Radiography 25 (2019) 235–240

Contents lists available at ScienceDirect

Radiography

journal homepage: www.elsevier.com/locate/radi

Acceptability of a new practice development for radiographers focussed on reducing 'never events' related to nasogastric feeding tubes in adult patients

G. Roe*, H. Lambie, A. Hood, D. Tolan

Department of Radiology, St James's University Hospital, Leeds Teaching Hospitals Trust, Beckett Street, Leeds, LS9 7TF, UK

ARTICLE INFO

Article history:
Received 28 September 2018
Received in revised form
25 January 2019
Accepted 4 February 2019
Available online 19 February 2019

Keywords:
Nasogastric feeding tubes
Radiographer
Patient safety
Practice development
Never events

ABSTRACT

Introduction: Ascertain if a new practice development designed to reduce 'never events' from feeding through misplaced nasogastric tubes (NGT) in a large teaching hospital Trust was acceptable to a large radiography workforce.
Methods: Despite National Patient Safety Agency guidance advising on safe practice for confirming position of NGTs a number of 'never events' still occur nationally due to misinterpretation of the check X-ray. A new practice development for radiographers included providing an immediate comment and removal of misplaced NGTs at the time of the check X-ray examination. Success of the new system was partly assessed using qualitative and quantitative measures of radiographer opinion of the training and different aspects of the system.
Results: There was a significant improvement in radiographers' level of confidence in image interpretation after training (58/98 positive responses before, 89/98 positive after training) and after five months of experience at undertaking the role (96/98 positive) ($p < 0.01$). There was increased confidence in NGT removal post training and with five months of experience (16/95 positive before training, 67/96 positive after and 81/95 positive with five months of experience). 97/98 (99%) of radiographers agreed the new system benefits patients, 93/98 (95%) believed it a positive step for the radiography profession.
Conclusion: Evaluation of this new practice development has shown it was embraced by radiographers and is a workable and potentially cost-effective solution in addressing real time image interpretation issues that were evident from previous 'never events'. Large scale implementation of this system across the NHS Radiography workforce should be considered.

Introduction

National guidance was issued in 2005 and 2008 regarding placement of nasogastric tubes (NGT) due to a number of deaths and cases of harm arising from misplaced tubes.[1,2] These adverse events persisted, with the majority being due to misinterpretation of the check x-ray image by ward staff. In 2009 feeding through a misplaced NGT was declared a 'never event' by the Department of Health (DoH).[3]

Our own large teaching hospital National Health Service (NHS) Trust encountered some of these 'never events'. Local and national investigations into such 'never events' identified four main issues pertaining to the check x-ray image that had to be addressed (Fig. 1). These major causative factors were addressed in order to prevent further 'never events'.

Evidence outside this Trust supported the use of radiographers taking a more active intervention at the time of the check x-ray image for NGT position.[4-6] It was identified that radiographers could play an integral part in patient safety but that this would involve a culture change and a large scale development in professional practice to enable it.[6,7]

The practice change regarding NGT consisted of developing two main roles for radiographers: first consistently accurate commenting of the tube position on the image; and second taking on a defined role in NGT management by removing misplaced tubes. Tube removal had not been undertaken previously by general

* Corresponding author.
E-mail addresses: gillsmurray@gmail.com (G. Roe), hannahlambie@nhs.net (H. Lambie), adrian.hood@nhs.net (A. Hood), damian.tolan@nhs.net (D. Tolan).

https://doi.org/10.1016/j.radi.2019.02.002

a) delays in obtaining the radiograph, leading to delays in feeding
b) delays in interpretation of the radiograph, leading to delays in feeding
c) interpretation of the wrong radiograph (e.g. reading a previous radiograph and not the most recent one or reading one from a different patient)
d) misinterpretation of NGT position on the correct radiograph [1,2]

Figure 1. Check NGT x-ray image issues to be addressed by the Trust[1,2].

radiographers in this Trust but was utilized in a smaller NHS Trust in Bristol.[6] Radiographers were also tasked with arranging for ward staff to attend the X-ray department to advance NGTs that were not far enough into the stomach to be deemed safe to feed. A training programme was created to provide the requisite education, skill development and reassurance through team working to allow the new service to commence which was on a larger more complex scale than attempted previously.[6]

Investigations of previous 'never events' highlighted a number of learning cases in which the wrong X-ray image was reviewed.[2] To help reduce this risk a sticker system was designed by radiology staff for all NGT patients having check x-ray images. A removable sticker is attached to the end of the NGT feeding port following each x-ray. This states the date and time of the x-ray and acts as a reminder to ward staff to check the correct image and the comment before they connect the tube for feeding.

