Addressing the patient experience in an MRI department: Final results from an action research study

Abstract

Introduction: Patients undergoing MRI can experience anxiety and claustrophobia. A multi-method action research study was conducted to determine how patient care was currently being delivered in an MRI department and to determine whether this could be improved.

Methods: This action research study employed both quantitative and qualitative methods. Changes were introduced into the department after baseline data collection to address areas for improvement. A survey was conducted of patients to establish their level of satisfaction/anxiety and to determine whether this improved during the course of the project. Staff practice was qualitatively observed over the course of the project and observations recorded in a field diary. Finally, focus groups were held with staff.

Results: For patients, the project resulted in improved satisfaction, lower anxiety and increased the amount of patients receiving information compared to the results of a baseline survey. However, these findings were not statistically significant. Amongst staff, qualitative observations portrayed a renewed focus on the patient in MRI including changes in their actions such as increased use of touch, improved communication and focused efforts to maintain privacy.

Conclusions: This study was able to achieve a change in practice through an action research cycle in a magnetic resonance imaging department. Over the course of the project, improvements were made to the department, and radiographers changed the way they acted and interacted with patients.

Background

Patients undergoing magnetic resonance imaging (MRI) can often experience anxiety during the scanning procedure. (1)   In some cases, this anxiety can result in a claustrophobic event, with the scan requiring termination early or the patient simply refusing to be scanned, with recent literature suggesting this occurs in 12 out of a 1000 patients.(2) In a survey of radiographers, 71.6% of respondents stated that patient anxiety was a common issue in their imaging department when patients presented for MRI.(3) Causes of anxiety during scanning include the enclosed nature of the scanner leading to a claustrophobic reaction; anxiety regarding results, or having to keep still for long periods of time when in pain or discomfort.(1, 4) It is imperative that the patient remains motionless during scanning to acquire optimal images due to the artefacts that appear as a result of moving, which lowers the quality and diagnostic value of the scan.(5-9) However, high levels of anxiety during imaging can lead to

1

increased patient movement during scanning.(10) In extreme cases, scans may need to be aborted or patients may refuse to have the scan, sedation may need to be used, or additional sequences performed.(11) These missed or increasingly difficult scans have financial implications as valuable staff and equipment time is lost. (11, 12)

Anxiety and satisfaction was investigated in an MRI department as part of an action research project. Action research 'is a form of research that investigates and describes a social or work situation with the aim of achieving a change which results in improvement.'(13) Action research is a cyclical process that can include many phases, including a process of diagnosis, action planning, action taking, evaluating and learning.(13) The results of the diagnosis stage of this action research project have been published previously. (13-15) During the diagnosis stage the investigators found high levels of patient satisfaction and low levels of anxiety within the department, but also identified a number of areas where there was potential for improvement. This paper reports on the final phases (action taking and evaluation) of an action research project aiming to investigate and improve the patient experience (with a particular focus on satisfaction and anxiety) within an MRI department.

Methods

Study Design

The project took place in the MRI department of a major metropolitan hospital in an Australian capital city. A multi-method action research approach was taken to determine how patient care was currently being delivered in the department and to determine whether this could be improved. This was conducted in five phases; (1) diagnosis; (2) action planning; (3) action planning; (4) action taking; and (5) evaluating and learning. The methods used in the diagnosis stage included patient and staff surveys, focus groups, and participant observation, with the results of these phases being reported in previous publications.(13-15) It was found during the diagnosis phase that the delivery of patient care was of a high standard, although there was room for improvement. The data collected during the diagnosis phase was then fed back to staff via a focus group, one-on-one discussions, and printed materials. Based on discussions with staff, strategies were implemented into the department where there were areas for improvement (phases [3] and [4], action planning and action taking). Following the implementation of these strategies, another phase of data collection (phase [5], evaluation) was

2

undertaken. Ethical approval was granted for this study. The lead researcher for this project was an external researcher and was not an authority figure in the department.

