



DEVELOPMENT AND STANDARDIZATION OF A TOOL FOR PATIENT'S PERCEPTION TOWARDS THE PHYSICIAN'S PRACTICES WHILE PRESCRIBING FOR RADIOLOGICAL EXAMINATIONS

SURESH SUKUMAR ^{1*}, DR. RAJAGOPAL KADAVIGERE .VENKATACHALAIHA²,
DR. SABU KARAKKA.MANDAPAM³ AND DR. BINU V S⁴

^{1*} Assistant Professor, MSc. Medical Imaging Technology, Department of Medical Imaging Technology, School of Allied Health Sciences, Manipal University, Manipal.

² Professor and Head, MD (radio diagnosis) Department of Radio diagnosis and imaging, Kasturba Medical College, Manipal University, Manipal.

³ Professor and Head, (Ph.D) Department of Health Information Management, School of Allied Health Sciences, Manipal University, Manipal.

⁴ Associate Professor, (Ph.D) Department of Statistics, Manipal University, Manipal.

ABSTRACT

The aim of the research was to develop and standardize a scale to assess patient's perception on physician's practices while prescribing for radiological examinations. The study data was collected from May 2013 to January 2014 in Udupi district. The questionnaire for the study was generated based on literature reviews. To assess content expert validation, the generated scale was given to the expert panel. Content validity index (CVI) was calculated using 4 point rater .CVI value of each item ≥ 0.83 is considered for the study. To determine the Reliability and exploratory factor analysis the sample size of 10:1 was considered. The tool was administered individually on the subject using rater administered by simple random sampling technique. The internal consistency(IC) of the scale was calculated by considering Cronbach's alpha values 0.70 and above to be good IC .Exploratory factor analysis (EFA) was carried out to identify the number of underlying factors by keeping factors loading fixed at 0.4 using SPSS15. From our study, 18 items scale was reduced to 15 items by considering CVI value of greater than 0.833. Overall IC for the entire 15 item scale was high with Cronbach's alpha of 0.835. The outcome of EFA shows two valid factors. The percentage of variability of factor one and two are 50.5 and 16.21. The outcome of the study shows that the standardized scale is potentially reliable and a valid measure tool, in assessing the physician's practices

KEY WORDS: develop and standardize, patient's perception and physician's practices



SURESH SUKUMAR

Assistant Professor, MSc. Medical Imaging Technology, Department of Medical Imaging Technology, School of Allied Health Sciences, Manipal University, Manipal

INTRODUCTION

The X - ray was discovered in 1895 by a German physicist, Sir W. C. Roentgen. Since then, the application of radiation has been widely used in Radiology, Nuclear Medicine and Radiotherapy for both diagnostic and treating different kind of diseases encountered by the human beings¹. Even though radiation play important role in medicine, the biological effect caused by medical radiation is more concerned in recent survey². Due to the advance development in the equipment such as PET computed tomography and multi - detector row computed tomography, there is a drastic increase in the radiological examination performed every year which crossed 3.6 billion and the number is expected to increase in future³. The application of computed tomography has increased dramatically since 1970, with the number of annual scan go up to 72 million in 2007 from 2 million in 1980s⁴, this result in the significant increase in the population's cumulative exposure⁵. Based on the literature survey it is estimated that 25% to 40% of computed tomography can be avoided, if the medical doctor follows the proper justification of radiological examination⁶. Increase concern has been recently expressed in the literature that medical practitioners who are referring the patient to the radiology examination has poor knowledge about the radiation dose of examination and its hazards⁷. As per the International Commission on Radiological Protection guideline, patient who are undergoing the radiology examination have to get the information about the benefit, risk and radiation dose imparted during the radiology examination. But actual practice is that the physicians who prescribe the radiology examination give less or no information about the radiology examination to the patient⁸. To enhance the value of research work about the physician practices while prescribing the radiology examination, valid and reliable items to assess the various aspect of the study is needed. One of the main problems in this area of research is the lack of valid tool to measure the physician practices while prescribing the radiology examination. The purpose of this

study is to development and standardization a scale for patient's perception towards the physician's practices while prescribing for radiological examinations