There is strong evidence to support this practice change from improved interpretation accuracy.[8] This novel approach to patient safety is supported by the radiography professional body and by an alternative system in a smaller NHS Trust.[5,7]

The aim of the study is to ascertain the acceptability of this new system by the large radiography workforce.

Methods

Training

A training and test package was designed by a gastrointestional (GI) advanced radiographer practitioner and a senior GI radiology registrar. The training was delivered by these two staff members and a small team of four radiographer 'key trainers'. This package was delivered over a 90 min period and contained the theory behind the new system, examples from prior 'never event' investigations and evidence from the literature.[9]

All 104 radiographers working in the general X-ray department across two main hospital sites were targeted to undertake this practice development. To ensure coherence across the department, all consultant and trainee radiologists (over 100) also underwent tailored training.[5,7,9]

In order to further support radiographers professionally, reassurance was given that the final decision to use the NGT (and therefore the overall responsibility) rested with the doctor caring for the patient on the ward.[10]

The success of the new system was assessed in two ways. First to provide quality assurance by assessing the accuracy of radiographer comments and second by qualitative and quantitative measures of staff opinion by asking how the radiographers feel about different aspects of the system.[8] This paper will focus on this second aspect.

Evaluation

The system evaluation (paper-based questionnaire) consisted of seventeen questions with sub-questions using a Likert scale, categorical questions and free text options in order to obtain the relevant information (appendix).

The questionnaire was piloted on two experienced members of staff and changes made from their feedback.[11] The questions were based on assumptions that the same issues would be applicable to other trusts and therefore improve the external validity and generalizability.[11]

Involvement of all relevant radiographers in the practice development and completion of the questionnaire was mandatory. However, the inclusion of their questionnaire responses in the study was voluntary and so it was necessary to obtain informed consent.[11] Three radiographers withheld consent and three returned their questionnaire after the deadline so were not included, leaving 98 of 104 eligible respondents (94.2% response rate).

Ethical approval was obtained from the School of Healthcare Research Ethics Committee as this was part of a Masters Degree thesis (SHREC/RP/394R, University of Leeds). The local NHS organization was satisfied that no additional NHS ethical approval was required.

Information required to evaluate the NGT system was constructed from experiential knowledge of issues already in existence within the Trust, the consensus views of staff and topics discussed in the published literature.[5,7] The following categories were evaluated; adequacy of training and resources, access to equipment, radiographer opinion on benefits to the profession and the patient, radiographer levels of confidence with different aspects of practice development, levels of support within the department, and finally problems encountered within and outside of the department.

Data analysis

All radiographers were surveyed five months post implementation of the new system and were asked to grade their level of confidence at three specific time points; before they had their NGT system training, at the time of implementation and five months post implementation. A one-tailed Wilcoxon signed rank test using the Monte Carlo method was used to assess any improvement in these levels of confidence as these data sets were non-parametric.[11] The responses were analyzed using statistical tests, frequency analysis and descriptive statistics and open-ended questions were analyzed for themes using IBM® SPSS® Statistics version 21.0.0.1. (Armonk, New York, USA). Missing data was not imputed, but was excluded from the overall responses to that question. Any free text comment repetitions were included in the results section they pertained to.

Results

Training

92% (90/98) of respondents stated that the amount of training was 'about right' with 7% (7/98) being concerned that it was 'too little' and 1% (1/98) stating it was 'too much'. 72% (71/98) of respondents were satisfied with the style of training they had with the majority of staff (51%, 50/98) having had training in small groups (Fig. 2).

A total of 90% (88/98) of respondents put forward suggestions for how training could be improved (Fig. 3). Over 50% of respondents felt that more image viewing and practice at completing the auto report would be beneficial (63%, 62/98 and 55%, 54/98 respectively).

30% (29/98) of respondents stated that training would be improved by making it more interactive which is supported by themes from free text analysis.

