Patient obesity and the practical experience of the plain radiography professional: On everyday ethics, patient positioning and infelicitous equipment

Abstract

Patient obesity is increasingly placing significant and multifaceted strain upon medical imaging departments, and professionals, in (particularly Western) healthcare systems. The majority of obesity-related studies in radiology are, however, primarily focused only upon the technical business of collecting diagnostically-efficacious images. This study, using Interpretative Phenomenological Analysis (IPA), qualitatively explores the everyday clinical experiences of eight expert UK diagnosticians working in plain radiography. Focus herein falls particularly upon (a) problems with patient positioning during examination, and (b) challenges arising around available equipment. In line with extant research, participants reported that difficulties with positioning obese patients could have negative impacts on image quality, and that insufficient table weight limits and widths, and inadequate detector sizes, can adversely affect examination. They also raised some more novel issues, such as how the impact of available gown sizes upon a patient's sense of dignity can cause practical and ethical dilemmas for a clinician *in situ*. The issue of how one might 'train' *experience* in positioning patients without bony landmarks as a reference point was also made salient, with strong implications for undergraduate radiography curricula. It is finally highlighted how the participating radiographers themselves seldom conceptualised any given problem as a purely 'technical' one, instead recurrently recognising the interlinking of material, socio-economic and moral matters in real healthcare contexts. By better understanding such nuance and complexity as lived by real radiographers, it is contended, a more context-sensitive and flexible path to effective training and guideline-production can be mapped.

Keywords: Bariatrics; Ethics; Obesity; Patient Positioning; Plain Film Imaging; Qualitative Analysis

Introduction

Affecting all socioeconomic groups, ages and genders, obesity ranks alongside smoking and heavy drinking in terms of precipitating a wide range of chronic health conditions, not least coronary heart disease, diabetes mellitus, osteoarthritis and respiratory problems[1,2]. Moreover, these associated comorbidities, and their corollary impacts upon premature mortality, place a significant strain upon (particularly Western) healthcare systems[3]. In the UK by 2013, one quarter of all adults were classed as clinically obese[4]. This upward trend is widely thought to be a major contributory factor in the increasing workloads of medical imaging professionals[5].

As such, and as noted by Buckley et al.[6], it is necessary for radiology departments to carefully prepare for this ongoing potentiality in order to manage associated workload-increasing difficulties such as, for example, the need for repeat projections. It is the case, however, that the primary literature pertaining to the practical, everyday problems *experienced* by radiographers when encountering such 'bariatric' individuals remains in a fledgling stage. Without strong foundational research, professional guidelines on specific aspects of conduct can have, at best, limited application to both the specificity and range of difficulties that may emerge in real medical encounters[7]. Moreover, and as may well be familiar to any clinical practitioner, over-rigid and/or top-down directives (usually derived from second-hand, abstract or generalised knowledge) can 'fly in the face' of the practical, nuanced and experience-based solutions to everyday problems found by practitioners themselves[7]. Indeed, directives of this order have been shown to sometimes have potentially *counter-productive* influence in everyday medical activity[8,9].

As such, using Interpretative Phenomenological Analysis (henceforth IPA)[10], this paper emerges from a broader study designed to produce a detailed analysis of the ways in which eight experienced diagnosticians working in plain radiography (computed radiography

and digital radiography, henceforth CR and DR respectively) have actively worked through the practical business of imaging obese patients. Focusing chiefly upon issues around (a) patient positioning and (b) equipment[a], it is contended that the emergent observations can help further inform and ground prospective endeavours to provide radiographers with pragmatic assistance in addressing such potentially challenging scenarios.

Literature Review

There is a substantial body of literature relating to the impacts of patient obesity upon medical practice emerging within the healthcare sciences, not least in nursing[11-13]. Relatively little of this corpus, however, relates directly to radiological disciplines, and even less to plain radiography itself. It is further evident that the majority of pertinent studies attend primarily to the influence of patient obesity on image quality and diagnostic efficacy[14-17]. Rather less emphasis is placed upon other orders of concern that can emerge within everyday clinical work. Outlined herein, thus, are key studies from all radiological domains that have (direct or potential) relevance to the practice of plain radiography.

