

Original Article

Cite this article: Clayton A, Griffiths S, and Gilbert P. (2023) Does the introduction of a formal neutropenic sepsis protocol improve therapeutic radiographer confidence and competence at recognising sepsis within the radiotherapy department? *Journal of Radiotherapy in Practice*. 22(e15), 1–7. doi: [10.1017/S1460396921000510](https://doi.org/10.1017/S1460396921000510)

Received: 22 April 2021

Revised: 23 July 2021

Accepted: 28 July 2021

Key words:

Radiotherapy; neutropenic sepsis; patient observations

Author for correspondence:

Siân Griffiths, Radiotherapy and Oncology, Royal United Hospitals Bath NHS Foundation Trust, Combe Park, Bath, BA1 3NG, UK. E-mail: siangriffiths2@nhs.net

Does the introduction of a formal neutropenic sepsis protocol improve therapeutic radiographer confidence and competence at recognising sepsis within the radiotherapy department?

Adam Clayton¹ , Siân Griffiths¹ and Philippa Gilbert²

¹Radiotherapy and Oncology, Royal United Hospitals Bath NHS Foundation Trust, Combe Park, Bath, UK and

²Advanced Practice, Royal United Hospitals Bath NHS Foundation Trust, Bath, UK

Abstract

Aim: The aim of this service review was to review whether implementing a formal training package increased therapeutic radiographer confidence and competence in recognising neutropenic sepsis in radiotherapy patients. In addition, authors also investigated whether the introduction of a weekly National Early Warning Score (NEWS) protocol had been successful in identifying cases of neutropenic sepsis.

Material and Methods: Therapeutic radiographer (n = 13) views on the new protocol were collected through an online questionnaire. A review of the clinical observation sheets of patients who received chemo-radiotherapy (n = 49) between 18 April 2019 and 31 October 2019 was undertaken. Information on disease site, NEWS scores, number of patients who had become neutropenic and action taken by therapeutic radiographers was collected.

Results: The majority of respondents to the questionnaire found that training benefitted both professionals and patients. Some challenges were highlighted relating to increased workload. For patients receiving regular observations, NEWS scores ranged from 0 to 4. When a patient scored on NEWS, the most common score was 1 across all treatment sites except cervix.

Findings: Implementing a neutropenic sepsis protocol appears to be beneficial to therapeutic radiographers as professionals, increasing their confidence in patient assessment and monitoring. Regular observations may help to identify deteriorating patients alongside clinical judgement and symptom reviews.

Introduction

Neutropenic sepsis is a life-threatening complication of cancer treatments – in particular chemotherapy, with mortality rates between 2% and 21% being reported in the adults.¹

A report by the National Confidential Enquiry into Patient Outcome and Death² reported issues in the management of neutropenic sepsis in adults receiving chemotherapy, with evidence of inadequate management of neutropenic fever and the need for urgent assessment and policies in organisations for dealing with neutropenic fever.

The introduction of more chemo-radiotherapy regimes has led to a greater need for therapeutic radiographers to have an increased awareness of patients at risk of developing neutropenic sepsis. There is a concern that patients themselves may be unable to distinguish between the signs and symptoms of neutropenic sepsis and the acute toxicities associated with radiotherapy treatment and therefore may not present out of hours if signs and symptoms develop.

Early in 2019, a patient at the Trust presented with multiorgan failure and died of neutropenic sepsis despite being on a course of daily radiotherapy, receiving regular on-treatment review and having been educated about the risks of neutropenic sepsis.

Therefore, an education training session for therapeutic radiographers and a formal protocol for regular review of patients undergoing chemo-radiotherapy were introduced. This aimed to help with earlier recognition of unwell patients and reduction in the risk of death due to neutropenic sepsis during radiotherapy and also increase therapeutic radiographer confidence and competence in recognising neutropenic sepsis in patients receiving radiotherapy.