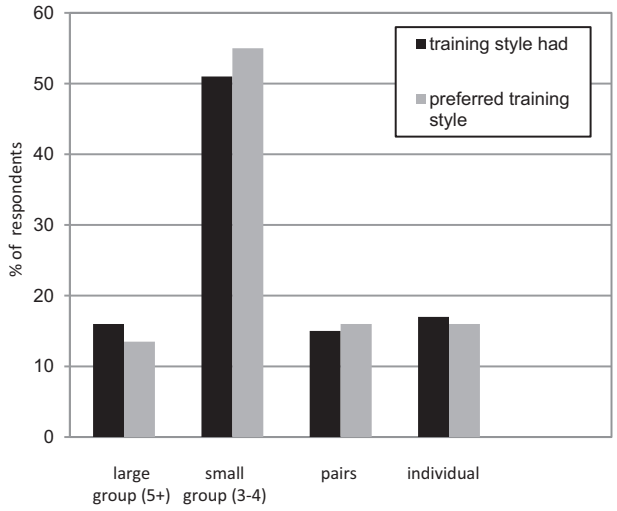

Figure 2. Style of training.

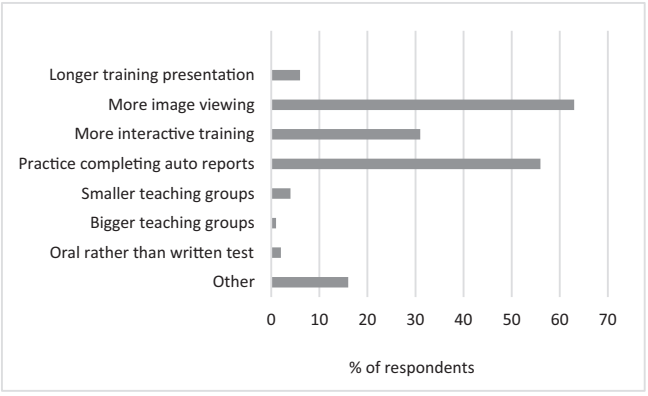

Figure 3. How could training have been improved?

Radiographer levels of confidence

A one-tailed Wilcoxon signed rank test using the Monte Carlo method showed a significant subjective improvement in the confidence levels of the respondents in their roles between the different time points (pre and post training and with five months of practical experience).

In relation to the respondents' levels of confidence in *commenting* on the NGT image there was a significant improvement after the training ($z = -6.232$, 9/98 negative responses, i.e. responses of 'very unconfident' or 'unconfident' and 89/98 positive responses, i.e. responses of 'confident' or 'very confident) compared to before their training (40/98 negative and 58/98 positive responses) ($p < 0.01$) and also after five months of experience of the system ($z = -4.902$, 2/98 negative and 96/98 positive responses) when compared to immediately after the training ($p < 0.01$).

This is also evident in the levels of confidence of the respondents regarding NGT *removal* as once again there was significant improvement after training ($z = -7.359$, 79/95 negative and 16/95 positive responses before, 29/96 negative and 67/96 positive responses after training) ($p < 0.01$) and subsequently after obtaining some practical experience ($z = -5.667$, 14/95 negative and 81/95 positive responses) ($p < 0.01$).

The theme in 21% (21/98) of free text comments was of confusion regarding certain aspects of the system which was resolved once they had their training. However, three staff stated that they were low in confidence due to minimal exposure to NGT check x-rays since they were trained.

Levels of support within the department

98% (96/98) of respondents felt well supported by radiographer trainers and other radiographers. 62% (61/98) of respondents also felt they were well supported by radiologists. Of those that felt unsupported by radiologists, this was usually related to interpretation performed out of hours (33%, 32/98) and reiterated in free text responses.

"It's your colleagues who are most helpful when you have an NG tube that's not visualised"
"Radiologists have always been keen to help with any 'borderline' cases"
"I requested an addendum from on-call radiologist…they did not understand the problem…not enough training (for the radiologists)?"

Access to equipment

Most respondents felt they had sufficient access to the necessary equipment. However, 23% (23/98) lacked access to equipment required to make a confident interpretation of the image; a diagnostic Picture Archive and Communication System (PACS) reporting grade monitor as opposed to IMPAX (PACS software on a standard hospital PC which has lower resolution) and 18% (18/98) had occasionally been unable to access the training resources due to limited access to computers (Table 1). This was supported by analysis of free text with 72% of comments referring to this.

Radiographer opinion on benefits to the profession and patient

95% (93/98) of respondents felt that this practice development was a positive step for the radiography profession, with 41% of free text comments indicating the new system was a positive step for the profession and the Trust. Although 72% (71/98) of respondents agreed it would raise the profile of radiographers, 24% (24/98) thought it would have no effect or a detrimental effect. Of that 24%, the main concerns were that radiographers would be seen as a nuisance to ward staff and that, even though it was an increased role for radiographers, it would not be recognized outside of radiology in this way.