In terms of the impact of patient obesity upon radiological practice *writ large*, a longitudinal documentary study conducted by Uppot et al.[16] examined radiology reports between 1989 and 2003. Findings indicate that over this fifteen year period, during which obesity rates had steadily risen, there had been a small but significant linear increase in the number of reports that claimed the quality of the images collected was 'limited due to body habitus'. The study further surmises, conversant with the findings of de Bucourt et al.[14] and Reynolds[17], that patient obesity most directly affects image quality in chest radiography and ultrasound, due to decreased penetration and attenuation through the subcutaneous fat. In a

[a] It should be noted that the absence of other core matters is an output of these issues being the focus of further papers emerging from the same original study.

similar vein, Yanch et al.[18] argue that beam attenuation, low image contrast, long exposure times and motion artefacts are also recurrent upshots of patient obesity in these realms. Using phantoms and subcutaneous adipose tissue to simulate patients when X-raying chests and abdomens, they conclude that to reduce the exponential dose increase, positioning the patient with the thinnest fat layer closest to the image receptor is most effective wherever the thinnest layer is (anterior or posterior).

Obesity-related difficulties have been reported to arise in mammography due to loss of image specificity; the number of false positives increases in obese patients, with a corollary higher recall incidence and biopsy rate[17]. Further challenges include overexposure of the patient, and missed areas of interest. Abdominal radiographs are also difficult to achieve in larger patients, and require particularly careful positioning. When the area of interest is missed, repeats will be required or the abdomen may need to imaged in quadrants[17]. In functional terms, meanwhile, contemporary image receptor sizes have been found to be too small for the effective imaging of obese patients, and it has been proposed that multiple receptors should be used to fully incorporate the area of interest[3,6].

Optimal image quality (and image acquisition) is further dependent on proper positioning of the patient, which can be highly problematic when that patient is obese[19]. Many older patients, moreover, are even more obese, and suffer from comorbidities that mandate special considerations when positioning them, such as additional staff to assist[19]. Carucci[3] proposes that when attempting to position the patient and receptor for a pelvic examination in such situations, the level of the patient's elbow can be used to approximate where the iliac crests are situated. This technique may have some facility, but implies that all patients' elbows are at the level of the iliac crests, a notion itself challenged in other research[12]. Excess adipose tissue in the abdominal and thoracic regions, and limited space for descent of the diaphragm, are also noted concerns during the imaging process[20,21].

McClean et al.[21] observe that breathing is more laborious for an obese patient, given that there is a reduction in the expiratory reserve volume, especially in the supine position. In order to overcome the risk of aspiration, a slight 'head-up' position is recommended[19].

Within Computed Tomography (CT) and Magnetic Resonance Imaging (MRI), table weight limits and gantry sizes are reported to be significant obstacles to the effective imaging morbidly obese patients[5,6,15,22]. This can sometimes mandate that clinicians who are unaware of a patient's weight in advance make an *ad-hoc* switch to other diagnostic imaging modalities[14], rather than risk damage to expensive equipment[15]. Furthermore, table *width* is typically determined by normative shoulder-to-shoulder measurements. With obese patients, however, the abdominal area is often the widest point of the body, rendering some imaging tables simply unfit for purpose[5] in these circumstances. Such problems arising *during* an examination can have a highly undesirable psychosocial impact on the patient[6]. At the very least, and as noted by Uppot et al.[16], clear advanced knowledge of a patient's weight and diameter can assist in scheduling an obese patient in for an examination in a manner that is helpful for patient and clinician alike.

In sum, obesity-related research in radiology as a whole has, to date, focused upon three primary domains that have implications for understanding everyday work in plain radiography. These are: (a) image quality, (b) the physical handling and positioning of the patients, and (c) the adequacy of equipment.

Methods

Given the complex, personalised and contextually-specific nature of activity within radiographic encounters, the broader project from which this paper emerges was designed to explore the lived experience of radiographers themselves, with a view to illuminating how

patient obesity impacts upon everyday practice. In this sense, IPA is oriented to the classically phenomenological question of "How is this thing *really* experienced, *in situ*?" in all of its pragmatic contingency, rather than the currently dominant concern within radiographic literature regarding "How should this thing *ideally* be handled, for regulation purposes?" As Smith, Flowers, & Larkin [10] argue, this form of approach can help critique existing models in an evidence-based manner, advance the development of current practice models without recourse to supposition or mechanistic reasoning, and also inform future field-based research endeavours.

Participants

IPA studies conventionally use relatively small sample sizes, facilitating high-definition investigation of experience and perception within a particular, tightly-defined population [23]. For this study, with institutional ethical approval and full informed consent, eight practising diagnostic radiographers, with individual experience levels varying from 5 to 35 years in clinical work, were interviewed (mean experience = 21.56 years). Five were current reporting radiographers, and the remaining three all had over 25 years of experience working in diagnostic radiography. These participants were recruited from four different hospitals, within three different National Health Service (NHS) trusts in the North West of England, all with access to diverse X-ray equipment.