Aim

Development and Standardization of a tool for patient's perception towards the physician's practices while prescribing for radiological examinations

Objectives

- To generate the domains & items for the patient perception towards the physician practices while prescribing radiology examination.
- To establish the Content Validity of the study
- To assess the internal consistency reliability of the study
- To perform the exploratory factor analysis to examine the factor structure of the scale

Methods

To develop and standardize scale to assess, the following phases are undertaken to develop the scale: (a) Item generation and Content expert validation, (b) Cognitive interviewing and Pilot test, (c) Reliability and exploratory factor analysis.

Study Sample

Patient's undergoing the radiologic examination in Udupi district, Karnataka (South India).

Sample Size

- **Content expert validation** 10 radiologists with minimum of 5 years experience and 2 experts in tool development.
- **Cognitive interviewing** – 12 patients
- **Pilot test** - 30 patients
- **Reliability and exploratory factor analysis** – The sample size for Reliability and exploratory factor analysis is calculated based on 1:10 ratio⁹. In our study we had collected 464 patients who visited radiology department for the radiologic examinations

Phase – 1 Item generation and Content expert validation

The items for this study were generated based on the qualitative research. To assess content expert validation, the generated scale was given to the expert panel, consisting ten radiologists with minimum qualification of MD in radiology with experience of 5 years and two members from our team who are expert in tool development. The expert panel reviewed it for its relevance to the subject, redundancy and its comprehensiveness. The expert members also identify whether the questions capture the constructs, the closeness of the items to the constructs¹⁰.

Phase – 2 Cognitive interviewing and Pilot tests

Cognitive interviewing

Cognitive interview (CI) is a tool to improve the questionnaire design. CI was conducted among the target population (sample - 12) by a trained interviewer who knows English and local language to read, write and speak fluently to identify the potential problem in items which then need to be resolved. The items were administered individually on the subject by rater administered in which interview was done on a face to face encounter.

Pilot tests

The purpose of the pilot test is to measure the extent to which the instrument is able to provide the data of sufficient quality and quantity to satisfy the research objective. A pilot study was carried out in 30 subjects who visited the radiology department for the examinations. Selection of subject was based on the simple random sampling technique. The items were administered individually on the subject by self-rater administered. Interview usually done in non-threatening environment

Phase – 3 Reliability and exploratory factor analysis

Conducting the test in large sample helps in examining the measurability of the instrument and it also to further reduce the items by factor loading method. To determine the Reliability and exploratory factor analysis the sample size

of 10:1(10 subjects for one item) was considered. The tool was administered individually on the subject by rater administered in which interview done in a face to face encounter. The selection of sample was based on the simple random sampling technique. To assess internal consistency (Reliability) we had calculated Cronbach's alpha for the overall scale, considering alpha values 0.70 and above to be good internal consistency¹¹. Factor analysis is statistical techniques used to identify a relative small number of factors that can be used to represent the relationship among set of many inter related variables Exploratory factor analysis was carried out to identify the number of underlying factors or domains and also to identify the items under each factor. The factors loading were fixed at 0.4 in the exploratory factor analysis to guide items retention and shorten the scale. All the analysis was carried out with SPSS version 15.

Ethical Considerations

- Informed voluntary written consent was obtained from the participants for the study
- Information collected used only for research purpose
- The study was approved by the Institutional Ethical Committee (IEC154/2013).