99% (97/98) of respondents were confident this practice development benefits the patient. However, five respondents were concerned that it may not *always* benefit the patient as it encouraged ward doctors to rely upon radiographer comments and not review the image themselves. There was also concern (twelve responses) that ignorance of the system on wards could compromise safety.

Improvements to NGT system

37% (36/98) of respondents made suggestions for how the new NGT system could be improved, with five main themes. The

Table 1
Access to necessary equipment

	Yes (%)	No (%)	Not applicable (%)
IMPAX	95 (97)	2 (2)	1 (1)
PACS	75 (77)	23 (23)	0
Radiology information system	98 (100)	0	0
PCs for training	79 (81)	18 (18)	1 (1)

commonest suggestion (eleven responses) was for standardization of all NGTs, which related to use of wide bore drainage NGTs, rather than fine bore feeding NGTs for which this system is aimed. A proportion of the suggestions (19%, 19/98) highlighted that communication with some wards had not been satisfactory and that there was still a lack of knowledge of the new system. There was also a theme (ten responses) that some training issues could be addressed to improve the system both on the wards and in radiology.

Problems encountered within and outside of the department

The majority of problems consisted of being unable to contact wards and clinics to pass on information and negative attitudes from ward and clinic staff, with 78% (76/98) of respondents experiencing one or more of these issues. These figures were supported by five themes that came out of the free text analysis: a lack of understanding of practice development by ward staff, communication issues with wards, negative attitudes from ward staff, problems obtaining aspirate details and issues with the hospital portering system.

66% (65/98) of staff had accessed the educational resource file once or twice in the study period. Of the 34% (33/98) who had never accessed it, two radiographers commented that they were unaware of its existence.

Discussion

In the UK, Law and colleagues described the requirement for culture change in NGT management in order to address the safety issues.[5] This not only applies to medical and nursing staff but also allied health professionals.[5]

Law and colleagues described an extension to an existing NGT service provided in North Bristol by the GI radiography team.[6] Due to the service provision in our own Trust, available across five hospital sites and eight different X-ray departments, while also taking into account different shift patterns and working hours, the GI radiography team alone was not in a position to provide a service similar to that in North Bristol. Therefore, a new system was created. Since implementation of this system no NGT related 'never events' have been reported in the Trust.

Adequacy of training and resources

There was a positive response regarding the volume of training delivered which was reflected in the reduced number of respondents expressing a degree of under confidence after the training (9/98) compared to before training (40/98) in relation to image interpretation. Five months after the training this had further reduced (to 2/98 negative responses) which confirms the training had a successful impact and that this was built on through utilization of this knowledge and skills. The training for tube removal was also effective with an increase in positive responses to 67/96 (from 16/95) and this was further improved after five months of practical experience (81/95). The experience each respondent had in the five months post training was varied in both exposure to image commenting and tube removal which explains the variance in the number of respondents who remain under confident to some degree with commenting and tube removal.

The statistically significant increase in confidence after training and with five months of clinical experience of the system indicates that the training program was effective in building on the existing knowledge and skills that radiographers possessed and that, with experience in undertaking these roles, their confidence further increased.

Although improvement in confidence indicates the content of the training was adequate, a number of respondents would have preferred more practical training. The training was intentionally designed to be focussed and straightforward, to avoid overloading radiographers with information and potentially reduce engagement with knowledge retention.[12] Training included the theory behind the practice change, scenarios from the workload in the Trust and interactive image viewing. The participants were also informed of a resource file containing a copy of the training presentation for perusal at their own pace at any point after the training. This approach to the training aimed to capture the different learning styles (activists, reflectors, theorists and pragmatists) within the large group of staff as set out by Honey and Mumford.[13]

Having to capture such a large body of staff with one method of training was a challenge and it is through this evaluation that we have highlighted varying preferences for learning between radiographers (e.g. individual training versus large group and a preference for more practical training). This concurs with studies from the literature which discuss the values and concerns of different training styles such as group or individual training or web-based methods and should be borne in mind for future training plans.[14]

This training satisfies guidance set by the Society and College of Radiographers (SCoR) stating that radiographers providing an immediate image interpretation service for NGT check x-ray images can successfully do so with appropriate education and training.[7]

Radiographer levels of confidence

Some of this data regarding the levels of confidence felt by the radiographers was gathered retrospectively (the pre and post training data). The reflective nature of their responses gave insight into their journey from first learning about the new system to incorporating it into daily practice. The data relating to the five month time point was obtained prospectively.

