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Factors influencing patients' demand for x-ray examinations in rural KwaZulu-Natal

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Abstract

The focus of this study was on the problem of unwarranted demand for radiological imaging by patients in rural KwaZulu-Natal, South Africa. Literature in the context of this topic is scarce. Consequently the aim of this study was to describe socio-demographic factors that might influence patients demand for x-ray examinations. A quantitative study in the form of a cross sectional survey was done. A convenient sample of 110 patients was surveyed using a structured questionnaire. The study revealed that very few respondents (10.9%) had a fair knowledge about x-rays. Results of the study indicate that age and educational level might influence patients' demand for x-ray examinations. The study further revealed that there might be other factors, such as the perceived benefits of x-rays, beliefs, lack of public health awareness as well as lack of effective communication between patients and health care-providers, that affect patients' demand for x-rays

Keywords

Conventional radiography, diagnostic imaging, radiation, unwarranted demand, medical x-rays.

Introduction

The discovery of the properties of x-rays just over a century ago gave medicine one of its most powerful and indispensable diagnostic tools [1]. X-rays have been utilised for both diagnostic and therapeutic purposes and its use for medical purposes has continued to grow [2]. It is estimated that about 30% to 50% of critical medical decisions are based on x-ray examinations [3]. Today, the use of x-rays is prevalent in both public and private health services in South Africa. Since x-rays are frequently used for diagnostic purposes means that many patients, both in well-developed urban areas as well as in rural areas not close to modern and sophisticated health care facilities, are familiar with its usage.

Some patients feel it is so important to be x-rayed thus if they are not referred for x-ray examination they, or their families, feel that the doctor has neglected them in some way [1]. Many patients, according to some researchers, demand examinations because they feel reassured by the use of high tech equipment [4]. The rural hospital, in one of the health districts of KwaZulu-Natal (KZN) where the researcher is employed, is no exception. However, literature indicates that much of this rise in demand is unnecessary and wasteful [5].

Although the number of performed x-ray examinations is on the rise, the

majority of them do not yield results that will alter or influence the course of clinical management. The same goes for x-ray examinations, which are performed on patients' demand; such examinations are not associated with improved physical functioning or reduced pain. To better understand and help patients change their behaviour, which in this case is their demanding of x-ray examinations, health care-workers need to be aware of factors that influence such patients' behaviour. An effective health education promotion strategy could be used to stem this trend but would require knowledge of factors that influence patients' demands for x-ray examinations. Consequently the aim of this study was to describe socio-demographic and other factors that may influence patients demand for x-ray examinations.

Background to the study

Most patients seen in the out-patient department (OPD) where the researcher works prefer a medical practitioner or nurse to refer them for an x-ray examination before any drug is prescribed. Such preference sometimes is noted after a prescription has been completed. The question thus is what are the factors, if any, that could influence such preferences.

Factors, such as gender, age and education and cultural beliefs could influence

patients' utilisation of diagnostic x-ray examinations. A study in Canada on the pattern of diagnostic imaging utilisation found that utilisation of diagnostic imaging increased with advancing age [6]. Besides the socio-cultural factors, lack of proper advice and soundly formulated guidelines could also be a precursor to patients' demand for x-ray examinations.

Issues related to health care-workers is another set of modifying factors that have been identified as having influence on patients' preference for medical x-rays. The way health staff advise a patient the first time he/she demands to have an x-ray examination could have an impact. Despite the fact that the use of medical x-ray imaging is rightfully determined by clinical factors, literature indicates both patients' wishes and pressure from other health-care providers affect general practitioners' decision about ordering plain radiography [6].

There is very little literature on patients' knowledge about medical x-rays. Yet various studies have documented deficiencies in knowledge of medical students, doctors, dentist and paramedics about ionising radiation under which medical x-ray fall [7].

