



## Review article

# A model for understanding diagnostic imaging referrals and complex interaction processes within the bigger picture of a healthcare system



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## ABSTRACT

Using experiences from the South African public healthcare system with limited resources, this review proposes a model that captures a holistic perspective of diagnostic imaging services embedded in a network of negotiated decision-making processes. Professional interdependency and interprofessional collaboration, cooperation and coordination are built around the central notion of integration in order to achieve a seamless transition through the continuum of various types of services needed to come to a diagnosis. Health-system role players interact with patients who enter the system from the perspective of their life-world. The distribution of diagnostic imaging services – within one setting or at multiple levels of care – demonstrates how fragments of information are filtered, interpreted and transformed at each point of care. The proposed model could contribute to alignment towards a common goal: services providing holistic quality of care within and beyond a complex healthcare system.

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## Introduction

Referrals for a diagnostic imaging investigation require the request for an opinion from a radiology specialist to detect or exclude disease. This action contributes to the prognosis, patient management, monitoring of the clinical course of disease and/or screening for at-risk health.<sup>1,2</sup> The referral and the imaging investigation itself lie “in the middle of the continuum”<sup>3</sup> of the patient’s journey through the healthcare system.

The aim of this review article is to provide a holistic perspective of diagnostic imaging services in a resource-limited healthcare system, based on the authors’ healthcare research experience in South Africa. The proposed model incorporates medical- and non-medical-provider interaction processes mediated through text (documents and files) and technology. The model could form the basis for research aimed at providing a holistic account of the quality of care services in a healthcare setting. The focus also includes a way of understanding how the lower levels of care in the healthcare sector, with a limited choice of imaging modalities, interact with higher levels of care.

## Diagnostic imaging within the complex healthcare system

The division between public and private health sectors is a global arrangement. Many countries, just as in South Africa, divide their public sector into the following levels: primary (level 1, district hospital), secondary (level 2, regional hospital) and tertiary (level 3, central hospital),<sup>4</sup> with specific guidelines for referrals between these levels. District hospitals often provide only X-ray services, and in some instances basic sonography and fluoroscopy. Regional hospitals provide additional services such as computed tomography (CT) and diagnostic sonography services, whereas central or tertiary-level hospitals provide access to the whole spectrum of diagnostic imaging services. Fig. 1 provides an overview of referral pathways and flows of processes for diagnostic imaging investigations in the public sector.

There is a wide diversity among countries regarding the structuring of the private health sector. In South Africa it is, for example, divided into a large, corporate private-for-profit hospital sector and a smaller and diversified, private-not-for-profit sector.<sup>4,5</sup> No complete typology of private and industry or workplace hospitals is available. Radiological services are outsourced, regardless of the level of the hospital. In the private sector patients often have direct access to some specialised imaging services via their general practitioners.

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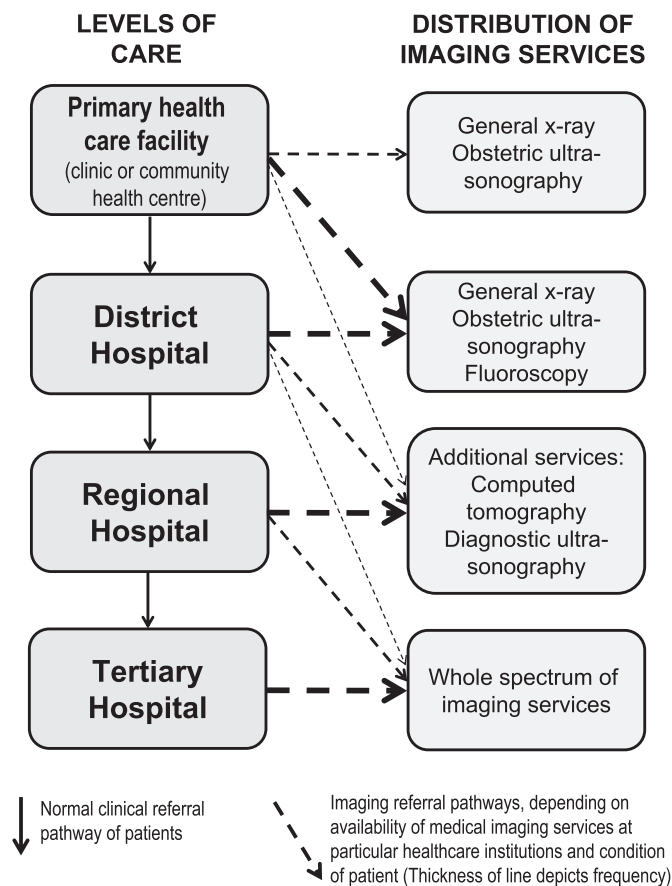


Figure 1. Referral pathways for diagnostic imaging services in the public sector.