Education was provided by the Trust's resuscitation nurses in a 2-h face-to-face session in the hospital simulation suite. The session covered training on how to take patient observations, how to interpret and record these results and when to refer for further advice or support. At the end of the session, a practice scenario was given so that each therapeutic radiographer could demonstrate their competence in the skills taught. Verbal feedback was given by therapeutic

| Physiological parameter | Score | | | | | | |
|--------------------------------|-------|--------|-----------|---------------------|--------------------|--------------------|------------------|
| | 3 | 2 | 1 | 0 | 1 | 2 | 3 |
| Respiration rate (per minute) | ≤8 | | 9–11 | 12–20 | | 21–24 | ≥25 |
| SpO ₂ Scale 1 (%) | ≤91 | 92–93 | 94–95 | ≥96 | | | |
| SpO ₂ Scale 2 (%) | ≤83 | 84–85 | 86–87 | 88–92 ≥93 on air | 93–94 on oxygen | 95–96 on oxygen | ≥97 on oxygen |
| Air or oxygen? | | Oxygen | | Air | | | |
| Systolic blood pressure (mmHg) | ≤90 | 91–100 | 101–110 | 111–219 | | | ≥220 |
| Pulse (per minute) | ≤40 | | 41–50 | 51–90 | 91–110 | 111–130 | ≥131 |
| Consciousness | | | | Alert | | | CVPU |
| Temperature (°C) | ≤35.0 | | 35.1–36.0 | 36.1–38.0 | 38.1–39.0 | ≥39.1 | |

Figure 1. National Early Warning Score scale.²¹

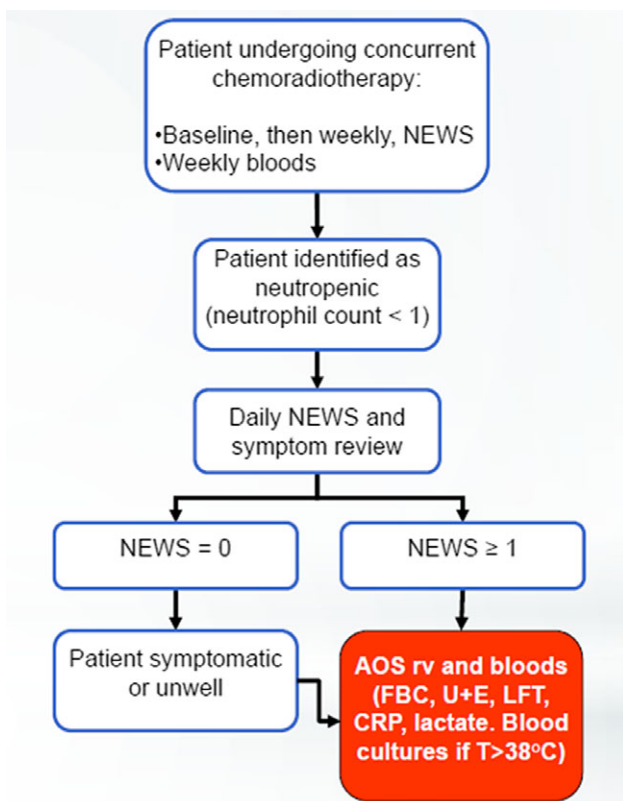


Figure 2. Flowchart for NEWS chemo radiotherapy protocol.

radiographers at the end of the session to aid in the development of future training and to ensure it had met their training needs.

After this training had been delivered, all patients undergoing chemoradiotherapy had a vital signs observation chart completed by the therapeutic radiographers to record their

National Early Warning Score (NEWS) (see Figure 1). Patients have baseline NEWS recorded on their first day of treatment followed by weekly observations. In addition, the patients receive weekly full blood counts and are closely monitored with daily clinical observations if they become neutropenic during treatment (neutrophils $<1 \times 10^9/L$). If the patients have a NEWS score of 1 or more, then a review of the patient is arranged through the Acute Oncology Service (AOS) (see Figure 2).

Literature Review

A literature review was conducted using the search terms ‘radiographer’, ‘radiotherapy’, ‘patient observations’, ‘vital signs’ and ‘sepsis’ across the CINAHL and Medline databases to review the current evidence base.

There were two studies conducted outside of the UK, which limit the comparisons that can be drawn with roles of therapeutic radiographers in the UK.^{3,4} Despite this, the authors highlighted the importance of a therapeutic radiographer’s role in providing basic nursing care.