It should be noted however that although diagnostic information obtained from all x-ray examinations may be essential, it is often obtained at a risk. Patients should therefore be knowledgeable

about the risks and benefits associated with medical x-ray imaging. For instance, some researchers^[8] argue that for patients to be involved in healthcare decision making, it is essential that attention is paid to how best to educate patients to increase their knowledge about the relevant medical options, etc. Patients' knowledge about x-rays is thus an important factor in influencing their behaviour towards x-rays. A patient's level of education is likely to affect his/her ability to make an informed decision and could have a bearing on the awareness of other radiological services (modalities) available. Poor knowledge about x-rays and lack of education of patients at the rural KZN hospital in this study could account in part for the high numbers of patients who demand x-ray examination.

While health-related media campaigns have been used to improve individuals' knowledge and behaviour towards a number of health issues, such as tuberculosis (TB), malaria and HIV/AIDS, very little has been done in terms of informing the public about the risks associated with medical x-rays. Lack of awareness on the risks associated with x-ray (ionizing) radiation becomes pertinent when one considers the number of patients who receive unnecessary radiation exposure^[8].

In the present era of increasing cost, attention has been given to the use of public health resources including medical x-ray imaging. Yet with regards to the utilisation of medical x-rays little success has been recorded. This failure may be that not enough is known about the determinants of use of radiological testing^[9]. In particular little is known about factors influencing patient preferences for x-ray examinations. The problem in terms of this study was that it was not clear as to what factors may influence patient demand for x-ray examinations. Furthermore, the limited literature on the factors influencing patient demand for x-ray examinations brought to the fore the fact that medical x-ray services and factors that prohibit or enhance its utilisation by patients remain complex. Why, then, this high demand? What are the factors influencing patients' high demand for x-ray examinations in a hospital in rural KZN?

Methodology

A non-experimental, quantitative research approach was used in this study. A survey was done as it is a strategy designed to obtain information about different aspects

of people^[10]. The choice of a quantitative survey was based on its ability to characterise the opinions and behaviours of the population quantitatively in a way that permits uniform interpretation^[11].

Descriptive surveys are carried out to describe population attributes, such as knowledge, perceptions behaviour, attitudes or health aspects^[12]. This was the essence of this study, which sought to investigate patients' knowledge about x-rays, and identify factors that may influence patients' demand for x-ray examinations. In this study the population included all patients seeking health care during normal working hours at the rural KZN hospital where the researcher was employed. A non-probability sampling approach was used because of its simplicity, practicality and quickness. This was in line with some researchers^[13] who argue that practical constraints such as time, cost and the diverse nature of the population, have a bearing on the sampling method used and also determination of sample size.

Convenience sampling was used to select a sample of 110 patients because of non-availability of a sampling frame. Since the validity of surveys relies heavily on respondents' willingness and ability to report their perceptions accurately^[14], the researcher developed a simple and understandable questionnaire as a way of enhancing validity. In an attempt to enhance reliability the questionnaire was translated and back translated. Furthermore, the role of anonymity of respondents was also used to increase the reliability of the study.

Based on the literature review, and in consultation with the researcher's academic supervisor and the statistician, a questionnaire was developed and pre-tested on patients before commencement of the study to ensure reliability of data collection instruments. To enhance instrument validity the research tool (questionnaire) was subjected to proof-reading and evaluation by experts in the field. The data were collected by means of the structured questionnaire over a period of three weeks. A trained research assistant helped with the process of data collection. Respondents were requested to answer the questionnaire anonymously.

Data entry and analysis were done using Epi info software programme version 6. Descriptive, as well as inferential statistics were used in the analysis. Percentages were rounded off to one decimal

point. For the purpose of data analysis respondents' age and source of income were grouped in categories; ≤ 24 (youth), 25-49 (adults) and 50 and above (seniors) and employed, unemployed, grants/pension and 'other' respectively. Educational level was also grouped in three categories: no formal education; primary; and secondary/university.

The three open-ended questions were not coded for quantitative analysis and were analysed individually. The respondents' responses were grouped in themes for quantitative data presentation purposes.

The respondents were informed about the survey before being invited to participate. Thereafter oral consent was obtained before administering a questionnaire or interview. Permission to conduct research was obtained from both the University of South Africa's Ethics Committee and KwaZulu-Natal's Health and Knowledge Management Committee.

