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1. Introduction

It has long been known that pressure ulcers (PU) cause patients significant pain and distress [1], however in recent years PUs have become an indicator of quality care and safety within the NHS [2, 3]. Category 2 or above PUs [4] are required to be reported in line with National Institute of Health and Care Excellence Guidelines [5, 6] and investigated.

The authors' organisation commenced root cause analyses (RCA) investigations for all severe (category 3 or 4 or non-resolving unstageable/ suspected deep tissue injury according to European Pressure Ulcer Panel grading [4]) hospital acquired PUs in 2010 in line with the commissioning for quality and innovation (CQUIN) targets [7]. In 2004 the National Patient Safety Agency had published guidance for RCA investigations [8] but it had not been applied to PU incident investigation in the authors's organisation or any others known to the authors. The RCA process is designed to identify the root causes and contributory factors that lead to a patient safety incident. Key learning points can then be identified to improve practice and patient care. As this process was new for PU incidents, tissue viability staff looked to other established investigation processes (e.g. infections) to adapt documentation and guidance.

In 2013 when the PU RCA process was thoroughly established throughout the trust, an evaluation of all the investigations was performed in order to identify key themes and make improvements to the documentation and process. Details of root causes and contributory factors for all completed RCAs during April 2011-March 2013 were identified and extracted. A thematic analysis was then performed on the extracted data; these were then coded and grouped into themes and subthemes [9]. Four key themes were identified: Individual patient factors, Education and training, Communication and Organisational/Environmental. 'Education and training' was the most frequently occurring theme, identifying that there was a lack of knowledge in PU prevention by nurses. PU competency frameworks were therefore developed which became mandatory for all registered and non-registered nursing staff. The next most frequently occurring theme was 'individual patient factors' e.g. co-morbidities, nutrition and compliance. This was taken into account when developing the competencies to ensure that staff were aware of how individual patient factors could impact upon a patient's susceptibility to developing a PU. 'Communication' identified issues regarding patient transfers between different wards or departments – in particular the patient's level of risk not being communicated at hand over and therefore the receiving area would not be adequately prepared. 'Environmental/organisational' issues included patients being cared for in inappropriate care settings (lodgers or outliers), being transferred to multiple different ward areas during their stay and delays in going to theatre or having a procedure.

One of the problems encountered with the original RCA process was that it could be subjective and lead investigators were searching for 'fixable' outcomes. One example of this was that throughout the 2 year period documentation would be a prominent factor; it was thought that as documentation improved on the ward, so would standards of care; additionally this was something that could be easily audited to demonstrate improvement. It is clear that poor documentation does not cause a PU, however it should reflect the standard of care given so needed to be considered in improvement plans. As a result of this previous analysis the tissue viability team identified that the RCA process needed improving to try and make it less subjective and to identify the true root causes and contributing factors.

In 2009 a National Institute of Health Research (NIHR) funded programme grant for Applied Research on PUs commenced (RP-PG-0407-10056). A co-author of this paper was an investigator in the study. One of the work streams in this project aimed to understand why patients develop severe PUs. This study used a retrospective case study design method to produce accounts of individual patients who developed severe PUs. An iterative review, involving reviewers (including patients) with different backgrounds, was used to validate and interpret the accounts [10]. An additional output of the study was to develop a methodology for RCA, suitable for use in current NHS practice. Based on the findings of the research study, the new investigation process needed to incorporate organisational themes and the patients' perspective. It needed to include a narrative of events as well as a timeline from the records; identify good practice; considering resource issues and organisational constraints.

A pilot of the new evidence based process was held with Tissue Viability link nurses in October 2013. This identified that staff had reservations about involving patients; they felt that this would not be possible due to capacity issues with many or it would lead to litigation. It was also apparent that staff did not identify the systematic or organisational issues. The template for recording the investigation was therefore amended and some guidance developed to support the process. This was tested with another patient and found to successfully identify contributing factors and issues not revealed through the traditional record review. The new investigation process was implemented in January 2014.