*Snaith and Lancaster*⁵ investigated whether physical examination skills were a requirement for radiographers. Despite warning about the possibility of crossing professional boundaries, the authors argue that clinical assessment skills are a ‘requirement of radiographers’ practice’ in modern healthcare and suggested further development of education programmes to allow for learning of these skills. Whilst the authors draw some interesting conclusions on whether these skills would be suitable for radiographers to learn, due to its age, the role of radiographers may have changed making it less relevant to today’s healthcare. Furthermore, the article is not specific to clinical assessments for neutropenic sepsis and often leans towards discussion in the roles of diagnostic radiographers, rather than therapeutic radiographers who work with difficult groups of patients.

| Questions | Answers | | | |
|--|----------|--------|----------|--------|
| | Band 5 | Band 6 | Band 7 | Band 8 |
| What staffing band are you? | Band 5 | Band 6 | Band 7 | Band 8 |
| Do you feel confident from the training you have received, in taking physical observations for patients and being able to interpret the results? | Yes | | No | |
| Do you feel more confident from the training you have received, in identifying patients who may be at risk of developing neutropenic sepsis? | Yes | | No | |
| Do you feel you would benefit from annual refresher training on physical observations for recognising neutropenic sepsis? | Yes | | No | |
| Do you think that radiographers' receiving this training has benefitted patients? Why? | Yes | No | Comments | |
| Do you think you have benefitted from this addition training? How | Yes | No | Comments | |
| Have you noticed any negative implications to physical observations being implemented within the department? Where? | Yes | No | Comments | |
| Are there any other areas of training that you feel would benefit your role? | Comments | | | |

Figure 3. Radiographer questionnaire.

Aim

The aim of this was to review whether implementing a formal training package increased therapeutic radiographer's confidence and competence in recognising neutropenic sepsis in radiotherapy patients. In addition, authors also investigated whether the introduction of a weekly NEWS protocol had been successful in identifying cases of neutropenic sepsis.

Design and Methods

Therapeutic radiographers' opinions and attitudes were collected through the use of an online questionnaire (Figure 3). The use of an online questionnaire allows quick distribution to all participants included within the service review. Information about the questionnaire and the online link was emailed via NHS email to all therapeutic radiographers who had received the formal training in April 2019 ($n = 15$). The survey was created through the use of smartsurvey.co.uk where the answers are given anonymously and stored on a private account created within the website. Informed consent was implied through questionnaire completion. Unlike interviews or focus groups, questionnaires are less time consuming and do not require close contact with the participants which can significantly increase the response rate.⁶ Kelley⁷ contradicts this view arguing that lower response rates can occur due to 'going in cold'; however, as the researchers were known to participants, this is less likely. The questionnaire used a mixture of closed-response and open-ended questions. Although open-ended questions elicit more detailed responses from participants, using 'yes'

and 'no' responses to several questions allows for easier coding of responses as participants are forced to choose either a positive or negative response. Consideration was given to using a Likert scale response format, but due to the small sample size, a binary response format was felt to be more useful to help conclusions to be drawn.⁸ There is a risk that using only closed-response questions does not provide sufficient data to draw valid conclusions and therefore some open-ended questions were also included in the questionnaire. If a researcher wished to gain a more in-depth exploration of participant experiences, an interview technique rather than written questionnaire would normally be employed.⁸

A pilot questionnaire was distributed to radiotherapy students to check clarity and understanding. The students had received cascaded training from therapeutic radiographers and were therefore reasonable surrogates to check validity. No issues were raised about the questionnaire comprehension or formatting following the pilot study.

The Giorgi method⁹ was adopted to analyse the qualitative survey responses. This involves the researcher reading the data set several times to gain familiarisation with the responses before identifying common themes and further exploration and discussion of these to allow the meaning to be fully understood. The concept of 'bracketing' was employed during data analysis – this is the separation of the researcher's own beliefs to ensure that responses are interpreted correctly. A second researcher also reviewed the data to reduce potential bias and ensure that common themes were deduced. Any discrepancies were resolved through discussion.

A review of the clinical observation sheets of patients who received chemoradiotherapy in the local radiotherapy department

Table 1. Number of patients receiving chemo-radiotherapy, patient observations and NEWS scores of 1 or more by treatment site

| Treatment Site | No. of patients receiving chemo-radiotherapy | No. of patients who had regular observations | No. of patients who had NEWS score of 1 or more during radiotherapy |
|----------------|--|--|---|
| Head and Neck | 16 | 14 | 11 (78.6 %) |
| Brain | 13 | 12 | 7 (58.3 %) |
| Cervix | 8 | 8 | 8 (100 %) |
| Rectum | 7 | 7 | 2 (28.5 %) |
| Lung | 5 | 4 | 2 (50 %) |
| Total | 49 | 45 (91.8 %) | 30 (61.2 %) |

between 18 April and 31 October 2019 was also undertaken. Information was collected regarding disease site, NEWS scores, the number of patients who became neutropenic and what action was taken by therapeutic radiographers when a patient presented with a NEWS score.