The results from this data confirm that both appropriate training and practical experience were key requirements in the successful implementation of this new system.

Radiographer opinion on benefits to the profession

95% of respondents agreed that this practice development was a positive step for radiography which supports studies demonstrating other types of role extension that have been fully embraced.[15]

Despite this only three quarters of respondents believed it would raise the profile of radiographers within the Trust. From the difference in responses to these two questions it could be argued that radiographers perceive that they are not highly valued when undertaking this role.

Taking on this new practice development highlights a change in attitude and culture towards allied health professionals that was proposed by the DoH in 2000. This document postulated that health services should be developed around the skills of staff rather than their job title and the boundaries of professional practice within radiography should shift.[15,16] This is further supported in the recent NHS England Allied Health Professions into Action document.[17]

Problems encountered within and outside of the department

Over half of respondents reported negative attitudes from ward doctors and a third from nurses. Qualitative analysis of the free text

answers has shown that ward staff were unaware of the new system or misunderstood it:

"…lack of understanding from referrers…"
"…wards need to be more aware of how system works, seems they don't know what's happening…"

It is likely that these negative attitudes were due to poor communication of the details of the new system to wards which is often a challenge in a large hospital Trust. This was despite specific promotion of the new system through management teams across all clinical specialty groups.

Almost two thirds of respondents stated they had difficulties in contacting wards to relay messages relating to the NGT. These communication issues are acknowledged, and, on some occasions, patients waited longer in the X-ray department than preferable to have their tube advanced before returning to the ward. We would consider that such concerns are outweighed by the benefits of not returning the patient to the ward with a misplaced tube, and this is an essential safety feature of this new system which ultimately could prevent harm and save lives.[4]

The reported issues regarding aspirate details related to referrers not stating the ph/inability to obtain aspirate which made it impossible to justify the imaging request.

Levels of support within the department

The level of engagement from radiographers achieved in this process was exemplary and supports practice development as a way of transforming culture and enabling emancipatory change both personally and within clinical teams.[12] It has brought together the radiographers in various departments with a feeling of greater teamwork when undertaking this role, evident in the questionnaire responses in which the majority of respondents felt supported by their radiology colleagues.

In terms of emancipation within their roles a number of radiographers stated that they were experiencing this:

"...more hands on with the comment and more responsibility… when removing [tubes]/saying they are in the right place. Our opinions are now valued and backed up by this training…"
"…I feel …one of the problems of the radiography profession is a lack of input at a basic level to influence patient outcomes… these small steps are key to developing the role of the radiographer and…improving patient outcomes…"

Over the past two decades there has been an increasing focus on supporting innovation within organizations and clinical teams to ensure delivery of a quality service.[5,18,19] The approach to NGT management in North Bristol is an example of the kind of innovation that drives organizations forward in terms of safety and quality. This was the foundation on which this practice development was built.[4,5] This is a system whereby quality is at the heart of practice and individual patient care is the number one priority, which concurs with the vision of the High Quality Care For All: NHS Next Stage Review Final Report.[8,18]

Limitations

There are some limitations to our research. The questionnaire was not a pre-validated questionnaire. However, measures were taken to maximize the validity such as conducting a small pilot amongst colleagues and utilizing validated question formats from the literature.[11] The risk of bias regarding questionnaire completion is acknowledged due to the working relationship of the researcher with other members of the radiography team. It was not possible to obtain the levels of confidence of radiographers in a pre-test/post-test fashion and all opinions were gathered at the same point in time, which may have resulted in recall bias.[11,20] There was also no control group against which to measure the true effect of the training on the radiographers. This practice development had to be undertaken by all staff and without delay in order to ensure consistency across the Trust. This does limit the assumptions made from the Wilcoxon test as, although there was a significant difference in levels of confidence before and after training, it is not known to what proportion of this was related to the training element.[20]

Conclusion

The positive responses from radiographers undertaking a new active role in the assessment of patients having NGT for feeding, alongside accuracy of interpretation of images, supports this practice development.[8] It is supported by the SCoR and Health and Care Professions Council and should be considered for wider adoption in the NHS.[2,7,21] Several publications support a variety of different aspects of radiographer role development and this role in NGT management could feasibly be added to this growing list.[10,12,22,23] The overall success of the implementation of this practice development in the large teaching hospital Trust indicates that it could be implemented into other trusts as a way of reducing NGT 'never events' nationally.