2. Methods

A second thematic analysis was performed to evaluate the new RCA process and the effectiveness of the PU competencies that had been implemented and completed throughout the trust. Thematic analysis is similar to content analysis, in that it provides a numerical description of the features of a set of text, but also allows for qualitative aspects of the extracted material to be analysed [11].

All of the completed RCA documents from January 2014-October 2014 were analysed and all root causes or contributing factors (as decided at the multi-disciplinary RCA meetings) were extracted. These were all then coded and put into themes and subthemes as they emerged. As part of the thematic analysis process, not only was the frequency of the codes analysed, but also the context in which they lie.

3. Results

A total of thirty two incidents were investigated. The mean age (range) of patients involved was 71 (5-96) and there were 14 males and 18 females involved (Table 1). The most common body site for PU occurrence was to the sacrum, followed by the buttocks.

Table 1 – Patient details

Patient	Sex	Age	PU location	Patient interview	Nutrition risk	Root cause found?	Was it avoidable?
1	M	59	Spine	Yes	Yes	Yes	Yes
2	F	53	Sacrum	No	Yes	Sequence of events	Yes
3	F	57	Buttock	No	No	Yes	No, patient had this PU on admission
4	F	68	Sacrum	Yes	Yes	Yes	No, patient admitted with a deep tissue injury
5	M	87	Sacrum	No	No	Sequence of events	Yes
6	F	81	Sacrum	No	No	Sequence of events	Yes
7	F	69	Sacrum	No	Yes	Sequence of events	Yes
8	F	75	Sacrum	No	Yes	Sequence of events	Yes
9	F	71	Sacrum	Yes	Yes	Sequence of events	Yes
10	F	84	Elbow	Yes	No	Sequence of events	Yes
11	M	77	Buttock	Yes	Yes	Sequence of events	Yes
12	M	55	Sacrum	Yes	Yes	Sequence of events	Yes
13	F	87	Sacrum	No	Yes	Yes	No - PU could not have been avoided due to co-morbidities of patient and skin tear already in situ
14	M	69	Buttock	Yes	No	Sequence of events	Unknown due to inadequate skin assessments, could have been present on admission
15	F	78	Sacrum	No	Yes	Sequence of events	Yes
16	M	81	Hip	Yes	Yes	Sequence of events	Yes
17	F	76	Buttock	Yes	No	Sequence of events	No - Sufficient evidence of good appropriate care
18	M	67	Spine	No	Yes	Sequence of events	Yes
19	M	69	Hip	No	Yes	Yes	Yes
20	F	5	Occiput	No	No	Yes	Yes
21	F	64	Sacrum	Yes	Yes	Sequence of events	Yes
22	M	67	Sacrum	No	Yes	Sequence of events	Yes
23	F	96	Buttock	Yes	Yes	Sequence of events	Yes
24	M	73	Sacrum	No	Yes	Sequence of events	Yes
25	M	76	Sacrum	No	Yes	Sequence of events	Yes
26	F	75	Ankle	No	Yes	Sequence of events	Yes
27	M	70	Sacrum	No	Yes	Sequence of events	Yes
28	F	87	Sacrum	No	Yes	Yes	No, patient end of life and admitted with C-Diff
29	F	68	Buttock	No	Yes	Yes	No - Found to be incontinence associated dermatitis
30	M	87	Sacrum	No	Yes	Sequence of events	Yes
31	M	84	Buttock	No	Yes	Yes	Yes
32	F	59	Buttock	Yes	Yes	Sequence of events	Yes

For only nine of the RCAs was a singular root cause found. In the majority of cases there would be a number of contributory factors which together would form a “sequence of events” which led to the PU developing. An example of this was an elderly lady who had multiple ward moves with poor communication on handover. She was then moved into a side room due to loose stools. Due to nursing culture surrounding barrier nursing, staff would be less likely to enter the side room which caused the patient’s low mood to worsen which in turn made the patient less likely to reposition themselves. This in combination with the poor skin condition caused by the loose stools led to the patient developing a category 3 PU.