Results

The overall response rate was 100%. A response rate of 100% is normally unusual and some of the reasons that contributed to achieving a response rate of 100% include the following: the study was non-threatening and most respondents were familiar with the research assistant because of his active involvement in the community activities.

The study sample was drawn from both respondents seeking health care services from out-patient department and those who were admitted as in-patients. The majority of the respondents (73.6%) came from the OPD. In terms of gender 40% were males and 60% were females. The respondents' ages ranged from 18 to 85 years; mean age was 36.5 years. Sixty percent (60%) were adults; and 19.1% were youth.

Of the 110 surveyed patients only 47.3% indicated that they had secondary/tertiary education. Those with primary school education accounted for 34.4% while 16.3% reported having had no formal education.

Respondents' knowledge of x-rays was determined using four questions. Out of 110 respondents 10.9% demonstrated good knowledge about x-rays. Those with average knowledge accounted for 15.5% of the study sample. The majority (73.6%) had a score of 0 or 1 and as such were considered to having poor knowledge about x-rays.

In terms of perceived benefits and expectations of x-rays and involvement of health care professionals there were six questions which attempted to solicit information on the respondents' interaction with health care-providers regarding x-ray examination and benefits, in terms of patient perceptions. The researcher is of the opinion that patients' perceived benefit and expectation of an x-ray examination outcome may influence patients' thoughts about x-rays.

When asked which source could provide factual information about x-ray 83.6% of respondents said they would trust health care-providers to provide them with factual information about x-rays. The question as to whether family members could be a source that could provide factual information yielded an 11.8% affirmative response.

Forty-six (n=46) respondents regarded x-rays as essential in the investigation process. The majority (58.2%) responded in the negative. On the issue of the reliability of x-ray examination compared to clinical evaluation, 60.0% of the respondents answered in the affirmative. They were of the opinion that x-rays are more reliable; 24.5% of the respondents were unsure.

Half of the respondents believed that x-rays have the ability to reveal all illnesses and pain, whereas 63.6% thought that an x-ray examination was a better option for diagnosing TB. Only 13.6% of the respondents answered negatively which seems these patients are familiar with the sputum test for TB.

In terms of patients' beliefs the survey found that 70.0% of the sample believed that all who were involved in an accident should be sent for an x-ray examination regardless of their clinical condition. Many respondents also believed that a child with a swollen elbow should be taken to the hospital for x-ray investigation instead of a traditional healer.

The strong belief in x-ray examinations by patients was affirmed because only 12.7% indicated that it was not necessary for all patients with coughs to ask for an x-ray examination. Only 26.4% of the respondents believed that a patient could receive proper treatment without an x-ray examination.

The researcher also attempted to determine whether some of the problems and barriers in the provision of x-ray services might affect patients' demand for x-rays. When respondents were asked whether

they would still be willing to be x-rayed if they were informed that undergoing x-ray examination would be painful 69.1% said they were willing to be x-rayed even after being told that the x-ray examination was painful. Of the surveyed sample 64.5% were of the opinion that having an x-ray was not expensive.

Forty percent (40%) indicated that adequate information about x-rays would affect their decision whether to make use of it. However, 50.9% answered positively when asked whether they would still be willing to be x-rayed if they knew that there was a health risk associated with the examination. In terms of payment for services 65.5% said they were willing to make extra payment for x-rays. Some indicated that they were unable to pay extra.

Relationship between gender, age and educational level and questions related to knowledge, perceived benefits and beliefs was investigated. This entailed cross tabulation between socio-demographic variables, namely gender, age and educational level, and questions related to knowledge, perceived benefits and beliefs. This was done in an attempt to examine frequencies of observations that belong to specific groups on more than one variable. By examining these frequencies, the researcher was able to identify relationships between cross tabulated variables. Gender, age and educational level were selected because of the likelihood of their influence on the respondents' health-related behaviour and could be used in making recommendations.