Procedure

Consistent with the approach advocated by Smith et al. [10], data were collected using semi-structured interviews schedules, and open questioning. These were conducted in person and at a location of the participant's choice. A synopsis of the discussion themes was sent to all

participants in advance of their interviews to (a) enable their own reflection on pertinent experiences and, thus, (b) to aid them in elaborating upon key issues in a way that might not have been possible had questions been "sprung" upon them[24]. Core issues for discussion were simply posed as:

- Could you give me an overview of the main problems that patient obesity has caused in your professional role? Can you provide examples?
    - How did it affect the process?
    - How did it affect you?
    - How did it affect the patient?
- How did you handle these situations?
    - What worked and what didn't?

Prompts, derived from extant literature, the clinical experience of the third author and findings from a pilot interview, were used to encourage elaboration. Each interview was digitally recorded, and transcribed in full. In line with institutional ethical requirements, all data were anonymised at the point of transcription, and all participants are allocated nominal pseudonyms (i.e. "R1" etc.) in the presentation of the findings. The mean interview duration was 30 minutes.

Analysis

Analysis was conducted manually (i.e. without the use of qualitative analysis software) and in line with the standard procedures of IPA[10,23]. Raw textual codes are collected into linked (subordinate) themes, and ultimately abridged into master (superordinate) themes that maintained integrity across the full body of data.

Trustworthiness

The trustworthiness of the research was monitored in line with Yardley's[25] standards for qualitative studies in healthcare. Firstly, using *triangular consensus validation*[26], the authors analysed and cross-referenced the data until agreement was reached regarding theme content. *Transparency and coherence*[25] were maintained through the publicly-verifiable correspondence between transparently-displayed data and the attendant interpretation presented. *Impact and importance*[25] of the study was tested through the presentation of preliminary findings at an international conference of researchers and practitioners, prior to final writing. All feedback, affirmative and critical, was incorporated into the analysis and discussion.

Findings and Discussion

Analysis of the collected data revealed N=20 subordinate themes, shown in Table 1:

Table 1: Subordinate themes

1. Image quality	11. Manual handling
2. Positioning problems	12. Table weight limits
3. Equipment	13. Technique difficulty
4. Patient management	14. Staffing
5. Exposure factors	15. Reporting/diagnosis
6. Examination time	16. Collimation
7. CR and DR	17. Patient care
8. Patient dose	18. Training

9. Patient limiting factors	19. Administration, documenting and alarms
10. Communication	20. Stigma and embarrassment

These cross-linked into four overlapping superordinate themes:

1. Practical motion and patient positioning.
2. Equipment that is limited in utility.
3. Imaging and diagnostic challenges.
4. Communication and interactional stigma.

In order to maintain the depth, transparency and integrity[25] of the original qualitative data within a restricted space, this paper (as previously outlined) addresses only superordinate themes 1 and 2, which are described below with reference to relevant literature.

Superordinate theme 1: Practical motion and patient positioning

Proper positioning of a patient has been recurrently highlighted as essential for the success of any procedure in radiology[19]. Participants in the present study, however, stressed a range of difficulties they had experienced with obese patients in this domain, both (a) in terms of the professional's ability to effectively position the patient, and (b) the patients' own ability to position themselves (due to restricted mobility).

> R3: "*The main difficulty is if sometimes if they struggle to move into the position that we need, sometimes you've got to compromise a little bit…"*
>
> R6: *"[There are problems with] mobility, so the ability of patients to get on and off tables, or to achieve the positions that we want, that we require of them."*

These problems were seen to have a range of corollary impacts upon image quality beyond those simply arising from excess adipose tissue[21].

> R1*: "…the practical problems of being able to position some of those patients correctly, because of their body size they may not be able to go into the standard positions that we would like them to be in and therefore the images could be suboptimal."*

Positioning problems also raised issues for participants around repeat exposures and increases in examination time[6].