RESULTS

Demographic characteristics

The study data was collected between May 2013 to January 2014 in Udupi district, The social demographic profile of the patient (N = 464) revealed that 64.2% (mean age 42.64±14.66) of the patient are male subject and 35.8% (mean age 41.66±14.14) of the patient are female subject (Ref Table - 1). Among the subject 66.2% was from rural and 33.8% from the urban population. The research group is predominantly literate, with 40.7% of all respondents having undergone primary school education (university or college or equivalent 17.5%, Intermediate between secondary level and university 15.9% and Secondary school 25.9%). Majority of subject (61.4%) don't undergo any radiology examination. With regard to the patient

awareness about the radiation, only 22.8% were aware about the radiation used in radiologic examination and 77.2% were not heard about the radiation. In our study

maximum of 48.1% had undergone the radiography examination (CT scan 33.4 % and Radiographic special procured 18.5%).

Table 1
Socio-Demographic Characteristics of patients

Sex	N- 464	Mean \pm SD(age)	%
Male	298	42.64 \pm 14.66	64.2
Female	166	41.66 \pm 14.14	35.8
Educational status			
1.University or College or equivalent	81		17.5
2.Intermediate between secondary level and University	74		15.9
3.Secondary school	120		25.9
4. Only Primary education	189		40.7
Rural and Urban			
Rural	307		66.2
Urban	157		33.8
Subjects undergone radiologic examinations (CT / MRI/X-ray) in the past			
Yes	285		61.4
No	198		38.6
Patients awareness about radiation used in radiologic examination			
Yes	106		22.8
No	358		77.2
Type of examination			
1.Radiographic special procured	86		18.5
2.Radiography	223		48.1
3. CT scan	155		33.4

Item generation

Based on the literature had generated eighteen items scale. Two types of interval response scale were used (a) Likert 5 point scale (1. Strongly agree, 2. Agree, 3. No opinion, 4. Disagree, 5. Strongly disagree) to know the patient perception on radiological examination and (b) Frequency 4 point scale (1. Always, 2. Occasionally, 3. Very often, 4. Never) to know the patient perception on physician practices while prescribing the radiology examination. In order to avoid the response bias, both positive and negative items were generated. The scoring of the items ranged from 1 to 5 for likert scale and 1 to 4 for the frequency scale ranged from 1 to 4. The positively worded statements are scored 5,4,3,2,1 for likert scale and 4,3,2,1 for frequency scale. The negatively worded items

being scored in reverse order i.e. 1,2,3,4, 5 for likert scale and 1, 2, 3, 4 for frequency scale.

Content expert validation

In the process of validation, experts had judged three items in the scale are highly redundant and not related to the medical doctors and suggested to exclude for the factor analysis (Ref table 2). The content in the excluded item is more of related to radiology technologist, rather than the medical doctors. Content validity index (CVI) was calculated using 4 point rater scale (1 - not relevant to 4 - very relevant). CVI value of each item ≥ 0.83 is considered for the study (80 % agreement). We had calculated the CVI of entire scale by total number of items retained divided by the total number of items undergone the content validity¹². Based on above formula the CVI for our scale is 0.833.

Table 2
Content validity index of items

Item	E - 1	E - 2	E - 3	E - 4	E - 5	E - 6	E - 7	E - 8	E - 9	E - 10	E - 11	E - 12	Agreement
1.	4	4	2	4	4	4	3	4	4	4	4	4	0.91
2.	4	4	3	4	4	4	4	4	4	4	3	4	1.00
3.	4	4	4	4	4	4	3	4	4	4	4	4	1.00
4.	3	4	4	4	4	3	4	4	4	2	4	4	0.91
5.	4	4	4	4	4	4	4	4	4	4	4	4	1.00
6.	4	4	4	4	4	4	4	4	4	4	3	4	1.00
7.	1	1	2	1	3	1	1	2	1	2	1	1	0.08
8.	2	2	2	1	1	1	2	2	3	1	1	1	0.08
9.	3	1	1	1	2	2	2	2	1	1	1	1	0.08
10.	4	3	4	4	4	4	4	4	4	3	4	4	1.00
11.	4	4	4	4	4	4	4	4	4	4	4	4	1.00
12.	4	4	3	4	4	4	4	4	4	4	4	4	1.00
13.	4	4	4	4	4	4	4	4	4	4	4	4	1.00
14.	3	4	3	4	4	4	4	4	4	4	4	4	1.00
15.	3	4	4	3	4	4	2	4	4	4	4	4	0.91
16.	4	4	4	4	3	4	4	4	4	4	4	4	1.00
17.	3	4	4	4	4	4	3	4	4	4	4	4	1.00
18.	4	4	4	4	2	4	4	4	4	3	4	4	0.91