3.1 Mobility

It was seen that there were two primary sources of pressure – either from a medical device, or due to reduced mobility. There were two device related PUs – one was from a neck collar and one from a Thomas splint. These were both due to these devices being used for longer than would normally be required. In the case of the neck collar there was a delay in clearing the c-spine due to the patient being acutely unwell. For the Thomas splint, the patient’s operation was postponed for 4 days due to the patient bleeding and requiring blood transfusions. The patient remained on heparin even though they were bleeding as it was felt the risk of DVT was greater than the risk of bleeding.

Thirty incidents were as a result of immobility in combination with other factors.

3.2 Nutrition

The largest contributory factor was poor nutrition, being identified in 25 of the RCAs. This could vary from patients refusing to eat, not liking the food provided or having a poor appetite to patients not being able to tolerate enteral feeding or having extended periods being nil by mouth. In these situations it is often only once that the PU has developed that the dietician becomes involved. A large number of these patients are admitted already malnourished and with a low BMI, although there was one example where a patient’s nutritional status was inaccurately assessed as the patient had a BMI of 38 on admission and was frequently eating, but was actually at risk of malnourishment because of the types of food that she was eating. In other circumstances there were patients who were assessed as not at risk of malnutrition by the nurses, but were found to have a low albumin on admission; however this information was not passed on to the nurses by the medical staff. This also gives an example of communication difficulties amongst the multi-disciplinary team.

3.3 Perfusion

The second most common contributory factor is medical conditions that affect the patient’s perfusion. This can either be through conditions that affect the patient’s central circulation such as sepsis, anaemia and persistently low oxygen saturation levels, or conditions that affect the patient’s peripheral circulation such as peripheral vascular disease. These tie in with inaccurate assessment of the patient’s level of risk – staff being unaware of how these factors make a patient more susceptible to developing a PU and therefore appropriate preventative care was not given.

3.4 Staffing

Issues with staffing came up a number of times; there is a section in the new RCA documentation where E-Rostering is checked for staffing levels and use of agency staff. 13 cases identified where

there were insufficient staffing levels to carry out the required interventions, and 5 cases where the level of acuity on the ward at that time led to patients receiving sub-standard care. An example of this was on a renal ward, where over one weekend there were eight renal transplants performed, therefore priority of care over this period was with these patients. In six cases it was felt that the patient wasn't being cared for in the most appropriate setting to meet their needs.

3.5 Repositioning

In 18 cases there were difficulties in repositioning patients – either due to patient factors (e.g. patient refusing to reposition) or medical factors limiting the ability to reposition the patient such as patients requiring an upright position for breathlessness, or patients being unable to reposition due to pain. There were a number of occasions where themes would overlap for example patients were not repositioned frequently enough because of insufficient staffing levels to deliver the care.

3.6 Skin

The vulnerability of the patient's skin remains a key factor in the development of PUs – in 8 cases there were issues with moisture (e.g. perspiration or incontinence) and in 9 cases there were other factors such as dehydration or medication (e.g. long term steroid use). In 6 cases the patients had persistent category 1 or 2 pressure damage with no change in their management plan and eventually developed into a more serious PU.

3.7 Equipment

Following the first thematic analysis, equipment for the prevention of PUs was addressed through the education and competency packages delivered. However, equipment remained a prominent theme; previously there might have been a delay in accessing pressure relieving equipment because of a lack of knowledge about the different equipment and risk not being accurately assessed, compared with now where there would be a delay in accessing equipment due to the level of acuity on the ward and staff not having enough time to order and transfer the patient on to a pressure relieving air mattress, especially over nights and weekends.