> R2: "*[There is] difficulty in achieving desired position, as [one can be] unable to feel for bony landmarks, [and] having to produce repeat images due to underexposure and or positioning errors."*

Such positioning challenges remain under-explored in contemporary radiographic literature[19], although recent work by Carucci[3] does highlight how poor anatomic landmarks can be highly problematic for the practitioner. Participants did, however, propose that these difficulties lessened with practical experience:

> R2: *"[W]ith experience, you can do it partly by eye can't you? And you don't need to feel as hard."*

In nursing and rehabilitation research[11], it has been noted how there is an abundance of direction on the safe manual handling of the 'average' patient, but that much more evidence is needed regarding techniques for the handling of obese patients, to facilitate more effective professional training in the maintenance of patient wellbeing. With respect to the physical safety of obese patients in radiographic practice, several participants in the present study identified antero-posterior (AP) chest X-rays as being particularly challenging scenarios, largely due to difficulties with the placement of receptors. For example, in one account:

> R1: "*I think probably one of the biggest problems we've had, is if you consider a patient who comes for a chest X-ray, and they are large, and we do a lot of those… actually sitting the patient forwards and…trying to put the cassette*

> *behind them…there's physically not a gap between the bed and the patient, so you're almost trying to push the cassette in and…you could hurt them if you don't do it properly."*

The same participant made reference to a piece of equipment their department had purchased ("…*basically like a sponge with a slot in it so you can put that behind them and then slide the cassette in."*) which had proven particularly useful in exactly these scenarios. No single artefact or technique, however, was a *recurrent* feature of participant accounts of how such thorny scenarios had been addressed in practice, indicating a lack of standardised practice in this area. Indeed, the meta-solution to virtually all positioning issues underpinning the experiences recounted by the participating radiographers was essentially *experience itself*, which facilitated practical adjustment on a case-by-case basis. Conversely, the value of training was also foregrounded, although there is no agreed 'method' evident in contemporary literature.

> R8: *"Obviously the more training you have…the better you are going to be at positioning without bony landmarks."*

These observations raise, by extension, issues around the learning of pertinent clinical techniques, and how junior radiographers might effectively be 'trained' in experience-based adaptability without (potentially) time-consuming and costly trial-and-error under the pressures of the modern NHS. This may well be an issue to inform future undergraduate curricula in radiography; an early start would appear essential.

Superordinate theme 2: Equipment that is limited in utility

In terms of issues surrounding physical apparatus in radiography[5,6,15], an array of problems was identified by participants, with a variety of consequences. One of the most striking of

these – bridging the issues of patient handling and equipment – pertained to the simple examination gowns with which patients are provided:

> R5: *"[S]ometimes the X-ray gowns don't fit. For me that's important because they've got to be…dignified haven't they?"*
>
> R8: *"Even down to examination gowns, they're not big enough for obese patients, and you end up having to X-ray them in their own clothes which sometimes can be ok but sometimes not appropriate and if you sort of give them a gown and it's not big enough it just makes them feel embarrassed."*

Respect for an individual's dignity[6] is a key imperative covered under the UK Standards of Proficiency for radiographers[27] and is, indeed, embedded in the UK NHS constitution as a core value[28]. The fact that issues of inappropriate 'kit' can present a moral problem for a radiographer before an obese patient even enters the room is, thus, clearly troublesome. Both R5 and R8 described *ad-hoc* strategies that had been used in their departments in an attempt to preserve patient dignity. Using two gowns (R8), for example, or in the case of R5 an even more careful approach to avoiding patient embarrassment was adopted:

> *"We've had bigger [gowns] made…[in the] linen room, so we've got a supply of those in the department…and then the patient is unaware that they're any different from anyone else."*

In practical terms, there was no allusion in any participant's account to a simple, standard 'larger' gown that could be unproblematically provided for obese patients to avoid creating embarrassment for them *in situ*. However, in addressing this simple 'kit' problem, the attention of the participating radiographers themselves to the inextricability of material and ethical issues in everyday clinical scenarios[29] is keenly evident, in a manner seldom explicitly elucidated in contemporary radiological research.

In technical terms, and in line with observations in extant literature[5,15], the equipment concerns that dominated participants' experiences were table weight limits, table width and

detector size. Regarding the former, participants confirmed a number of the problems outlined in prior research:

> R3: "W*hilst X-raying patients, sometimes we are unable to use the hydraulics on the table, depending on the size of the patient; whether they exceed the table limit."*
>
> R7: "*We've had a few patients over the years that have been too heavy for the table, generally it means we can't move the table top if we do risk laying them down, we can't use any of the table functions."*

Critically, however, the core problems experienced by participants were seldom framed as specific to table weight limits *per se*, but rather as issues with 'older' kit.