The Trust's research department was approached, but it was decided that the format of this work was a service review and as such National Research Ethics Committee approval was not required.

Results

Questionnaire results

Out of a possible 15, there were 13 responses (86.7 %) to the survey.

Twelve therapeutic radiographers (92.3 %) responded 'yes' to feeling more confident in taking observations and recognising signs and symptoms of sepsis. However, they also stated that they believed annual refresher training would be beneficial.

When asked whether they felt training had benefitted patients, all respondents said 'yes'. Participant 7 stated 'patients must feel like they are getting a greater standard of care'. Participant 12 also commented on the experience for patients: 'monitoring patients can only be a good thing . . . it puts the patient at ease knowing they are being monitored'. Reassurance for patients was echoed as a theme throughout the responses alongside being able to recognise signs of neutropenic sepsis earlier and being able to better respond to changes in patients' wellbeing.

In addition, 11 respondents (84.6 %) reported that training was beneficial to them as professionals, commenting on confidence in assessing patients and referring to clinicians with participant 5 reporting they 'feel more confident and equipped in dealing with a symptomatic patient'. Several participants also commented the benefits of the training in terms of role expansion and continuing professional development (CPD) using phrases such as 'good role expansion' (participant 3), 'further develops the role of the therapeutic radiographer' (participant 7) and 'contributes towards CPD and extends our role' (participant 10). Only one of the two respondents who felt the training had not benefitted them expanded on this, stating 'taking obs at the pre-treatment stage is not often required . . . therefore I do not feel competent' (participant 11).

Four respondents (30.8 %) felt that carrying out regular patient observations had a negative impact with time and staffing pressures emerging as a common theme in the comments. Participant 2 stated that the protocol is 'difficult to manage when staffing is reduced', and these feelings were shared by the other respondents stating 'time pressures when the sets are busy'

(participant 1), 'additional pressure for staff' (participant 3) and 'when the department is busy and short staffed, its an added pressure' (participant 4). Although not a common theme, participant 4 also commented on 'AOS doctors not responding/taking a long time . . . and making you feel intimidated when making them aware of low score results'.

Ten respondents suggested other areas for training and development of therapeutic radiographers such as catheter care, wound dressings, suction and cardiac monitoring of patients with cardiac implanted electronic devices.

Review of clinical observation sheets

Forty-nine patients received chemo-radiotherapy between April and October 2019 for cancers of the brain, lung, cervix, head and neck and rectum (Table 1). Of these, 45 (91.8 %) had regular observations taken. Four patients became neutropenic during radiotherapy leading to daily observations, and four patients did not receive regular patient observations as per protocol, but there was no reason documented by therapeutic radiographers for this.

Thirty patients (61.2 %) had a NEWS score of 1 or more over 55 episodes during their radiotherapy. A NEWS score was most prevalent in cervix patients whom all scored 1 or more during observations during radiotherapy (Table 1).

NEWS scores ranged from 0 to 4. Where a patient did score on NEWS, the most common score (67.3 %) was 1 across all treatment sites except cervix where an equal number of NEWS scores were 2 (Table 2). Of the 55 episodes of a NEWS score of 1 or more, a documented review was undertaken in 48 episodes (87.2 %) as per protocol. The majority of reviews were conducted by AOS (n = 31), but some had clinician (n = 14) or clinical nurse specialist (n = 3) reviews. There was no formal review of the patient in 7 episodes (12.8 %) of a NEWS score of 1 or more as per protocol, but no reasons were documented by therapeutic radiographers. Radiotherapy was not withheld in any patients.

Of note, during this time period, nine patients who were receiving radiotherapy alone (and therefore were outside of the neutropenic sepsis protocol) but thought to be clinically unwell had clinical observations taken by therapeutic radiographers prior to a clinician review.

