Received:
4 August 2017

Revised:
25 September 2017

Accepted:
1 October 2017

<https://doi.org/10.1259/bjr.20170574>

Cite this article as:

Murray TE, Halligan JJ, Lee MJ. Inefficiency, dignity and patient experience: is it time for separate outpatient diagnostics?. *Br J Radiol* 2017; **90**: 20170574.

COMMENTARY

Inefficiency, dignity and patient experience: is it time for separate outpatient diagnostics?

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ABSTRACT

There is international and national variation in the location of diagnostic imaging centres relative to hospitals. Diagnostic cross-sectional imaging has traditionally been performed within a hospital, catering for both inpatient and outpatients. The resulting two-tiered system caters for emergent and complex inpatients, in addition to typically ambulatory outpatients. These outpatients are less complex, and often attend an acute hospital for the specific purpose of diagnostic imaging. In both the UK and the Republic of Ireland, outpatient radiology is often provided on-campus in state-funded hospitals, reflecting the allocation of resources nationally. In many other countries, hospitals provide acute and high-level care, with community centres addressing outpatients' clinical and diagnostic needs. Mixing inpatients and outpatients introduces variability into the scanning process, and many institutions struggle to provide for the very different needs of outpatients. Current strategies of mixing these two fundamentally different groups should be reassessed, and either in-hospital segregation or dedicated outpatient diagnostic imaging centres merit serious consideration in any future healthcare planning.

There is national and international variation in the location of diagnostic imaging centres relative to hospitals. Traditionally diagnostic imaging, in particular cross-sectional imaging, is performed within a hospital which caters for both inpatient and outpatients. This creates a two-tiered system catering for unstable, complex and emergent inpatients, in addition to typically well, ambulatory outpatients with less complex needs who are often attending an acute hospital for the specific purpose of diagnostic imaging. In both the UK and the Republic of Ireland, radiological investigations are often performed on-campus within state-funded hospitals. While records of total numbers of studies performed within the National Health Service (NHS), and within each trust, are published by the NHS and the Royal College of Radiologists, to the authors' knowledge there is no published breakdown of scans by campus type and patient type. A 2015 survey reporting a mean of 3.9 CT scanners per NHS radiology department, suggesting at least cross-sectional imaging tends to be performed within medium to large departments.¹ Government policies have not always championed out-of-hospital diagnostic imaging beyond outsourcing waiting lists on an ad-hoc basis. A 2016 UK review concluded that imaging services now face a paradigm shift, and in the short-term

we may see an expansion of community-based radiology.² Current NHS policy favours "reducing the amount of time people spend avoidably in hospital through better and more integrated care in the community, outside of hospital".³ The best response may be a re-design of the services to deliver better out-of-hospital care or re-focusing activities towards co-locating with services to provide lower risk urgent and elective care.⁴

In countries such as Canada, Australia and parts of the USA, the concept of an ambulatory outpatient attending an acute hospital for diagnostic testing is foreign. Hospitals are for acute and high-level care, with community centres addressing outpatient clinical and diagnostic needs. In large hospitals, multiple machines combined with high departmental staffing levels permit economies of scale and scope that allow for segregation of highly structured outpatient lists with highly variable inpatient and emergency cases. Small and medium-sized hospitals however may have only one or two scanners per modality such as MR or CT, providing little buffer for fluctuations in inpatient or emergency cases. Boland et al demonstrated that separating inpatient and outpatient scanning increases patient throughput and productivity,

and further recommends out-of-hospital segregation for outpatients where possible.⁵

Variability broadly consists of two types, controlled variability and random variability. Controlled variability in this context reflects the increased complexity of protocoling for complex sick patients, coordinating scan time with dialysis or theatre, arranging transfer times with intensive care staff etc. This heterogeneity leads to inefficiencies.⁶ Random variability refers to variations which cannot be influenced, such as the hour of presentation, or the nature of the pathology. Both variations reduce the ability of radiology schedulers to “smooth out” demand, which decreases efficiency.⁷ The immutable inefficiencies of inpatient care have a knock-on effect, and are disruptive to concurrent outpatient scanning.⁵ Contemporary business models emphasize the cost and stress induced in any system or process by variability. Reducing variation improves process efficiency, the central message behind the Six Sigma initiative, which aims to reduce standard deviation in any process to 6σ (equating to 3.4 defects per million on a factory line or similar).

