Radiography 21 (2015) 364–369

Contents lists available at ScienceDirect

Radiography

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

Breast compression – An exploration of problem solving and decision-making in mammography

J.M. Nightingale*, F.J. Murphy, L. Robinson, A. Newton-Hughes, P. Hogg

University of Salford, United Kingdom

ARTICLE INFO

Article history:
Received 6 August 2014
Received in revised form
13 November 2014
Accepted 19 November 2014
Available online 16 December 2014

Keywords:
Breast screening
Compression
Focus groups
Qualitative
Problem solving
Decision making

ABSTRACT

Objective: Breast compression decreases radiation dose and reduces potential for motion and geometric unsharpness, yet there is variability in applied compression force within and between some centres. This article explores the problem solving process applied to the application of breast compression force from the mammography practitioners' perspective.

Methods: A qualitative analysis was undertaken using an existing full data set of transcribed qualitative data collected in a phenomenological study of mammography practitioner values, behaviours and beliefs. The data emerged from focus groups conducted at six NHS breast screening centres in England (participant $n = 41$), and semi-structured interviews with mammography educators ($n = 6$). A researcher followed a thematic content analysis process to extract data related to mammography compression problem solving, developing a series of categories, themes and sub-themes. Emerging themes were then peer-validated by two other researchers, and developed into a model of practice.

Results: Seven consecutive stages contributed towards compression force problem solving: assessing the request; first impressions; explanations and consent; handling the breast and positioning; applying compression force; final adjustments; feedback. The model captures information gathering, problem framing, problem solving and decision making which inform an 'ideal' compression scenario. Behavioural problem solving, heuristics and intuitive decision making are reflected within this model.

Conclusion: The application of compression should no longer be considered as one single task within mammography, but is now recognised as a seven stage problem solving continuum. This continuum model is the first to be applied to mammography, and is adaptable and transferable to other radiography practice settings.

Background

Breast compression decreases radiation dose and reduces the potential for motion artefact and geometric unsharpness.[1,2] Insufficient compression may be detrimental to image quality[3]; compressing beyond an optimum level may have an effect on client discomfort.[4,5] Imaging centres do not specify a desired target compression force,[6] however most recommend a range and maximum.[7] This can result in compression force variability between and within clients (consecutive screening).[8–11] Murphy et al. postulated that the application of compression force may require a high degree of problem solving and decision making,[12] and our article explores this concept further. There is sparse evidence related to problem solving within radiography[13–15] and none within mammography.

A problem is a task requiring a response when no satisfactory solution is immediately evident.[16] Problem solving is a complex process influenced by personal preferences, skills and experiences,[17,18] and includes two opposing models: *behavioural*, incorporating elements of 'trial and error' and habitual responses; *cognitive*, using 'heuristics' (rules of thumb; judgements) to make decisions in the presence of uncertainty.[17] These problem solving models incorporate decision-making (choosing an alternative with the highest probability of success).[18] *Analytical* decision making requires conscious cognitive input, time and preparation,[19] whereas *intuitive* decisions follow an unstructured pathway involving an emotional response without conscious thought.[17]

In situations with tight time pressures, high stakes or increased ambiguity, experts often use intuitive approaches.[20–22] Intuition

* Corresponding author. School of Health Sciences, Frederick Road Campus, University of Salford, Salford, M6 6PU, United Kingdom. Tel.: +44 0161 2952158.
E-mail address: J.Nightingale@salford.ac.uk (J.M. Nightingale).

http://dx.doi.org/10.1016/j.radi.2014.11.004
1078-8174/

Table 1
Study participants.

Level	Grade	Number
Radiography assistant practitioner	4	6
Radiography practitioner (Mammographer)	6	24
Radiography advanced practitioner (Mammography)	7	10
Radiography consultant practitioner	8	1
Mammography educators and clinical coordinators (individual interviews)	–	6
Total participants	–	47

has been previously linked with radiography practice.[13,14] Conflicting demands between image quality, radiation dose and patient experience during the application of mammography compression may result in uncertainty and ambiguity, both challenges to problem solving.[16] This conflict between the 'process' (patient experience) and the 'product' (the resultant image) has recently been recognised by Strudwick in an ethnographic study of radiography workplace culture[23] and was noted as a 'professional dilemma' in a phenomenological study by Lundvall et al.[24] To date no models of the mammography compression problem solving process have been developed, and an enhanced understanding may be valuable in identifying best practice and reducing variation. This research involves the analysis of existing qualitative research data,[12] aiming to propose a problem solving model for compression force application with due regard to existing models of problem solving and decision making.