Conflict of interest statement

No conflicts of interest.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.radi.2019.02.002.

References

1. National Patient Safety Agency. *Reducing the harm caused by misplaced nasogastric feeding tubes*. 2005. https://improvement.nhs.uk.
2. National Patient Safety Agency. *Incidents related to nasogastric tubes*. 2008. https://improvement.nhs.uk.
3. NHS Improvement. *Never events list 2018*. 2018. https://improvement.nhs.uk.
4. Law R. Problematic fine bore nasogastric intubation : a radiographer led service development. *Radiography* 2008;**14**:82–4. https://www.radiographyonline.com/.
5. Law R, Pullybank AM, Eveleigh M, Slack N. Avoiding never events: improving nasogastric intubation practice and standards. *Clin Radiol* 2012;**68**(3):239–44. https://www.clinicalradiologyonline.net.
6. Law R. *Reducing the risk of a nasogastric intubation 'never event': a radiographer led service development. Imaging and Therapy Practice*. 2011. August, https://www.radiographyonline.com/.
7. Society and College of Radiographers. *Radiographers and naso-gastric (NG) intubation*. 2nd ed. 2012. http://www.sor.org.
8. Roe G, Harris K, Lambie H, Tolan D. Radiographer workforce role expansion to improve patient safety related to nasogastric tube placement for feeding in adults. *Clin Radiol* 2017;**72**(6):518.e1–7. https://www.clinicalradiologyonline.net.
9. Chin H, Totterdell B. Practice development in healthcare service reform. *Nurs Manag* 2009;**16**(1):24–8. https://www.ncbi.nlm.nih.gov.
10. Hardy M, Culpan G. Accident and emergency radiography: a comparison of radiographer commenting and 'red dotting'. *Radiography* 2007;**13**:65–71. https://www.radiographyonline.com/.

11. Bowling A. *Research methods in health: investigating health and health services*. 3rd ed. Maidenhead: Open University Press; 2009. https://www.dawsonera.com.
12. Manley K, McCormack B. Practice development: purpose, methodology, facilitation and evaluation. *Nurs Crit Care* 2003;**8**(1):22–9. https://www.ncbi.nlm.nih.gov/pubmed/12680515.
13. Rasool GH, Rawaf S. Learning style preferences of undergraduate nursing students. *Nurs Stand* 2007;**21**(32):35–41. https://search.proquest.com.
14. Garzonis K, Mann E, Wyrzykowska A, Kanellakis P. Improving patient outcomes: effectively training healthcare staff in psychological practice skills: a mixed systematic literature review. *Eur J Psychol* 2015;**11**(3):pp535–56. https://www.ncbi.nlm.nih.gov.
15. Price RC, Le Masurier SB. Longitudinal changes in extended roles in radiography: a new perspective. *Radiography* 2007;**13**:18–29. https://www.radiographyonline.com/.
16. Department of Health. *Meeting the challenge: a strategy for the allied health professions*. 2000. http://www.official-documents.gov.uk/.
17. NHS England. *Allied health professionals into action*. 2017. https://www.england.nhs.uk/wp-content/uploads/2017/01/ahp-action-transform-hlth.pdf.
18. Trust A. *Vision statement*. 2014. http://www.leedsth.nhs.uk/about-us/the-leeds-way/.
19. Department of Health. *High quality care for all: NHS next stage review*. Final report. 2008. http://www.official-documents.gov.uk/.
20. Peat J, Barton B, Elliott E. *Statistics workbook for evidence-based health care*. Chichester: Wiley-Blackwell; 2008. https://www.dawsonera.com.
21. Health and Care Professions Council. *Standards of proficiency*. 2013. http://www.hcpc.org.uk/.
22. Snaith B, Hardy M. Radiographer abnormality detection schemes in the trauma environment – an assessment of current practice. *Radiography* 2008;**14**(4):277–81. https://www.radiographyonline.com/.
23. Judson EE, Nightingale J. An evaluation of radiographer performed and interpreted barium swallows and meals. *Clin Radiol* 2009;**64**(8):807–14. https://www.clinicalradiologyonline.net.