There were only a few areas where significant differences were found between socio-demographic factors and areas covered in the questionnaire. A significant difference was determined between: respondents' levels of education; their knowledge of whether x-rays could prevent disease; between respondents' ages; their perception that an x-ray examination was more reliable than a clinical assessment by a doctor.

Open-ended questions were included in the study to allow respondents to elaborate on and present comments and viewpoints about x-rays^[15]. Viewpoints, comments and answers given by respondents in response to open-ended questions were organised into thematic categories (Tables 1-3). These were further used in the discussion to support results obtained from structured questions. Some of the

key themes generated include:

- X-ray checks inside body
- X-ray shows TB/fracture
- X-ray provides information and explanation about patients' disease or injury
- Doctors get information about health problem which they can't see with eyes
- Know more about how x-ray works and whether there risks
- Health workers should communicate x-ray results

Almost all respondents, regardless of age and educational level, were unable to differentiate between what an x-ray is and what its purpose is. Results are reflected in Table 1. On the issue of information obtained from x-ray examination, 48.7% perceived x-rays as something that provides information and an explanation for illness or injury. When undergoing an x-ray examination, a patient believes that the cause of his/her ill health will be explained. Another theme which attracted a high number of responses (27.5%) was that respondents said that an x-ray was important because it provided doctors with hidden information that a naked eye could not see. Results are reflected in Table 2. Knowledge required about x-rays was dealt with; 48.9% of the respondents indicated the need for workers to communicate the results of x-ray examination (see Table 3). In general it seemed as if the questionnaire in itself made the respondents think about factors like risks and costs of x-ray examinations that would not have been significant to them previously.

Discussion, limitations and recommendations

There were a few areas where differences were found between socio-demographic factors and areas covered in the questionnaire. In terms of influence of gender there were more women than men in the study sample. Many factors could contribute to this situation, for example, women coming for routine mammography examinations. No significant difference however was found between the gender groups on demand or preferences for x-ray examination. In terms of the influence of age the study found that there was a relationship between respondents' age groups and the reliance on x-ray examination rather than on doctors' clinical assessments (p-value=0.045). Analysis of data revealed that the major-

Table 1: Understanding of x-rays: themes

Themes	Percentage
Comment – I don't know	15.3%
X-ray checks inside body	27.1%
X-ray shows TB/fracture	28.2%
Purpose of x-ray	20.0%
Fair idea of what x-ray is	9.4%
Total	100%

Table 2: Information obtained from x-ray examination: themes

Themes	Percentage
X-ray provides information and explanation about patients' disease or injury	48.7%
Get information about TB and other chest problems	6.3%
Get information about health problem which they can't see with eyes	27.5%
Information that assists in treatment of patients	10.0%
Information about how well you are	7.5%
Total	100%

Table 3: Knowledge required about x-rays: themes

Themes	Percentage
Know more about how x-ray works and whether there risks	20.5%
Health workers should communicate x-ray results	48.9%
Doctors should explain how they are able to see problems on x-ray	10.2%
Ability of x-ray	15.9%
Cost of x-ray	4.5%
Total	100%

ity of respondents in the adult (66.6%) and senior (57.0%) age groups perceived x-ray examination to be more reliable than a doctor's clinical evaluation. Furthermore, the majority of respondents in the senior group (78.3%) indicated that all patients with coughs should ask for an x-ray examination which also differed significantly from other age groups (p -value=0.006). This trend might be linked to the educational level of respondents; since this study was done in a rural context the older age groups were more likely to be less educated.

The study results reveal that there was a significant relationship between educational level and knowledge regarding x-ray as prevention against disease (p -value = 0.023). Almost all of the respondents with no formal education (94.4%) believed that x-ray alone could prevent disease. It was further revealed that respondents educational level had an influence on the perception that x-ray was a better diagnostic tool for TB than sputum test (p -value=0.038). It was found that the less advanced the respondents' educational level was, the stronger the perception and expectation that through

x-ray TB could be diagnosed better than a sputum test. This observation is similar to that of a study done in Norway which revealed that education had little impact on x-ray examination rates^[16].

