vascular surgery.

The hospital theater department has engaged in a systematic program of quality improvement (QI) since 2008 influenced by the model developed by Langley et al. Daily safety huddles and weekly safety meetings are used to coordinate QI activities. One strand of this QI project involves the monitoring and improvement of prelist briefing and checklist use. Individual theaters began collecting data on potential “harm prevented” at theater briefs and checklist pauses to determine whether checklist modifications resulted in improvements. These data include all errors discussed or captured at the morning briefing or checklist pauses. Since May 2013, this data collection has been embedded in all theaters across the NHS board.

**Data Collection**

Data are collected by staff in individual theaters on the principal paper copy of the theater list in real time; this information is collated on a daily basis by a theater coordinator and stored on a spreadsheet alongside data from the Scottish Patient Safety Programme (SPSP). The SPSP is a national QI program, which requires hospitals to audit and improve care processes targeted to reducing specific adverse events; in operating theaters, this includes monitoring and acting on data on briefing and checklist use, glucose control, and prophylactic antibiotics use.

**Data Analysis**

Data from May 2013 to April 2015 were reviewed and analyzed by A.G. All data relating to theater list errors were extracted for analysis. Additional information was extracted from SPSP data. Data were examined using Microsoft Excel (2010, Microsoft Corp, Redmond, WA) and are presented as simple frequency counts and percentages by surgical specialty.

**RESULTS**

A total of 29,480 theater cases were performed for the study period. No cases of wrong-side, wrong-site, or wrong-procedure surgery were recorded. The SPSP data confirm all theater lists began with a safety brief and checklist pauses were completed before every procedure. Nine cases, where the side or planned procedures were changed on the day of surgery because of a change in the patients’ condition, were not included as WSSP errors. There were further 2 cases where no side was documented on the theater list.

A total of 86 WSSP list errors (0.29%) were recorded for the 2-year period. The incidence of WSSP errors by individual surgical specialty is outlined in Table 1. Ophthalmology recorded the largest proportion of errors per number of surgical cases performed (1 in 87 cases), with gynecology recording the smallest proportion (1 in 2671 cases).

The list error type that occurred most frequently was episodes of potential “wrong-side” surgery (62/86, 72.1%), most (33/62, 53.2%) of which were associated with ophthalmology (Table 2).

**DISCUSSION**

For the 2-year study period, there were no cases of wrong-site/side or procedure surgery in the hospital, but there were a total of 86 WSSP list errors. This approximates to 1 WSSP list error every 10 to 14 days. There was considerable variation in incidence by specialty, with 1 in 87 cases incorrectly listed in ophthalmology theaters to 1 in 2671 in gynecology. In specialties with a high degree of laterality to disease (ophthalmology/orthopedics), there was an increased proportion of wrong-side listing compared with other specialties.

One of the strengths of this study is that data have been collected prospectively in real time. The data collection process has been refined through application of QI methodology to minimize any additional workload to frontline theater staff and, therefore, to maximize reporting. Information is handwritten on the principal theater list during the morning theater briefing and subsequent safety pauses without the need for any additional forms or repetition. The collation of data by theater coordinators is paired with the established SPSP data collection process, again minimizing additional workload. Because there were no episodes of wrong-site surgery for the study period, it is likely that all WSSP errors were reported on theater lists; any underreporting could only occur at the collating level. One shortcoming of this real-time data collection process is that there is limited detail on the

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**TABLE 1. Incidence of WSSP List Errors by Surgical Specialty**