Method

Our study involved the re-analysis of existing data collated during a qualitative phenomenological study of mammography practitioner behaviours, values and beliefs; a comprehensive outline of the methodology is described by Murphy et al.[12] Following ethical approval, focus group interviews were conducted at six breast screening centres in England selected for widespread geographical location and unit size. The focus groups (41 participants in total) encompassed all the practitioner levels involved in the NHS breast screening service (Table 1). They were facilitated by two researchers who invited discussion following a pre-determined set of questions (Table 2). Semi-structured interviews with 6 mammography educators were also undertaken. One researcher was a qualified mammographer, the other was experienced in conducting focus groups and interviews. The focus groups were transcribed and analysed by categorising data using a phenomenological approach. The findings presented in this article emerged from a re-analysis of the complete transcribed data set collated by Murphy et al.[12] This involved a single researcher extracting data related to the mammography compression problem solving process into categories, themes and sub-themes, following a thematic content analysis process originally described by Burnard.[25] The themes were then peer-validated by two other researchers. None of the researchers were mammography practitioners by profession, potentially reducing bias and assumptions within the study. The study adopted the principles of rigorous 'trustworthiness' criteria.[26,27]

Table 2
Focus group questions.

	Mammography practitioners focus group questions
1	Describe your decision making process when considering how much compression you will apply to the breast
2	At what point do you make a decision(s) about the amount of compression to be applied?
3	What factors influence your level of compression?
4	Under what circumstances would you use increased compression?
5	Under what circumstances would you use less compression?
6	Is there a minimum level of compression to be applied, if so what is it?
7	Is there a maximum level of compression to be applied, if so what is it?
8	Has your technique (compression) altered during your career? If so how?

Findings

Seven consecutive stages in which the mammography compression problem solving process is informed emerged from the data (see Fig. 1). Each of the stages will be explored using quotations from the participants (italicised) within the text.

Stage 1 – assessing the request

The mammography request is scrutinised and the participant's initial opinion of the required compression force (low, normal, high) is formulated. Referral mechanism is influential; symptomatic patients often have greater compression tolerance '*because they are in a different frame of mind aren't they*?', whereas clients who have had previous surgery, radiotherapy, cysts or pacemakers '*… you're thinking the breast may be a bit tender*'. Breast compression with implants caused uncertainty for most practitioners who noted that guidance was sparse and conflicting. Breast screening attendance history is informative: '*I think if it is their first time and they are quite nervous, you tend to go a bit easy on the compression, because I don't want the lady not to come back for the second round*'. Age and menopausal status influences the physical qualities of the breast; some participants note that they are 'gentler' with younger women, nevertheless one participated indicated '*I think you just take more time to explain what you're going to do*'. Several participants noted that older clients appear to have a lot of breast pain.

Many participants outlined their initial compression force 'rules of thumb' for each of the main categories of clients encountered, and these are illustrated diagrammatically in Fig. 2.

Stage 2 – first impressions

First impressions occur when the client enters the mammography room, informing immediate equipment choices, adaptations of technique and potential compression required. Patient mobility is assessed within the first few seconds: '*You're looking at how well the patient can move, their actual movement, their whole body shape …*'. Participants discussed disabled clients '*… it just takes longer, but we don't compromise … it is in their interest to get the best possible on*

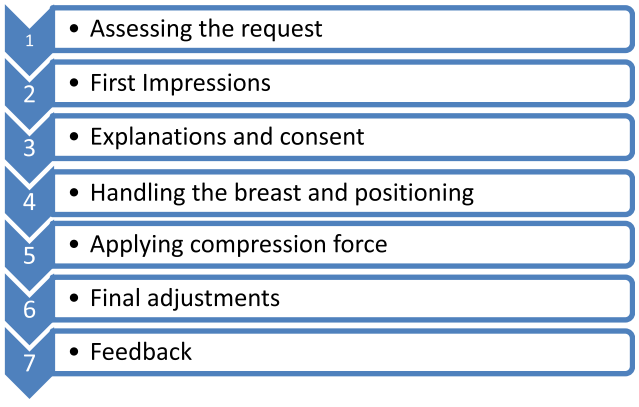

Figure 1. The seven stages of the mammography examination that contribute towards compression force problem solving and decision-making.