Data collection

Both quantitative and qualitative approaches to data collection were utilised. The survey of patients conducted during phase 1 (diagnosis) was repeated during phase 5 (evaluation) amongst a new sample of patients to evaluate the effectiveness of the strategies employed during phases 3 (action planning) and 4 (action taking). The sample frame consisted of all outpatients during the data collection period (August and September). Outpatients were phoned by the administration staff on the day before their examination to determine whether or not they were willing to take part. All participants willing to take part signed a consent form. Patients were told that saying no to the survey would not impact on their scan or the treatment they received. Surveys were anonymous and participants placed them in a sealed box once complete. There was no way to link an individual patient to a survey and patient confidentiality was maintained. The survey questions and their method of answering are reported in table 1. Further detail on the questions and measurement methods is provided elsewhere. (14)

Table 1: Survey questions

Question	Measurement
Did you receive information explaining the procedure and what to expect prior to your scan (either written or verbal)?	Yes/No
If yes, did you find this information useful?	Likert scale
How anxious were you during your scanning experience?	Visual analogue scale (VAS)
How satisfied were you with your scanning experience?	VAS
If you were anxious, did the actions of hospital staff within the department reassure you?	Likert scale
Have you previously had a scan, either here or in another department?	Yes/No
If yes, how anxious were you during your last scanning experience?	VAS
How satisfied were you with your last scanning experience?	VAS

Qualitative observations were collected at baseline and once again following implementation of improvement strategies by a participant observer. The degree of participation ranged from passive participation (observing but not taking part in any activities) to moderate participation (taking part in discussions or infrequently assisting in activities such as sliding) but never reaching active or complete participation.(16) Field notes and observations were recorded during this time into a field diary, which was filled out by the researcher whilst in the setting.

3

Statistical analysis

For the VAS results, the data was considered to be interval level data, and therefore a mean, mode and median are provided. The Likert scale data was considered ordinal scale data, and therefore a mean, mode and median are provided. (17) Confidence intervals for the mean are reported.(18) Responses to yes/no questions are reported as percentages. When testing hypotheses, although parametric tests have been used for visual analogue scale data,(17) non-parametric tests were deemed more appropriate in this case for the following reasons; the sample was not random, ordinal or interval data was used, and the distribution was not normal.(19) As such, the Mann Whitney U Test was chosen to determine if there was a difference when samples differed,(19) and the Wilcoxon Signed Ranks Test was used for repeated measurements on the same sample.(19)

Action planning and implementation strategies

In many action research studies, there is a need to make significant changes to practice. However in this case, the results of phase 1 identified that practice in regards to patient care appeared to be of a high standard already,(13-15) and therefore the focus was on ensuring that systems are in place to ensure this continues, and to reinforce this 'good' practice.(14)

All the training and strategies discussed during these stages took place in between the formal data collection periods. Strategies to improve the patient experience included updating the patient information booklet (to ensure content was accurate and related to the scanner in the department) and making this more readily available (by placing it in cubicles, at the front desk, alongside magazines etc); placing posters around the department about what to expect during their scan; and ensuring the patient is provided with verbal information regarding their scan. Music has been shown to reduce anxiety and improve the experience of medical radiation procedures. (20, 21) Although music was offered routinely within the department, a music list was created which gave patients the choice to choose their favorite artists to listen to during their scan. Additionally, patients were informed that they could bring in their own CD if they wished. A number of strategies were more difficult to address with material solutions, such as ensuring radiographers introduce themselves and talk to patients during the scan. Most of the time, these simple steps were forgotten or overlooked and we were initially uncertain how we could actually improve other than by discussing these issues frequently and making a concerted effort to improve on these. It was decided that we could collate all of these steps in