> R8: *"…[older] table weight limits aren't very high generally speaking, they're about 23 stone*[b] *aren't they? So…that's proving more and more of a problem because we are getting more and more patients that are above that weight limit, which means in certain circumstances we are not able to image them at all.'*
>
> R1: *"[W]e definitely have people who are bigger than 23 stones now so that equipment is quite old now so will probably [soon] become obsolete."*

In short, and in this area, it was recognised by all participants that equipment manufacture *was* keeping pace with changes in the size of patients[c], but that patient care suffered where the workplace itself did not – or could not – re-equip at the same speed. A similar problem was also raised with respect to table height:

> R1: *"Some of the older equipment doesn't drop down as far, as low to the ground as the newer stuff, so if you've got one that will drop down a bit lower it means that larger a patients are easier to transfer from a chair onto the table, whereas at the moment they might struggle in the same way that an elderly patient may struggle."*

In this respect, the broader matter was fundamentally seen less as a purely technical one, and more as a situated consequence of practical economics in the NHS itself,

[b] Approx. 146kg.

[c] For example, Siemens Ysio© has a table weight limit of just over 302kg.

which themselves were unequally distributed. While some participants faced problems such as those described above on a day-to-day basis, others did not:

> R4: "*One advantage we have now if we do get someone a bit larger, our new kit, the weight limit for the table is actually 41 stone*[d]*, I think you're going to be hard-pressed to find someone who is too heavy for a weight limit of 41 stone."*

Regarding detector sizes, on the other hand, participants working chiefly in CR *and* DR maintained that the technology itself was struggling to keep pace with the increasing size of patients, in some procedures. Today, DR detectors typically measure 43cm x 43cm, compared to CR's 35cm x 43cm[30]. However, as noted by R8 with respect to the *abdominal* imaging of obese patients:

> *"[E]ven the largest cassette isn't big enough for an obese abdomen. You might have to do it in four separate bits with sort of joining up the images together. It's not ideal when you come to report and diagnose off an image if it's split into…four different images. [A]nd…again there's no point in going in and…doing an abdomen on one film or two films if they're large. You need to make that decision straight away that you're going to do it in separate sections, and that way it limits the number of repeats or the extra views you're going to have to do."*

The core technical problems in imaging obese patients recognised by Carucci[3] are highly evident herein, though framed within a context of limited time and resources. A shortfall in the efficacy of the available technology for a particular purpose, in short, mandates (perhaps undesirably) quick clinical decision-making regarding how to make 'the best of a bad situation'. This also raises questions for managers responsible for sourcing new equipment, and the manner in which selection criteria for particular items of radiographic kit are defined and prioritised[31].

[d] Approx. 260kg.

Conclusion

Much contemporary research in medical imaging reveals a great deal of (highly important) information about technical issues, particularly those involved in producing diagnostically-useful images[14-17]. It does not, however, bring us a great deal closer to the equally important practical business of *being* a radiographer dealing with an obese patient. This business involves facing interlinked human and technical problems in a real, pressurised working healthcare environment. Some of these, as reported above, precede the patient even entering the examination room. Rather, and unlike some other domains of health research[11-13], obesity-related challenges in radiography are often abstracted from real professional contexts and treated as purely technical exercises. While this is largely an outcome of the drive to produce universal directives for 'good practice'[7], real-world clinical problems do not arise, in a socio-economic vacuum. They are not inherently 'standardised'[8,9], and the best technical directives are not always the best *human* ones.

The form of research reported above is (necessarily) small in scale, and the types of claim that can emerge are more focused on opening debates than closing them[10]. With this is mind, participants reported difficulties with positioning obese patients in plain radiography, with corollary impacts on image quality[3,17,18,21], and that insufficient table weight limits and widths[5,6,15,22], and detector sizes[3,6], can adversely affect, or even outright prevent, examination. They also raised some more novel concerns relating to issues as apparently mundane (though hardly trivial) as available gown sizes. Crucially, though, none of these were raised without *context*. Equipment shortfalls and their technical consequences were framed within broader discussions of economics, ethics and patient dignity. Positioning issues were discussed as much in terms of patient wellbeing as efficacy of imaging. The issue of how one might 'train' experience was also made salient.

In sum, thus, while we might analytically isolate any one of the issues above for exploration in research, in the experience of the practising radiographers interviewed they were never independent of an array of other concerns. It is in the elucidation of these experiential links between the technical, material and moral aspects of clinical work - and the inventive *ad-hoc* activity of clinicians themselves - that IPA research finds its real value[32]. To paraphrase David Silverman[7], effective change in medical practice stems initially from an understanding of what *does* happen, for real practitioners, in all of its socially-specific nuance and complexity.

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