Note: E - Expert

Cognitive interviewing

After getting the informed consent we had conducted the formal discussion with a patient who is visited the radiology department based

on the simple random sampling technique .The socio-demographic characteristics of patient for content validity shown in table 3.

Table 3
Socio-Demographic Characteristics of patient for Content validity

Sex	N- 12	Mean \pm SD	%
Male	4	37.00 \pm 13.0	33.3
Female	8	38.00 \pm 11.46	66.7
Educational status			
1.University or College or equivalent	8		66.7
2.Intermediate between secondary level and university	4		33.3
Rural and urban			
Rural	7		58.9
Urban	5		41.7

Based on the Cognitive interviewing, the subject had difficulty to choose the response scale (likertscale) initially. The response scale used in this study was likert 5 point scale and frequency 4 point scale. To rectify the problem we had explained the each response option in the tool elaborately. The average time taken for the cognitive interviewing based on rater administered was 30 minutes

Pilot tests

The pilot test of 15 items were carried out individually on 30 subjects based on self-rater administered (Ref table 4). Based on the pilot study few modifications were made in the item to improve the questionnaire design. Thus the pilot study resulted in modification of few items to facilitate the readability and comprehensibility of the sample subject (Ref table 5). The average time taken for the pilot test based on self-rater administered was 20 minutes.

Table 4
Socio-Demographic Characteristics of patient for Content validity

Sex	N- 30	Mean ±SD	%
Male	19	38.68±13.99	65.1%
Female	11	35.81±13.96	34.9%
Educational status			
1.University or College or equivalent	12		40.0%
2.Intermediate between secondary level and university	4		13.3%
3. Secondary school	14		46.7%
Rural and Urban			
Rural	19		63.3%
Urban	11		36.7%

Table 5
Modification considered in pilot study

Example - 1

In Q 18 sentence , *I give more importance to the diagnosis from radiological examination* was rephrased as to *I give more importance to the diagnosis from radiological examination rather than discussing the radiation effects of radiological examination*

Example – 2

In Q 1 sentence *The Referring doctors explain about the radiological examination* was rephrased as to *The Referring doctors explain about the importance of radiological examination.*

Reliability

Measurement of reliability is another important step in the process of standardization of the scale. In this study we had considered internal consistency as a part of Reliability test. To estimate the internal consistency, we had calculated the Cronbach's alpha for the scale overall by considering alpha values 0.70 indicative of good internal consistency. From our 464 subjects (99.1% valid data and 0.9% invalid

data) the internal consistency was calculated for 15 items. Overall internal consistency for the entire 15 item scale was high with α of 0.835 (ref -Table 6). We also calculated the internal consistency for both the Patient perception on radiological examination (Domain two - 0.876) and for the Perception towards the physician practices in radiologic examinations (Domain one - 0.826)

Table 6
Cronbach's alpha for items and domain wide

Sl.no	Items	Cronbach's alpha	Perception towards the physician practices in radiological examination	Patient perception on radiological examination
Q1	Importance of radiological examination	0.834		0.806
Q2	Relevance of radiological examinations	0.834		0.789
Q3	Radiation dose involved in examination	0.833		0.783
Q4	Risks associated with the dose	0.835		0.787
Q5	Benefit associated with dose	0.841		0.814
Q6	Wishes to undergo radiological examination.	0.838		0.814
Q10	Information about radiation dose	0.826	0.874	
Q11	Explanation about examination	0.810	0.854	
Q12	Risk of radiological examination	0.806	0.849	
Q13	Benefit of radiological examination.	0.812	0.855	
Q14	Importance to the diagnosis	0.813	0.855	
Q15	Quality of patient care	0.818	0.863	
Q16	Doctors prescribe more radiology investigation	0.826	0.866	
Q17	The literacy level of patient	0.822	0.871	
Q18	Awareness program	0.825	0.873	