4

to a flowchart outlining the patient encounter and detailing along the way what steps needed to be taken. This flowchart was developed in collaboration with a smaller group of radiographers, which was then further developed into a visual, colour-coded flowchart (Figure 1). A colour print out of the flowchart was then laminated and provided to each radiographer (in addition to spares for the department) and also placed in the control room. This flowchart identified a number of important actions that radiographers needed to perform during the patient encounter, including reminders for the radiographer to introduce themselves, bring the patient in earlier to allow time for explanation, explain aspects of the scanning experience, ask the patient if they are okay, talk to the patient during the scan, thank the patient for their time, inform the patient that their results will be sent to their referring Doctor, and strategies to maintain patient privacy.
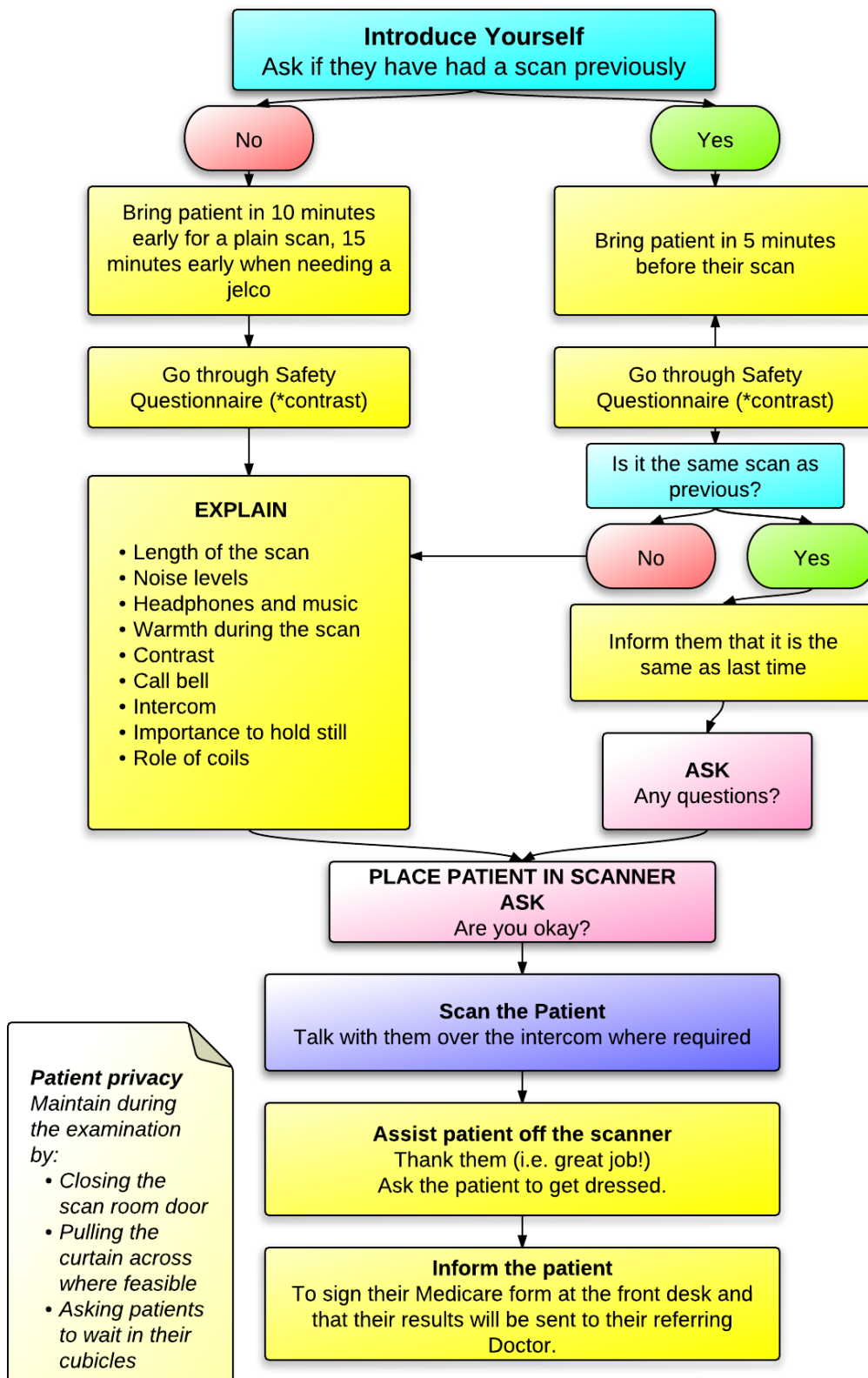
Figure 1: The patient encounter flowchart (Note: 'Jelco' refers to a peripheral intravenous catheter)

RESULTS: Qualitative observations

Based on the field notes recorded in a reflective journal by the participant observer, a table (table 2) based on major observations during the project was created to summarise whether there were any differences that were observed during the two data collection periods.

Table 2: Observations during field work

Pre	Post
Connecting with patients	**Connecting with patients**
Rarely, radiographers introduced themselves to patients.	Although it did still not always occur, radiographers did appear to introduce themselves more often to the patient.
Radiographers used humour to help break down barriers and connect with patients	Radiographers still used humour with the patients
Radiographers avoided physical contact except where necessary with inpatients	Radiographers appeared happy to assist both inpatients and outpatients to the scanning table, such as putting their arms around patients, and touching them to reassure them.
Radiographers rarely greeted inpatients to the department, and at times, deferred to the orderly bringing the patient down. Inpatients were not offered reading material (such as magazines or booklets).	Radiographers greeted inpatients to the department, and let them know how long it would be until their scan. Sometimes, inpatients were offered reading material.
Staff Support	**Staff support**
Radiographers assist and support each other in day to day tasks	Radiographers continued to assist and help each other out