Discussion

Although chemotherapy is more often associated with neutropenic sepsis than radiotherapy,¹⁰ the introduction of more chemo-radiotherapy treatment regimens makes it imperative for the therapeutic radiographers to identify the signs and symptoms of neutropenic

Table 2. NEWS scores recorded by treatment site

| Treatment Site | NEWS score 0 | NEWS score 1 | NEWS score 2 | NEWS score 3 | NEWS score 4 |
|----------------|--------------|--------------|--------------|--------------|--------------|
| Head and Neck | 53 | 15 | 4 | 1 | 2 |
| Brain | 102 | 7 | 2 | 1 | 1 |
| Cervix | 0 | 7 | 7 | 2 | 0 |
| Rectum | 26 | 2 | 0 | 0 | 0 |
| Lung | 6 | 3 | 1 | 0 | 0 |
| Total | 187 | 34 | 14 | 4 | 3 |

sepsis. The audit showed all treatment site groups contained patients that scored 1 or more at some point during their treatment, with the largest proportions seen in the cervix and head and neck patients. These groups of patients would be receiving intravenous chemotherapy and so would be reviewed weekly by the clinicians and chemotherapy unit staff in addition to therapeutic radiographers. However, there were also a significant proportion of patients who had a NEWS score of 1 or more in the rectum and brain treatment site groups. These patients receive oral outpatient chemotherapy, and their only reviews would be with the therapeutic radiographers each day, supporting the requirement for therapeutic radiographers to have an awareness of chemotherapy-induced neutropenia and sepsis. The Society of Radiographers' Scope of Practice¹¹ supports this view, arguing therapeutic radiographers are ideally placed to assess patient well-being, having the benefit of seeing patients on a daily basis to advise, review and support them through treatment.

The audit showed 91.8 % patients who received chemoradiotherapy had regular observations alongside a small number of patients receiving radiotherapy alone. Therapeutic radiographers performing additional observations on patients outside of the written protocol suggest that they feel confident in identifying patients who are unwell and training has given them the skills to do this. Increased confidence as a result of training is well documented within the literature,¹² and this was further supported by questionnaire responses where therapeutic radiographers reported increased confidence in their role and a professional benefit to being trained in clinical observations. A significant number of therapeutic radiographers felt this additional training developed their role and contributed towards their CPD, helping to meet standards set by the Health Care Professionals Council (HCPC).¹³ To maintain their confidence and competence in clinical observations, 92.3 % of questionnaire respondents felt that they would benefit from annual refresher sessions. McEvoy et al.¹⁴ reported that refresher sessions increase the retention of cardiopulmonary resuscitation skills as well as showed a significant correlation between self-confidence and improved retention of skills. There is no reason to doubt that annual refresher training for patient observations would not be equally advantageous.

Despite the vast majority of the patients in the audit having a NEWS score of 0, neutropenic sepsis has a mortality rate of up to 21 %.^{1,12} Therefore, it is imperative patients displaying early signs of sepsis are identified quickly, supporting the introduction of a formal protocol to identify them. By comparing a baseline NEWS score with readings throughout treatment, therapeutic radiographers will be able to assess what is deterioration versus what is normal for the patient.¹⁵ A systematic review conducted

by Patel et al.¹⁶ found that extremes of NEWS scores (0 or 7 and more) gave more information about the likelihood of deterioration and the need for intervention, arguing there is a lack of evidence for action required with intermediate NEWS scores (1–6). This supports the need for clinical judgement and symptom review alongside NEWS scoring, helping to identify those patients who do not have neutropenic sepsis but are experiencing side effects from radiotherapy. This will potentially increase timely access to health professionals for management of these. There have been several studies attempting to identify risk factors for developing complications of chemotherapy and neutropenia so high-risk patients could have additional monitoring,¹⁷ however, they are limited in sample size and risk factors considered so more research is required.

The most common negative implication of the protocol introduction as identified by the therapeutic radiographers was the increased workload due to having to carry out patient observations alongside treating patients. This could be the reason for patients not being reviewed by the AOS team despite scoring on NEWS in seven episodes or did not receive regular observations at all, although the lack of documentation by therapeutic radiographers makes this difficult to verify. Increased workloads, when not managed effectively, can have a negative impact on an organisation and patient experience.¹⁸ Fisher et al.¹⁹ suggest task delegation and patient education as ways of managing increased workloads. This already occurs in the radiotherapy department whereby the treatment machines utilise a third therapeutic radiographer in addition to the two therapeutic radiographers delivering treatment. This therapeutic radiographer will carry out machine-associated and patient care tasks such as patient observations and symptom reviews. Patients are educated in group chemotherapy consent sessions about the risk of neutropenic sepsis and given details for the chemotherapy hotline if they develop symptoms out of hours. Reiterating this information at the beginning of radiotherapy may be helpful, particularly for those patients on oral chemotherapy who are reviewed less frequently.²⁰ Radiotherapy patient information leaflets could also be used to highlight this information to patients.