Worldwide, acute hospitals struggle to deal with increasing demand driven by a higher expectation of care and demographic trends towards ageing populations. Outpatient and ambulatory scanning is a low-variability process. Lessons from the field of operations management are directly applicable. The theory of *variation and uncertainty buffering* suggest three methods to improve productivity: (1) reduce underlying variation, (2) segregate different levels of variation and (3) buffer variation.⁸ Clearly the first point is not applicable to radiology, as we cannot eliminate the uncertainty associated with acute care, such as who comes through the Emergency Room door. The second point is directly applicable however, and advocates separating high and low-variability processes. This suggests drawing a line under inpatient scanning as a fundamentally high-variability process, and separating it from outpatient and ambulatory scanning which is a low-variability process, thus removing many outpatients from inevitable inpatient bottlenecks. With regard to the third point, while many small- and medium-sized hospitals currently use outpatients as scheduling buffers, dividing inpatients into non-immediate and immediate scans, and spreading out non-immediate (stable) inpatient scans throughout the day may still provide leeway for schedulers.

Outpatients are of a higher performance status. Expectations and needs in this group are fundamentally different to those of the sicker group of inpatients. The outpatient group may highly value online-scheduling, a seamless check-in process, ample transport or car-parking, and notification of report-times. While these facilities have become standard in non-medical service-based customer experiences, strained hospital systems struggle to attain such a level of service. The sharing of facilities between inpatients and outpatients also raises issues of confidentiality and dignity. In many institutions, shared waiting areas and corridors expose the sickest and most vulnerable patients to both outpatients and those in accompaniment. It can be hard to reconcile this arrangement with inpatients’ fundamental right to privacy, dignity and the avoidance of degradation.⁹

Legacy and policy considerations have culminated in the status quo in the UK and Republic of Ireland, with outpatient imaging often performed within acute hospitals. Hospital-centric imaging reflects the evolution of radiology departments over decades, where incremental increases have funded the gradual expansion of radiology services within pre-existing departments. Outright capital purchase remains the most common funding methodology in the NHS at present for CT equipment.¹ A shift to outpatient diagnostics would require substantial initial capital expenditure with a lag time of years, a poor fit with contemporary short electoral cycles and short-term budgetary goal-setting. Demand for medical imaging grows at 3.4% annually, which suggests a doubling of current scan volumes over the next 21 years.¹ Such increased capacity is unlikely to come from incremental increases in efficiency alone, and will also require infrastructural expansion. A challenge for many institutions remains finding physical space within the hospital into which to expand. Where congested hospital campuses presents a physical barrier to further expansion, investment in outpatient-focused satellite under the auspices of an established radiology department allows for off-site expansion.

While off-site expansion is associated with certain challenges, many of these can be successfully addressed through a combination of flexible scheduling and rule-based referring. Off-site scanning is ideally suited to studies where little or no medical oversight is required (such as non-contrast studies). Studies requiring intravenous contrast can be grouped on days when a radiologist is present, or arrangements can be made and training offered to existing on-site medical staff. Modern digital radiology information systems and picture archive and communication systems allow for seamless scheduling, image viewing and reporting across sites. Rule-based scheduling can permit patient age, address, scan type and even comorbidities to be considered when selecting suitability for a satellite or community radiology centre. With consistent branding and patient information, patients can easily comprehend the concept of an offshoot department and there is little scope for confusion. While sharing staff between sites may appear complex, the particular location and more-structured workflow may be attractive to some radiologists and radiographers from a commuting perspective or work preference, particularly when limited to several sessions per week.

Studies with an invasive component such as CT Colonography, or where medical management of heart rate may be required such as CT Coronary Angiography, are clearly less amenable to performance within the community and should remain within a hospital in the absence of a robust community setup. Additionally, certain patients such as those who may require sedation, anxiolytics, or the accessing of an implantable venous access devices, are also unlikely to be suitable for community cross-sectional imaging. Furthermore, while cross-sectional imaging is well suited to off-site reading, other modalities such as ultrasound may benefit from constant real-time consultant oversight. Additionally, certain modalities such as nuclear medicine with specific medical physics and supply chain requirements, and overlap with a variety of localizing surgeries, demonstrate economies of scale which likely favour large units. A further concern of off-site radiology expansion may

be any possible curtailment of primary hospital capacity, which could be problematic in cases of machine breakdown or major incidents. Given consistent national trends of increasing radiology demand however, off-site expansion will be of greatest interest to those looking to add additional capacity in the future, it is unlikely that smaller units for example would consider moving one of their existing two CT scanners out of any hospital and into a satellite community-based centre.

Mixing of patients diffuses variability into an otherwise non-variable group, and many institutions struggle to provide for the very different needs of outpatients. In many institutions

where combined inpatient and outpatient services are provided, balancing outpatient higher-order needs with emergent care is challenging, and the effect of variability on scanning efficiency is considerable. Current strategies of mixing these two fundamentally different groups should be reassessed. Furthermore, given the need for continued infrastructural expansion to meet ever-increasing demand for cross-sectional radiology in the future, off-site expansion targeting outpatients allows the segregation of outpatients, frees capacity for inpatients, and allows physical room to expand beyond often-congested hospital departments. Outpatient diagnostic imaging centres merit serious consideration in any future healthcare planning.

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