Providing support Radiographers allowed family members into the scan room Radiographers often talked to patients over the intercom, often once at the start of the scan and once at the end. Some radiographers talked a lot over the scan, some not as much. For a cognitively impaired patient, they told them they were doing well. For claustrophobic patients, radiographers provided additional patient care.	**Providing support** Radiographers still allowed family members into the scan room All radiographers made a concerted effort to talk to patients during their scan, including mentioning how long scans would take, when a long one or noisy one was coming up, checking on them to see if they were okay, telling them they were doing well, and talking to them on multiple occasions. For claustrophobic patients, radiographers still provided additional patient care.
Music Radiographers almost always told patients they could listen to music, and often offered them a choice. Radiographers often chose the music for the patient. On occasion, music was forgotten to be played.	**Music** Radiographers informed patients of the music list, and always told them they would be able to listen to music of their choice during the scan. Inpatients were offered the music list as something to look at. The music list provided the patient with something to do. Very rarely, the music was forgotten to be put on.
Reducing Anxiety/ Increasing Comfort Three eye shades existed for patients. A patient had complained of the smell of one of these eye shades, which were reusable.	**Reducing Anxiety/ Increasing Comfort** New eye shades were purchased, which could be disposable or patients could take them if they wished.

Post-scan	**Post-scan**
If patients asked about their results, the radiographer would inform them of what the next step in the process was.	A number of patients were commended for doing a 'good job' or for 'doing well' in the scanner. Radiographers often offered voluntarily information regarding the process for results, although not always.
Discussing the patient	**Discussing the patient**
When patients were out of earshot, derogatory terms (light-hearted) or jokes at the patient's expense were sometimes employed by the radiographers. Radiographers showed true concern for some of their patients, and were emotionally invested in their results.	As seen previously, when patients were out of earshot, derogatory terms (light-hearted) or jokes at the patient's expense were sometimes employed by the radiographers. Radiographers still showed true concern for some of their patients, and were emotionally invested in their results.
Privacy	**Privacy**
Outpatients were required to change into gowns with no exceptions. Patients often crossed the waiting bay floor to the scanner clutching the back of their gown. The curtain in the waiting bay could be pulled across inpatients when located in the waiting bay, to preserve their privacy, but this rarely happened.	Outpatients were required to change into gowns, although one gentleman was allowed to stay in his clothes after checking and another larger lady was double gowned. Patients often crossed the waiting bay floor to the scanner clutching the back of their gown. The curtain was still used infrequently but there was a noticeable increase in use.

9

Department Changes	Department Changes
An old out-dated patient information booklet is available on the corner table of the waiting room.	An old out-dated patient information booklet is available on the corner table of the waiting room, but also available at the reception desk, and in the patient cubicles.

A large poster explaining the MRI procedures in simple terms is located in the waiting room, on the back of the patient cubicle doors and in the waiting bay.

Music lists are available in the patient's cubicles and at reception.

A patient care flowchart is present in the scanning room. |

RESULTS - Survey

There were 120 responses to the first survey (during the diagnosis phase) and 121 responses to the second survey (during the evaluation phase), although not all were complete, which resulted in a lower number of responses for some questions. All participants in the survey were outpatients. Tables 3 and present the results of anxiety and satisfaction respectively amongst participants in the second survey. Table 5 provides a comparison of the baseline and follow-up survey.

Table 3: Anxiety amongst participants in the second survey (measured on a VAS, 0=no anxiety, 10= high anxiety)

Group	Responses	Mean anxiety and SD	Mode	Median
Overall	120	2.39, SD 2.7 (95%CI 1.9-2.9)	0	2
Previously Scanned	98	2.51, SD 2.74 (95% CI 1.96-3.06)	0	2
First scan	14	1.786, SD 1.929 (95% CI 0.67-3)	0	1.5

Patient not provided information about the scan and what to expect	12	3.17, SD 2.76 (95% CI 1.41-4.92)	0	3
Patient provided Information	104	2.38, SD 2.66 (95%CI 1.86-2.89)	0	2

Table 4: Ratings of Satisfaction

Group	Responses	Mean satisfaction and SD	Mode	Median
Overall	121	8.93, SD 1.83 (95%CI 8.6-9.26)	10	10
Previously Scanned	100	8.93, SD 1.85 (95% CI 8.56-9.3)	10	10
First scan	14	9.07, SD 1.39 (95% CI 8.27-9.87)	10	10
Patient not provided information about the scan and what to expect	12	8.17, SD 1.9 (95% CI 6.96-39.37)	9	9
Patient provided information	105	9.02, SD 1.82 (95%CI 8.67-9.37)	10	10