Exploratory Factor Analysis (EFA)

Exploratory factor analysis was undertaken to examine the factor structure of the scale¹³.we had calculated the EFA from the sample of 464 subject (ref -table - 7). Figure 1 represents the scree plot diagram, a graphical representation

of Exploratory Factor Analysis to determine the number of factor. The percentage of variability of factor one is 50.5 and the percentage of variability of a factor two is 16.21

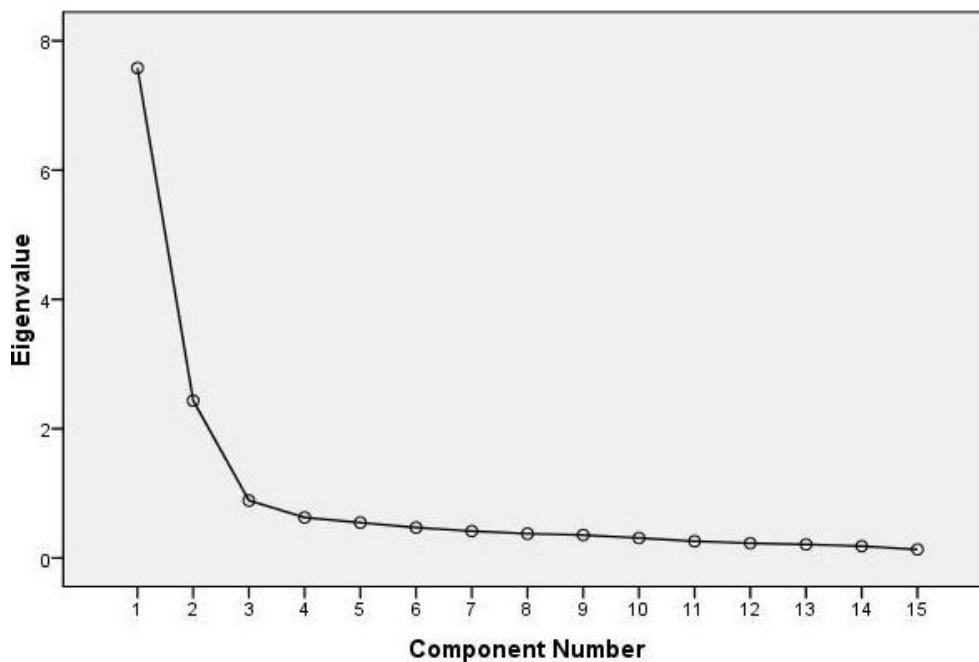
Table 7
Factor loadings from EFA

Sl.no	Items	
Patient perception towards the physician practices in radiology examination(Factor 2)		
Q12	Risk of radiological examination	0.845
Q11	Explanation about radiation	0.802
Q13	Benefit of radiological examination.	0.799
Q14	Importance to the diagnosis	0.788
Q15	Quality of patient care in the hospital with more number of investigations	0.695
Q16	Doctors prescribe more radiology investigation	0.677
Q18	Awareness program.	0.593
Q17	The literacy level of patient	0.590
Q10	Information about radiation dose	0.572
Patient perception on radiological examination(Factor 1)		
Q3	Radiation dose involved	0.822
Q4	Risks associated with the dose	0.801
Q2	Relevance of radiological examinations	0.773
Q1	Importance of radiological examination	0.740
Q6	Wishes to undergo radiological examination.	0.664
Q5	Benefit associated with dose	0.656

Note: - Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.856 and Bartlett's Test of Sphericity is 3.088. (P= 0.001).