| Specialty   | List Errors | Surgical Cases | Incidence |
|-------------|-------------|----------------|-----------|
|             | n           | n              |           |
| Ophthalmology | 39          | 3389           | 0.01150782| 1 in 87 cases |
| Orthopedics  | 14          | 6973           | 0.00200774| 1 in 498 cases |
| General      | 9           | 5622           | 0.00160085| 1 in 625 cases |
| OMFS         | 6           | 1438           | 0.00417246| 1 in 240 cases |
| Urology      | 6           | 2723           | 0.00220345| 1 in 454 cases |
| ENT          | 5           | 2146           | 0.00232992| 1 in 429 cases |
| Vascular     | 2           | 1516           | 0.00131926| 1 in 758 cases |
| Gynecology   | 1           | 2671           | 0.00037439| 1 in 2671 cases |
| Unknown      | 4           | —              | —         |
| Total        | 86          | 29480          | 0.00291723| 1 in 343 cases |
underlying nature of the errors and no further investigation to determine what other system-wide factors contributed to contribute to the errors that occurred, minimizing opportunities for team or organizational learning and improvement. On identifying the incidence of list errors by specialty, the head of each department was notified allowing them to set up independent audit processes. In addition, the “harm-prevented” data collated within theaters are shared on a monthly basis across all departments, mid and senior management, and the chief executive to provide regular updates on errors identified and captured within the theater department. The hospital is shortly to begin a wider analysis of the listing process, barriers, and checks in partnership with the Patient Safety & Quality Improvement team within NHS Education for Scotland.

Nine instances where the theater list was altered on the day of surgery because of a change in patient circumstances were not included as errors. These episodes were felt to be symptomatic of disease progression and occurred approximately once every 2 to 3 months. It is possible that the data set underreports these episodes if these details were not recorded at the time. However, with application of the NHS 12-week waiting time guarantee between a patient being placed on a waiting list and the procedure being carried out these types of errors should be minimized. A further potential source for changes to the list on the day of surgery is the use of pooled surgical lists. This entails numerous surgeons sharing a combined waiting list for common procedures, but required bilateral or vice versa.

| Surgical Specialties | Wrong Side | Wrong Procedure | Unilateral* | Total |
|----------------------|------------|-----------------|-------------|-------|
| Ophthalmology        | 33         | 1               | 1           | 39    |
| Orthopedics          | 11         | 2               | 6           | 14    |
| General              | 3          | 4               | 9           |       |
| OMFS                 | 5          | 1               | 6           |       |
| Urology              | 3          | 1               | 6           |       |
| ENT                  | 1          | 4               | 2           |       |
| Vascular             | 2          | 2               | 2           |       |
| Gynecology           | 4          | 1               | 1           |       |
| Unknown              | 4          | 1               | 4           |       |
| Total                | 62         | 8               | 4           | 86    |

*Bilateral/unilateral errors where the patient was listed for a unilateral procedure but required bilateral or vice versa.

TABLE 2. Number of List Errors by Type Across Different Surgical Specialties

and I listed with both the wrong procedure and wrong side. In Neily et al’s27 2009 review of wrong-site surgery the incidence of wrong site never events is broken down by specialty; it is noteworthy that this incidence closely resembles the incidence of WSSP listing errors by specialty identified in this study. This again suggests an association between list errors and wrong-site surgery and its potential as a target to reduce never events.

Although list errors are not a prerequisite for a never event, they can play a significant role, working through 3 distinct mechanisms. Firstly, theater lists can act as a lead point for never events if the error is copied on to patient consent and subsequent documentation. Secondly, they can act as a compounding factor because the list is used to inform theater layout and equipment setup, that is, theater could be set up for a right- or left-sided procedure. Indeed, patient positioning errors are a known independent risk factor for wrong-site surgery.25 Finally, regular list errors have the potential to normalize discrepancies between documentation and procedure being carried out. This could have an impact on staff raising concerns and cultural drift more generally.31 Scheduling errors have been identified as the fifth most common root cause of wrong-site/side never events27 and may contribute to approximately 25% of all such events.25 With the incidence of wrong-site/side never events seemingly static across the UK, list errors need to be addressed as part of a wider risk reduction strategy.