It was expected that many respondents would have knowledge about radiography because it has been in use for a long time. On the contrary, the study revealed that very few (10.9%) had knowledge of x-rays. Quantitative results are supported by qualitative responses emanating from open-ended questions where only 11.1% seemed to have a fair idea of what an x-ray was. Poor knowledge about x-ray examinations clearly has an implication on a patient's ability to make an informed decision. Evidence from literature suggests that lack of knowledge is the most significant threat to unwarranted demand for radiographic imaging^[17].

The results from this study further suggest that there are a number of factors apart from socio-demographic factors that might influence patients' demand for x-ray in the context of this study. In terms of perceived benefit of x-rays the likelihood of patient demand for an x-ray service is possibly dependent on the

balance between perceived benefits and barriers that may prevent the intended action^[18]. However, comments from the respondents suggested that patients seeking health care services at this rural KZN hospital believed that x-rays could provide information and an explanation for their illnesses or injuries. This observation supports the results from a Norwegian study on patients' views on the importance and usefulness of conventional or plain radiography which found that patients thought conventional radiography was needed to rule out serious diseases^[18].

The majority of respondents (60.0%) appeared to believe in the reliability of the x-rays more than a doctor's clinical investigation. Furthermore, 54.5% of the respondents did not believe that a doctor could treat a patient properly without an x-ray examination. This is line with other findings^[18] which assert that some patients consider plain radiography to be more reliable than clinical evaluation.

The responses in this survey implied that patients' perceptions and behaviour concerning medical x-rays were based on beliefs and expectations which emanated from inadequate information and lack of knowledge. One would therefore expect conflict between modern technology and traditional medicine in a rural setting. The high number of respondents who had faith in x-ray imaging in this study was, however, in sharp contrast to the results from a study conducted on Norwegian patients which revealed increased scepticism towards x-rays among the public and health-care providers^[19]. It should, however, be noted that the context of Norwegian study was in an area where advanced technology has been freely available for a long period.

In terms of lack of information it would seem that patients' health behaviour may be influenced by knowledge and availability of health information associated with it. The researcher is not aware of any health educational campaigns related to x-ray examinations in the study context or elsewhere in South Africa. Unlike in developed countries, where patients have some information about and opinions regarding x-rays, the results from this study suggest that it was obvious that an x-ray examination and x-rays in particular are not well understood by patients.

The fact that 83.6% of the respondents said they would trust health care-workers as a source of proper information

about x-rays needs to be considered in the wider context of health communication between health care-providers and patients. It is only by making evidence-based information available to patients, in an easy-to-understand form, and also by ensuring that patients have adequate time to discuss benefits, costs and risks associated with x-rays, that patient demand for x-ray will be done with truly informed consent ^[20].

The study sought to determine the impact of lack of public health awareness. Diagnostic radiography, which also includes plain or conventional radiography, carries small but real risks ^[21]. However, data presented in this study suggested that respondents were not aware of the ionising radiation risks associated with x-rays. These results support the findings of a research conducted in Turkey which showed that few patients knew that x-rays could be hazardous though they were aware that x-rays were used in mammography ^[22]. Since decision-making involves making a choice, which in many cases involves a trade off, patients should be well informed. Public health education can influence the general population and, in particular patients, not only to have a positive attitude about medical x-rays but also to be aware of the risks. Some researchers suggest that making information available to patient about radiation risk may reduce unwarranted x-rays performed without specific clinical indication ^[23].

It has been argued that the likelihood of patient demand, in this case for x-ray examination, is thought to depend on the balance between perceived benefits and barriers to preventative action ^[18]. However, the results of this study contradict this assertion. What the study found was that there was no association between a respondent's income and demand for x-ray examination. While this observation may differ from the results of other studies, which found an association between socioeconomic factors and the use of x-ray ^[24], it however supports other findings which showed that the use of conventional x-ray and computerised tomography was not influenced by one's socioeconomic status ^[6].