Figure 1
Scree plot of Exploratory Factor Analysis

Scree Plot



DISCUSSION

The purpose of this study was to develop and standardize a scale to assess the patient's perception towards the physician practices while referring for radiologic examinations. The outcome of the study shows that the standardized scale is potentially reliable and a valid measure tool, in assessing the physician's practices. As per the International basic safety standards for protecting people and the environment, the physician who are prescribing the Radiologic examination should inform the patient about the type of examination, discuss the relevance of radiological examinations prescribed for diagnosis of patient's specific condition, information about the radiation dose involved in the radiological examination and the risks and benefits associated with the radiation dose received from the radiological examination. In our study result shows that 87.4 % of physicians don't discuss the relevance of radiologic examination and 90.3% of referring physician doesn't explain the radiation dose involved in the procedure. The most concern outcome of the study is that, patients undergoing the radiologic examination don't get any information about the risk (87.0%) and benefit (88.1%) associated with the procedure. The possible reason for not discussing the relevance of radiology procedure may be due to the patient's poor literacy level about the radiation. The most concerned problem with the patient is literacy level which plays a major role to understand about the effects of radiation. In our study majority of the subject had completed the primary education (40.7%). This was reflected in our present study, in which 61.4% of research subject of research population had undergone the previous radiologic examination and only 22.8% of subject was aware of radiation used in radiology department. Due to the poor awareness about the radiation among the patient, the referring physician may find difficult in explaining the patient about the benefit and risk of the examination. Even though our result supports the patient's poor literacy had act as a barrier for the referring physician to inform the patient about the benefit and risk, Our literature survey showed that the

medical practitioner who are prescribing the radiologic examination has poor knowledge about the radiation and dose involved in the procedure^{14,15}. The study conducted in the Sub-Saharan African Country shows that the knowledge of referring physicians regarding the justification of radiologic examination is poor(79.5%)¹⁶. The questioner based survey about the radiation awareness among the Indian medical practitioner will give more strength to our study.

Recommendations

Furthermore survey has to conduct in large sample using this scale to know more about the physician practices while prescribing radiology examination in different part of India and worldwide. This study was conducted only on the study population who are visiting to radiology department (48.1% radiography examination, 33.4 % CT scan and 18.5% Radiographic special procured). Further study can be conducted on the patients who are visiting the Nuclear Medicine and Radiotherapy department. The questionnaire could be translated to other Indian languages to increase its application in other regions of India. Many studies had reported worldwide that the medical physicians who prescribe the radiology examination have poor knowledge about the radiation dose. But there is no valid tool to measure the knowledge and awareness about the radiation. The Further study on the development and standardization of radiation awareness tool for physician is necessary in order to check the knowledge and awareness about the radiation.

Limitations

Although the scale was developed based on sound literature survey and quality research on patient and doctors, few limitations need to be considered. Even though we had conducted the study in the large sample, internal consistency alpha valued for few elements is low, they may still considered significant. The internal consistency alpha for over all scale is 0.835. The possible reason for the low internal consistency could be that the scale was administered to 40.7% of all respondents

undergone Primary school education as compare to other Educational status. We didn't conduct the test- retest reliability due to the difficulty in follow-up the patient who is undergoing the examination. Further conducting the test- retest reliability will add more strength to the scale.

CONCLUSION

The aim of the present study is Development and Standardization of a tool for patient perception towards the physician's practices in

radiology examination. In present study we had developed 15 item questionnaires to measure perception towards the physician practices in radiological examinations. The study also established the content validity, reliability and Exploratory Factor Analysis. Patient who are undergoing the radiology examination had poor knowledge about the radiation and get very less or no information about the benefit, risk and dose involved in radiologic examination from the prescribed doctors.

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