The Joint Commission Center for Transforming Healthcare previously identified 3 contributing factors to incorrect scheduling; these can be seen in Box 1.4

BOX 1. Factors that contribute to incorrect scheduling and potential contributory factors in wrong-site surgery

1. Booking documents not verified by office schedulers
2. Schedulers accepting verbal requests for surgical bookings instead of written documents
3. Unapproved abbreviations, cross-outs, and illegible handwriting used on the booking form

Computer software also has a role in the generation of, or protection against, list errors. Cima et al15 reported on the introduction of a new electronic scheduling system within the Mayo Clinic, which significantly reduced scheduling errors in both gynecology and colorectal surgery. The UK software interfaces should be reviewed to ensure risk of left/right slips and lapses are minimized during list formulation. For the clinician, a pragmatic approach must ensue. List errors should be recognized as a real and recurring threat. Surgeons must resist the temptation to “short cut” and use the theater list as a primary source for consenting. Consent should include a reconciliation process to ensure patient findings, imaging, letters, and lists match. Surgeon involvement in this reconciliation process has been identified as being the greatest contributor to the prevention of wrong-site surgery.25 As the UK increasingly moves toward pooled surgical lists and patients arriving on the day of surgery, there can be considerable time pressure to meet patients for the first time, review notes, and consent before the start of theater. Organizations should, therefore, examine clinical and administrative systems to ensure that there is adequate time to complete these procedures properly and ensure that all notes and imaging, be they electronic or paper, are easily accessible in consenting areas.

Different human factors concepts and approaches routinely used in safety-critical industries may be helpful to NHS care teams.
in better understanding and minimizing system hazards and risks related to complex problems such as surgical list errors and never events.36 The use of barrier management methods can assist us to better assess care systems to identify and improve existing patient safety “controls” and “safeguards” for reducing risks.37 This can be achieved either as a proactive safety management approach or retrospectively as part of incident investigations. This enables assessment and identification of the full range of protective controls thought to be in place, how robust they actually are and how they can be defeated, and who in the organization has responsibility for implementing, supporting and maintaining each type of safety control.37

Similarly, there is growing interest in healthcare and other high hazard industries in the human factors subdomain of resilience engineering.38 This discipline advocates the need to strike a balance between the traditional approaches to safety management, which are focused on reducing and eliminating the number of things that go wrong (termed Safety-I), while optimizing and improving the number of things that go right (termed Safety-II). Given that list errors and never events are comparatively rare, it arguably makes sense to begin to explore, understand, and learn from why things go right in most surgical cases.

To more effectively influence surgical wrong-site/side list errors and related never events will require targeted education and training of the surgical workforce (and others including organizational leaders and NHS policymakers) in fundamental human factors principles and approaches. This goal is embedded in policy in NHS England39 and is now appearing in national surgical training curricula. However, a broader and more comprehensive understanding of human factors as a systems and design-based discipline will be necessary if frontline care teams (“field experts”) are to untangle the complexities of system interactions that can contribute to list errors and never events and design effective solutions to reduce risks thereby enhancing human and organizational performance and well-being in this area.

CONCLUSIONS

This is the first UK data to identify the incidence of WSSP list errors. Data are similar to a previously published study from the United States,33 but there is no other direct UK comparison. It would be very useful to repeat this data collection process in similar surgical settings for comparison. A wider project to understand and define the association between system failures, including list errors, and wrong-site surgery events in the UK could further legitimize it as a target for reducing wrong-site surgery. We have demonstrated considerable interspecialty variation in WSSP list error incidence. This requires further examination with more comprehensive data collection, informed by human factors thinking and methods, to understand the exact nature of these differences and begin to formulate system (re)design interventions to reduce error incidence.

List errors are an attractive target and act as strong system signals40 in the fight against wrong-site surgery. They are clearly implicated in the development of wrong-site surgery events, and it would be useful to more clearly understand and define this association and begin to design solutions to strengthen system barriers and safety management procedures. Tracking theater list errors could be an attractive process measure in national QI strategies because it provides a clear binary end point—an operation can be listed either correctly or incorrectly. There is potential for such data to act as a lagging indicator41 to help identify hospitals at increased risk of wrong-site surgery never events. Overall, the list errors themselves need to be addressed by examining how lists are compiled, processed, and implemented from human factors–based systems and design perspective to develop and test interventions for further minimizing the risk of catastrophic wrong-site surgery.

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