One of the questionnaire respondents stated that they 'felt intimidated' when contacting the AOS team regarding low scores, despite it being departmental protocol and them being involved in its design. Whilst this was not a recurring theme, it is important that staff feel confident in contacting clinicians should the need arise, and, therefore, it was provided as feedback to the relevant teams.

Limitations

This is a small-scale service review and as such the sample of therapeutic radiographers is small, containing varying levels of training and clinical experiences. As such, the findings are not wholly generalisable to other departments. However, key themes have emerged regarding the benefit to implementing a training package and protocol to help detect neutropenic sepsis in patients undergoing chemo-radiotherapy. The training package and protocol could be adopted within other radiotherapy centres, allowing for a larger sample of therapeutic radiographer views and patients to validate the findings in a wider clinical context.

The questionnaire design does lead to limitations when analysing participant responses. Whilst a binary-type response does enable easier data analysis with small sample sizes, it does not always allow for sufficient data to draw valid conclusions. In the

future, further consideration to using a Likert scale format in the questionnaire or an interview or focus group alongside the questionnaire to allow for an in-depth exploration of therapeutic radiographer opinions and experiences of working within the neutropenic sepsis protocol should be given. This would help to increase the validity of conclusions drawn and increase the evidence base to allow for other radiotherapy departments to adopt and develop a similar protocol.

Whilst the questionnaire obtains therapeutic radiographer views of a neutropenic sepsis protocol in the radiotherapy department, it may be useful to also gather the views of clinicians. Whilst obtaining a set of observations prior to clinical assessment of the patient may be beneficial, it is unclear whether this protocol has increased the workload of the clinicians by increasing the number of reviews required. Obtaining their views would give a better insight into the benefits and drawbacks of such a protocol on the wider multi-disciplinary team.

Impact on Practice

The neutropenic sepsis protocol has been fully implemented within the authors' department for all chemo-radiotherapy patients with support from the therapeutic radiographers and the AOS team. Regular training sessions are provided to ensure all staff remain confident and competent in their skills. Future audit and review are essential in ensuring that the protocol remains relevant to clinical practice and that the training package continues to meet the learning needs of the therapeutic radiographers. Further development of the questionnaire design would help to increase the validity of the conclusions drawn and could lead to a similar protocol being introduced in other UK radiotherapy departments.

Conclusion

The introduction of more chemo-radiotherapy regimes in cancer mean it is imperative that therapeutic radiographers are trained in the identification and management of chemotherapy side effects.

The introduction of a training package for therapeutic radiographers in taking clinical observations and NEWS scoring appears to be beneficial to therapeutic radiographers as professionals and increases their confidence in patient assessment and monitoring. Additional training also helps to fulfil some of the requirements of lifelong learning set out by the HCPC regulatory body. However, questionnaire responses also indicate continued education and training is required to maintain confidence and competence in skills. Following this, patient observations training has been added to the standard induction package for new therapeutic radiographers as well as annual refresher training.

Baseline and regular clinical observations of patients throughout treatment allow for better assessment of whether a NEWS score represents deterioration in the patient's condition although there is still a lack of evidence regarding the implication of an intermediate NEWS score. It is therefore essential that clinical judgement and a detailed symptom review are utilised alongside clinical observations. This will also benefit patients who do not have neutropenic sepsis but are experiencing side effects of radiotherapy and/or chemotherapy, allowing them quicker access to a healthcare professional for management of these. More research into risk factors for neutropenic sepsis should be encouraged to allow for targeted monitoring of those patients at higher risk.

Introduction of an observations protocol will undoubtedly have an implication on department workload, but ways of managing this such as task delegation and patient education can help to overcome this. Despite this, the protocol has been fully implemented into routine use within the authors' department. Future audit is recommended to ensure that the protocol remains relevant to department practice by gaining clinician opinions and of the training package to ensure that it continues to meet therapeutic radiographers' requirements.

Acknowledgements. None.

Financial Support. This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

Conflicts of Interest. The authors declare none.