Table 5: Comparison of results from baseline to follow-up survey

11

Question	Survey 1	Survey 2	Significance
Anxiety	Mean= 2.617	Mean= 2.392	P=0.748
Satisfaction	8.857	8.934	p=0.82
Ranking of information usefulness	Mean= 3.535	Mean= 3.75	P=0.008
Received information	92/111	105/117	P=0.1346
Rating of actions performed to reduce anxiety	3.455	3.712	P=0.119

Resistance and Barriers

Radiographers were, for the most part, supportive and enthusiastic about the changes that we wanted to put in place and what we wanted to achieve as a team. One issue did arise with the introduction of the flowchart form a minority of the radiographers, as they felt this was not necessary and that the processes outlined in the flowchart were obvious. The head of unit relayed these feelings to me and so in response, I spent time in the department to make sure that I discussed the flowchart with each radiographer either in small groups or on a one-by-one basis. The radiographers appeared to appreciate the chance to discuss the flowchart and provide their feedback, and once they had aired their issues, embraced its use as a reminder tool.

Barriers encountered during the project included those imposed by the short timeframe we had available to us. For example, we ordered name badges for MRI staff to enable better communication and interaction with the patent early in the action-taking period, however, they still had not arrived at the original scheduled date for the second round data collection, or at the revised later date. Similarly, although the booklet was updated, it was not possible to have this printed and disseminated in time for the second round of data collection due to the bureaucratic processes for getting it approved within the hospital administration system. Although, the radiographers would have liked to double gown, they simply weren't able to, as due to financial pressures, the department were unable to get hold of enough clean linen at times for even a single gown for each patient.

Staff reaction to the project

After going through the results of the second phase of data collection, the group were asked what their initial impressions were of the findings. The group overwhelmingly thought that the findings were positive and some members were pleasantly surprised by these findings. A staff survey found that radiographers rated themselves better in their delivery of care in the end of project survey compared to the baseline, a finding that did reach statistical significance (1st survey VAS (score of 0-10) mean= 7.75, 2nd survey mean= 8.5, p=0.029). On reflecting, it is interesting to note that they thought that their standard of patient care prior to the project was superb and this study had reinforced that there was room for improvement. Participants made statements such as: *'Pleasantly surprised'*; *'Even though we thought we were really, really good, it just shows there is still room for improvement'*; *'I think our standard is quite high, we do spend a lot of time talking to the patients, so it has been a bit of a pat on the back I think'*

The group were also asked whether they felt that there actually had been a change in practice, and it was felt by the group that there had been changes in regards to patient care. For example, it was noticed that the patient care and attention afforded to outpatients was superior to that provided to inpatients: *'I think we do get up and greet the inpatient more quickly'* ;*'It's been of benefit to the department as a whole'*; *'I introduced myself to my patients this morning and they were dears they remembered and were calling me by name'* ;*'The couple of things I think we have carried on with is introducing the radiographer by name and that's continued on even though the survey has finished and I really like that'*

Some of the staff also felt that it would be hard to achieve any more improvements, without sacrificing some of their or the scanner's time, which was already limited: *'I can't see many more areas where we can go very much further without spending more time'*

13

Discussion

Through an action research process and engagement with radiographers, we were able to introduce change and make improvements at the patient, staff and department level. The aim of action research, at its basis, is to achieve some sort of change, whether it be in practice, culture, or the organisation.(22, 23) For patients, we were able to improve satisfaction, lower anxiety, increase the amount of patients receiving information (albeit non-significantly) and increase the perceived usefulness of this information. Amongst staff, there was a renewed focus on the patient in MRI including changes in their actions (such as use of touch, improved communication, maintaining privacy) and the creation of a reflective cohort of practitioners who learnt from each other, and were energised and empowered to make changes and do better in their department. A simple change such as being on a first name basis with the patient has been shown to be important to the patient,(24) and staff made a concerted effort to improve in this area. Within the department, there were changes in practice, new processes introduced and additional educational material in the form of posters and booklets made available.