The focus of this paper is mainly on diagnostic imaging in the public sector of a resource-limited country. However, client cross-over between the public and private sectors when seeking healthcare is a common phenomenon. This type of fragmentation impacts on the healthcare system and on patients – financially and clinically – in terms of providing a continuum of services of optimal quality. Although diagnostic imaging (including referral, decision making and interaction) focuses on individual patients at a micro-level in the healthcare system, meso- and macro-level trends influence the individual encounters between patients and healthcare providers and the outcomes with regard to management, treatment, and follow up.<sup>6,7</sup>

When reflecting on diagnostic imaging services as being embedded in and intertwined with the medico-clinical pathways, the notion of integration becomes central. Integration implies effective, accessible, continuous and comprehensive care services of quality. It also entails collaboration, coordination and alignment of interactions and decisions, mediated through healthcare providers. These providers are, according to the actor network theory, first-order actors, with text and technology being second-order actors.<sup>8</sup> Collective intra- and inter-institutional navigation is required to provide the necessary continuum of care and a smooth and safe transition for the patient in his or her journey through the healthcare system until the ultimate diagnosis and treatment plan can be achieved.<sup>8–11</sup>

#### Complexity and interconnectivity in interactions and decision-making processes

Each service stage of the patient's journey is made up of multiple small steps with interfaces between these steps. Caring for an individual patient requires a holistic understanding, greater than

the sum of its parts. The 'bigger picture' emerges from the complexities and interactions in a health system. The building blocks for making a decision regarding the most appropriate diagnostic investigation of choice with minimal risk and optimal benefit are strongly shaped by organisational structure, institutional members, the quality of information on the request document, the actual investigation and its outcomes. The process evolves as the various events unfold, based on the actions taken with each event and depending on the interactions of the professionals within the system. The process is highly dependent on who is communicating with whom in a particular institution or what forms the content of the communication.

The hierarchical interconnectivity between different levels of the health system<sup>12</sup> is evident throughout the referral process for diagnostic imaging investigations. A hospital is an indivisible unit with a high degree of specialisation and diversity among its healthcare providers, its components (including technology), and feedback and interaction loops.<sup>13</sup>

Decisions in everyday situations are embedded in a broader context and are part of a decision–action cycle that is affected by monitoring and feedback and not by a single judgement.<sup>10</sup> The way that services are distributed in the healthcare context of diagnostic imaging often means that the notion of interprofessional, team-based, patient-centred decision making does not apply or is not appropriate.<sup>14</sup> In this regard, Patel et al.<sup>13</sup> refer to distributed diagnostic imaging services involving the “management of streams of information and ... communication and coordination among individuals and from data sources” in order to come to shared understandings and decisions. Meaningful communication relationships between healthcare professionals and between professionals and patients are difficult to develop without mutual understanding.<sup>10</sup> The interdependency at different levels and stages of decision making and the diversity of healthcare providers involved in the fragments of decisions contribute towards building the bigger picture. “Even if a single individual ultimately decides on a course of action others are critically involved in the process”.<sup>13</sup>

We developed a model to capture the bigger, institutional macro-level picture applicable at any hospital or health centre providing diagnostic imaging services. The model depicted in Fig. 2 was adapted from Yabroff's<sup>15</sup> health services research framework for evaluating cancer screening. It shows the interconnectivity between healthcare professionals (including various levels of the healthcare system) and patients. It also shows the network of relations and interactions between the role players involved in referrals for diagnostic imaging investigations, interpretation of images, communication of results, and the drafting of treatment and management plans.

At the macro-level the model contextualises the connectivity of the health system and its providers with patients and their communities regarding decision making in diagnostic imaging. The common goal shared by all healthcare providers is to deliver quality service and care to the patient.<sup>16</sup> Central to this network of interconnectivities are *what* patients present with and *how* they present their histories, their symptoms and the narratives of their condition. The immediate challenge is the coordination of information as part of a continuum of patient care within this network of interactions.

#### Routine actions and interactions in decision making

Various role players routinely interact in decision making at the meso- and macro-level. Diagnostic imaging routines are highly subject to context, needing adaptation as the context or situation changes.<sup>17</sup> However, the quality of routine actions should continue to enable continued efficiency and optimal outcomes in all circumstances.

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