References

1. National Institute for Clinical Excellence. *Neutropenic Sepsis: Prevention and Management in People with Cancer*. [Online]. 2012. <https://www.nice.org.uk/guidance/cg151/chapter/Introduction#managing-suspected-neutropenic-sepsis-in-secondary-and-tertiary-care-2>. Accessed 17th February 2020.
2. National Confidential Enquiry into Patient Outcome and Death. *Systemic Anti-Cancer Therapy: For Better, for Worse?* [Online]. 2008. <https://www.ncepod.org.uk/2008sact.html>. Accessed 17th February 2020.
3. Vancakvičienė A, Macijauskienė J, Blaževičienė A, Basevičius A, Andersson B. Assessment of radiographers' competences from the perspectives of radiographers and radiologists: a cross-sectional survey in Lithuania. *BMC Med Educ* 2017; 17: 1.
4. Andersson B, Fridlund B, Elgán C, Axelsson Å. Radiographers' areas of professional competence related to good nursing care. *Scand J Caring Sci* 2008; 22 (3): 401–409.
5. Snaith B, Lancaster A. Clinical history and physical examination skills – a requirement for radiographers? *Radiography* 2008; 14 (2): 150–153.
6. Sahlqvist S, Song Y, Bull F, Adams E, Preston J, Ogilvie D. Effect of questionnaire length, personalisation and reminder type on response rate to a complex postal survey: randomised controlled trial. *BMC Med Res Methodol* 2011; 11 (1): 62–70.
7. Kelley K. Good practice in the conduct and reporting of survey research. *Int J Qual Health C* 2003; 15 (3): 261–266.
8. Polgar S, Thomas S. *Introduction to Research in the Health Sciences*, 4th edition. Elsevier Churchill Livingstone: London, 2000.
9. Whiting L. Analysis of phenomenological data: personal reflections on Giorgi's method. *Nurse Res* 2001; 9 (2): 60–74.
10. Bate J, Gibson F, Johnson E, Selwood K, Skinner R, Chisholm J. Neutropenic sepsis: prevention and management of neutropenic sepsis in cancer patients (NICE Clinical Guideline CG151). *Arch Dis Child* 2020; 98 (2): 73–75.
11. The Society and College of Radiographers. *Code of Professional Conduct*. [Online]. 2013. <https://www.sor.org/learning/document-library/code-professional-conduct>. Accessed 30 September 2020.
12. Moran S, Warren-Forward H. Development of a training package to increase the performance of radiographers in assessing screening mammograms. *Radiographer* 2011; 58 (2): 10–13.
13. The Health and Care Professions Council. *'Standards of Continuing Professional Development'* [Online] 2020. Available at: <https://www.hcpc-uk.org/standards/standards-of-continuing-professional-development/>. Accessed 24 August 2020.
14. McEvoy N, Patton D, Walsh S, O'Connor T, Moore Z, Nugent L. What is the effect of frequent basic life support refresher sessions on health care professionals' retention of cardiopulmonary resuscitation skills? A systematic review. *J Educ Pract* 2018; 9 (29): 22–31.
15. Nazarko L. *'How to Read the NEWS: The New Early Warning System'*. [Online]. 2020. <https://www.independentnurse.co.uk/professional-article/how-to-read-the-news-the-new-early-warning-system/218551/>. Accessed 29 September 2020.

16. Patel R, Nugawela M, Edwards H, Richards A, Le Roux H, Pullyblank A, Whiting P. Can early warning scores identify deteriorating patients in pre-hospital settings? A systematic review. *Resuscitation* 2018; 132: 101–111.
17. Lyman G, Lyman C, Agboola O. Risk models for predicting chemotherapy-induced neutropenia. *Oncologist* 2005; 10 (6): 427–437.
18. Wilkinson E. UK NHS staff: stressed, exhausted, burnt out. *Lancet* 2005; 385 (9971): 841–842.
19. Fisher R, Croxson C, Ashdown H, Hobbs F. GP views on strategies to cope with increasing workload: a qualitative interview study. *Brit J Gen Pract* 2017; 67 (655): e148–e156.
20. Handley N, Schuchter L, Bekelman J. Best practices for reducing unplanned acute care for patients with cancer. *J Oncol Pract* 2018; 14 (5): 306–313.
21. Royal College of Physicians. National Early Warning Score (NEWS) 2. 2017. <https://www.rcplondon.ac.uk/projects/outputs/national-early-warning-score-news-2>.