There were barriers to some of the changes; these included resource barriers (such as lack of gowns for double gowning), organisational barriers (bureaucratic process required for updating an information booklet, and personal barriers (resistance to change). Some of these barriers could not be addressed during the course of the project; however, all efforts were made to ensure staff were interested in the project and engaged. Radiography has been described as a profession characterised as clinically competent but unreflective practitioners, where there is a poor attitude to research, a resistance to change, and low-self-esteem and general apathy.(25) Although this makes this field an appropriate culture in which to conduct practical and empowering action research, it can also dissuade any type of research from being conducted. There were fears that the project would not be embraced by the practitioners and that the apathy associated with the profession would result in its failure. Fortunately, all of the staff engaged in the project. However, not all staff were as enthusiastic as others, with some more concerned with efficiency. Morton-Cooper wrote about efficiency orientations and stated that these came about 'as a result of wanting to 'get on with the job' rather than being willing to spend time on reflection, team building and group discussion, it is an interest in short-term

14

results in minimum time, rather than long-term effectiveness.' (p.57)(22) This was evident throughout the project and is characteristic of the radiography profession, where there is a focus on getting people scanned and always having the scanner occupied, which can lead to a lack of time attending to the patient. This findings is similar to the findings of Lewis et al.,[26] who found in their study that 'the foundations of the patient-radiographer relationship being eroded by situations where quality time spent with the patient was superseded by the demands to work quickly' (p.94).(26) As one of the radiographers stated in the final focus group, 'I can't see many more areas where we can go very much further without spending more time.'

The methods used during this project included a staff survey, patient survey, staff focus group and a period of non-participant observation and reflective journaling in a field diary. These methods were chosen to assist in triangulating the data, and were seen as complementary to each other. (27-29) This allowed a deeper understanding and a more full and rounded picture of the construct under investigation as it was viewed through a number of lenses and different datasets.(29) The credibility (and therefore trustworthiness)(30) of the research can be improved by complimenting the limitations of one stated method with the strengths of another.(23) In this study, we found that the small improvements noted in the follow-up survey were reflected in the qualitative observations.

There are some potential limitations with this project. Patients were contacted the day before the scan to determine whether they were willing to be involved, and the simple act of contacting them prior to the scan may have had an effect on their level of anxiety and/or satisfaction. Additionally, since the survey was voluntary, there may be certain characteristics present in the patient group who did volunteer compared to the general population which may have affected the results.

Change can be difficult to introduce in healthcare, particularly in settings where there may be an unengaged workforce, such as that described in radiography. A visual model can be useful to facilitate this change in medical imaging departments. From the results of this research, it is now possible to posit a new model for practice change in a radiography department which departments worldwide can consider when implementing new practices. This project followed the Susman and Evered model of action research and was successful in achieving a change. (31) The steps that led to change in this department, and which may be considered by others

15

attempting to produce change, were reflection, discussion, measurement, and strategising approaches to change. As action research is cyclic, the department plan to continue evaluating and taking action to improve patient care into the future.

Staff involved in the project were asked to reflect on what their role was in terms of patient care, and how this could be improved. These reflections were shared in-group discussions, and as these discussions occurred, it led to the creation of a reflective cohort of practitioners who learnt from each other, and were energised and empowered to make changes and do better in their department. Measurement of baseline and follow up practice provided objective feedback to staff, which was an important mechanism to encourage staff to take part in the project, and additionally provided assurance that their efforts were not in vain. Finally, the group took time to strategise how to approach and reinforce change, and developed items such as flowcharts, which acted as reminders to change.