This study had several limitations that should be taken into account when interpreting the results. First, a convenience sampling was used in the selection of respondents and as this method does not allow for a representative sample to

be selected, the difference between the sample and the study population was not ascertained. Secondly, it is important to note that this study was contextual, as the research was conducted in a single KZN rural hospital. Therefore, the results cannot be generalised to other South Africa rural hospitals. Due to the complexity of human behaviour and its social intricacies, factors that could influence patient demand for x-ray examination in one locality may not have the same effects in another.

Despite these limitations it is an important study that may be used as a point of departure for other studies. In light of the above and in the setting of limited valuable health care resources and budgetary constraints, results from this study may help in understanding factors influencing patient demand for medical x-rays. These results can help to formulate a plausible strategy for the reduction of unwarranted x-ray examinations resulting in the reduction of unnecessary radiation exposure to the patients. Based on these findings, strategies aimed at reducing unwarranted demand for x-ray examination by patients can be developed and implemented without having negative effect on patient satisfaction and clinical management.

Recommendations for health care-providers and information dissemination include:

- Health care-providers, in particular doctors, should discuss issues of importance with their patients during clinical encounters and should negotiate with patients with the aim of influencing their expectations of x-rays.
- Health care-providers (doctors, physiotherapists, and nurses) should avoid giving information and advice on x-rays without cooperating and liaising with other providers especially radiographers and radiologists (where available). The latter may initiate discussions in this regard.
- Health care-providers, especially doctors, should be able to explain effectively to a patient that a clinical history and assessment are usually sufficient to enable provision of proper treatment.
- Patients should be told that other than being associated with radiation risk, x-rays have limited diagnostic capabilities and that there are other modalities that can be used for the same purpose with better results and fewer or no radiation risks involved, for example

sputum tests for TB or sonar (where available).

- New evidence on the complexity and uncertainty of risks and benefits associated with x-rays as it emerges should be made available.

In terms of public health education it is argued that increased awareness among the patients and the community in general should help reduce the number of unwarranted x-ray testing and thereby significantly reduce the biological burden on current and future generations. Recommendations in this regard are as follows:

- Standardised pamphlets/flyers about x-rays taking into account the language, educational level and culture of the target population should be produced.
- The hospital, in conjunction with radiographers, should develop awareness campaigns which may include activities aimed at sensitising health care-workers, patients and the general public about the benefits and risks (pros and cons) of x-ray services.
- An effective and persuasive public health campaign, that must attempt to influence patients' cognitive factors such as perception, attitude and belief, should be designed. This, however, must be supported by an effective and sustainable point of care guidance. This means that doctors and nurses and other health care-workers who refer patients must be equipped with knowledge about x-rays to enable them articulate well with the patients.
- Mass media communications to disseminate information about x-rays should be used.

However, the challenge for hospital policy-makers is how to establish an effective health education programme that will not scare patients but allow them to have access to beneficial x-ray examination without unnecessary overuse.

In terms of further research the following is recommended:

- This study could be replicated at other KZN and South African rural hospitals to establish the validity of the findings of this study.
- This study could be extended by including more KZN rural hospitals in one large study.
- An educational campaign could be conducted and the study repeated.

- A study could be conducted to determine the knowledge of x-rays by other health care professions that frequently come in contact with patients.
- Other studies on factors influencing the use of x-rays from the doctors' perspective may be needed to confirm, complement or challenge the findings of this study.
- A study could be done to compare patients seeking health care services in urban areas with those in rural areas with particular attention to x-ray.

It is important, however, to emphasise that the likely success of these recommendations depends on a multifaceted and coordinated approach involving all stakeholders.

Conclusion

This study highlights several factors which differ from those cited in other studies to be precursors of unwarranted demand for x-ray examinations by patients. It follows from the above results that a deeper understanding that might be gained through further studies is needed to formulate a clear picture of the dimensions that a problem of demand for x-ray examination is having on both patients and health care resources. This study raises a question: do patients seeking x-ray services at this KZN rural hospital differ significantly from other patients with regard to factors influencing demand for x-ray examination?. To answer this means that further studies are needed to establish the validity of this study's findings and especially their generalisability. Until then the problem may remain elusive and strategies to reduce patients' demand for unwarranted x-ray examinations in rural KZN may continue to remain out of reach.

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