3.8 Patient/ relative information

Most of the investigations did not include an interview with the patient or relative. This was often because of delays between the PU being identified and the RCA being started, which meant the patient had either been discharged from hospital or had died. Some of the interviews with patients produced limited information (this reflected the investigators comfortableness with the process). Three interviews were very informative:

- One patient described feelings of physical and mental exhaustion (due to his new diagnosis of cancer and some radiotherapy followed by a chest infection), he knew the nurses were busy and didn't want to ask for help with moving. This was not identified by the staff who described him as 'mobile but refusing to get up or move'
- One relative commented on the air mattress alarming for a long time which the nurses did not identify
- One relative who had been very distressed by his father's PU attended the RCA meeting, he added details of the amount of time spent off the ward and helped to identify that although

his father could change position when asked, his short term memory loss resulted in him saying yes but then not actually moving, something which was missed by the nursing staff.

4. Discussion

These results are based on the specified root causes and contributory factors given in the reports. It appears that there has been little patient involvement in the process with less than half of the patients who developed a severe PU being interviewed (table 1). Previous research [10] has identified that organisational factors are often key in identifying the root cause; however this was not reflected in this study.

Damage caused by pressure from medical devices are not always reported and investigated as a PU incident, possibly due to the lack of evidence for risk factors and effective preventative interventions. The two incidents described prolonged use of the device but do not record this being considered a risk factor.

Immobility has been previously identified as one of the most prominent risk factors for PU development [11]. In an acute care setting, there are a number of different reasons as to why a person is immobile, from the nature of their medical condition that has brought them into hospital, to the treatment that they receive which reduces their mobility. Therefore early mobilisation and rehabilitation can help to reduce PU incidence. Delays in investigations, treatments and rehabilitation can therefore mean that a patient is immobile for longer and thereby increasing their risk of developing a PU; an example of how organisational factors can impact upon a patient's PU risk.

Poor nutrition in hospital patients is a known risk factor [12]. Previous studies have identified clinicians' failure to identify malnutrition risk and respond to increased risk of PUs [10], however this study did not identify why staff overlooked the patients nutritional needs or the barriers to communication between medical and nursing staff regarding nutrition.

The staffing issues are a reflection of organisational issues affecting much of the NHS at this time, however there was very little evidence of reasons why staff prioritised other care over PU prevention. One theory is that despite nurses holding a high value to PU prevention, other aspects of nursing such as medication rounds, bed management and doctors' rounds take priority over PU prevention [13, 14]. The notion of patients refusing care, particularly repositioning is notable due to the lack of exploration of the reasons for refusing care. Sometimes pain is cited but there was little evidence of effective pain management.

It is possible, that due to the nature of this study and the authors' involvement in the RCA process and investment in the reduction of PU incidence within the trust, this review could be subject to bias. This was minimised by extracting root causes and contributory factors directly from the documentation, and allowing the themes to emerge throughout the data extraction process. Also, the author who did the data extraction had just returned from maternity leave and so had no involvement in any of the RCAs included in this review.

5. Recommendations

- To improve the quality of the RCA process, and to help to identify the systemic and organisational failures that lead to a severe PU developing, the authors recommend including the patient's voice and interviews with staff involved in the patient's care. This can help in describing the scenes of events around the time of the incident.
- The research evidence suggests that lead investigators should be independent to the incident in order to minimise bias [10], however this is often not possible due to staffing, and the role of the lead investigator often falls to the ward manager where the incident occurred.
- Investigating causes of severe PUs is complex; there is very little research or written discussion about how to conduct an effective PU RCA.
- An MDT approach should be taken for both PU preventative care and the RCA process.

6. Conclusion

The current investigation process has identified key patient factors contributing to severe ulcers but the development of systems and organisational explanations is limited.

The quality of the RCA process is improved when it is completed by someone external to the patients care as it minimises bias. Patient and staff interviews also provide more of an insight into the ward environment and care delivery issues during the period leading up to the patient developing a PU. Despite a new evidence based process for investigation there is still scope for further improvement, and further research is required into the RCA process. Until we fully understand why severe PUs develop, we will be limited in our ability to prevent them.

7. Conflicts of Interest

None to declare

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