The below model posits that by a process of critical reflection, group discussion, measurement, and strategising approaches to change (such as flowcharts), radiographers can change their practice.
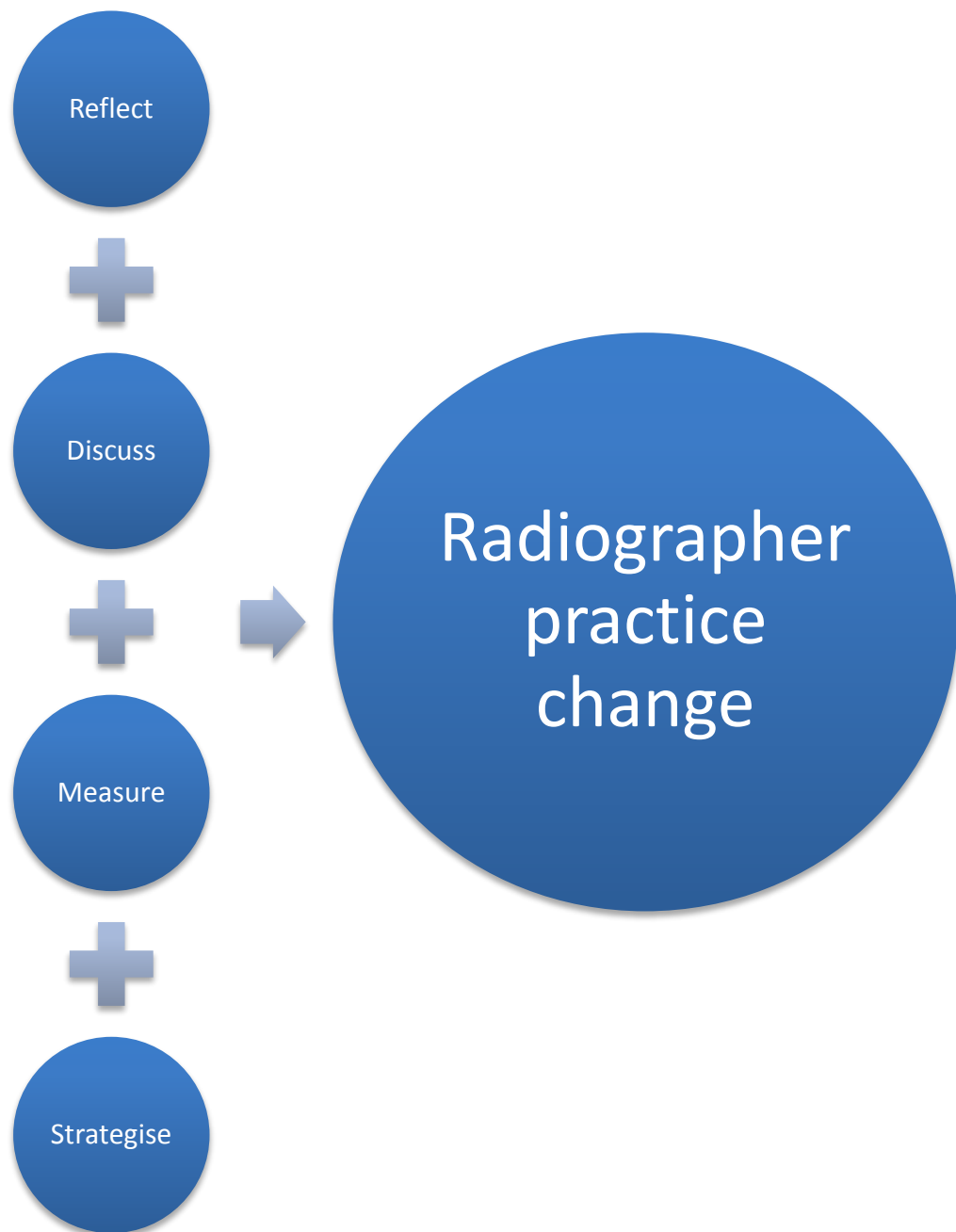
Figure 2: Model for radiographer practice change

Conclusion

In conclusion, through an action research cycle, practice change was achieved in a magnetic resonance imaging department. Over the course of the project, improvements were made to the department, and radiographers changed the way they acted and interacted with patients.

This change was achieved through reflection, discussion, measurement of outcomes and feedback, and strategising approaches to change. Action research has been shown to be viable with radiographers, and result in improved practice and empowered practitioners.

References

1.   Munn Z, Jordan Z. The patient experience of high technology medical imaging: a systematic review of the qualitative evidence. JBI Library of Systematic Reviews. 2011;9(19):631-78.

2.   Munn Z, Moola S, Lisy K, Riitano D, Murphy F. Claustrophobia in magnetic resonance imaging: A systematic review and meta-analysis. Radiography. 2015;21(2):e59-e63.

3.   Tischler V, Calton T, Williams M, Cheetham A. Patient anxiety in magnetic resonance imaging centres: is further intervention needed? Radiography. 2008;14(3):265-6.

4.   Lukins R, Davan IG, Drummond PD. A cognitive behavioural approach to preventing anxiety during magnetic resonance imaging. J Behav Ther Exp Psychiatry. 1997;28(2):97-104.

5.   Harned IRK, Strain JD. MRI-compatible audio/visual system: Impact on pediatric sedation. Pediatric Radiology. 2001;31 (4):247-50.

6.   Lemaire C, Moran GR, Swan H. Impact of audio/visual systems on pediatric sedation in magnetic resonance imaging. Journal of Magnetic Resonance Imaging. 2009;30 (3):649-55.

7.   Murphy K, Brunberg J. Adult claustrophobia, anxiety and sedation. . Magnetic Resonance Imaging. 1997;15:51-4.

8.   Harris L, Cumming S, Menzies R. Predictign anxiety in magnetic resonance imaging scans. International Journal of Behavioural Medicine. 2004;11(1):1-7.

9.   Bangard C, Paszek J, Berg F, Eyl G, Kessler J, Lackner K, et al. MR imaging of claustrophobic patients in an open 1.0 T scanner: Motion artifacts and patient acceptability compared with closed bore magnets. European Journal of Radiology. 2007;64 (1):152-7.

10.   Grey S, Price G, Matthews A. Reduction of anxiety during MR imaging: a controlled trial. Magnetic Resonance Imaging. 2000;18:351-5.

11.   Dewey M, Schink T, Dewey CF. Claustrophobia during magnetic resonance imaging: cohort study in over 55,000 patients. Journal of Magnetic Resonance Imaging. 2007;26(1322-1327).

12.   Melendez J, McCrank E. Anxiety-related reactions associated with magnetic-resonance-imaging examinations. Journal of the American Medical Association. 1993;270(6):745-7.

13.   Munn Z, Pearson A, Jordan Z, Murphy F, Pilkington D. Action research in radiography: What it is and how it can be conducted. Journal of Medical Radiation Sciences. 2013;60(2):47-52.

14.   Munn Z, Pearson A, Jordan Z, Murhpy F, Pilkington D, Anderson A. Patient anxiety and satisfaction in an MRI department: Initial results from an Action Research study. Journal of Medical Imaging and Radiation Sciences. 2015;46(1):23-9.

15.   Munn Z, Jordan Z, Pearson A, Murphy F, Pilkington D. 'On their side': Focus group findings regarding the role of MRI radiographers and patient care. Radiography. 2014;20:246-50.

16.   Spradley JP. Doing participant observation. In: Spradley JP, editor. Participant Observation. New York Holt, Rinehart and Winston; 1980.

17.   Wewers ME, Lowe NK. A critical review of visual analogue scales in the measurement of clinical phenomena. Research in Nursing and Health. 1990;1990(12):227-36.

18.   Mantha S, Thisted R, Foss J, Ellis JE, Roizen MF. A proposal to use confidence intervals for visual analog scale data for pain measurement to determine clinical significance. Anesth Analg. 1993;77:1041-7.

19.   Perera R, Heneghan C, Badenoch D. Statistics Toolkit. Oxford: Blackwell Publishing; 2008.

20.   O'Callaghan C, Sproston M, Wilkinson K, Willis D, Milner A, Grocke D, et al. Effect of self-selected music on adults' anxiety and subjective experiences during initial radiotherapy treatment: A randomised controlled trial and qualitative research. Journal of Medical Imaging and Radiation Oncology 2012;56:473-7.

21.   Slifer K, Penn-Jones K, Cataldo M, Conner R, Zerhouni E. Music enhances patients' comfort during MR imaging. AJR American journal of roentgenology. 1991;156(2):403-.

22.   Morton-Cooper A. Action research in health care. Cornwall: Blackwell Science; 2000.

23.   Hart E, Bond M. Action research for health and social care: a guide to practice. Buckingham: Open University Press; 1995.

24.   Nightingale J, Murphy F, Blakeley C. 'I thought it was just an x-ray': a qualitative investigation of patient experiences in cardiac SPECT-CT imaging. Nuclear Medicine Communications. 2012;33:246-54.

25.   Sim J, Radloff A. Profession and professionalisation in medical radiation science as an emergent profession. Radiography. 2009;15(203-208).

26.   Lewis S, Heard R, Robinson J, White K, Poulod A. The ethical commitment of Australian radiographers: does medical dominance create an influence? Radiography. 2008;14:90-7.

27.   Whitehead D, Taket A, Smith P. Action research in health promotion. Health Education Journal 2003. 2003;62(1):5-22.

28.   Pearson A. Nursing at Burford: A story of change. Middlesex: Scutari Press; 1992.

29.   Webb C. Action research: Philosophy, methods and personal experiences. . Journal of Advanced Nursing. 1989;14:403-10.

30.   Murphy F, Yielder J. Establishing rigour in qualitative radiography research. Radiography. 2010;16:62-7.

31.   Susman GI, Evered RD. An assessment of the scientific merits of action research. Administrative Science Quarterly. 1978;23(4):582-603.