

## Overuse of Radiological Imaging in National Health Insurance Fund Centres, Khartoum Sudan 2013

Siham Ahmed balla<sup>1\*</sup>, Haidr Abu ahmed<sup>1</sup>, Omnia Mustafa Eltayeb<sup>1</sup>

<sup>1</sup>: department of community medicine, faculty of medicine, university of Khartoum

### **Abstract:**

**Background:** Overuse of radiological imaging contributed to risk of radiation.

**Objective:** To identify causes of overuse and unnecessary radiological imaging and the responses of radiologist towards doubtful imaging requests.

**Methods:** A cross sectional study carried out in four reference diagnostic centres accepting insured patients. Self-administered questionnaire was testing the perception of radiologists by Likert scale. Eleven and five causes were listed for overuse and unnecessary imaging respectively. Factor analysis was used to extract the domain causes. Cronbach's Alpha was used for reliability at >0.7. Fisher exact test was used at 95% confidence level to test the association of the cause, insufficient clinical examination, with time being working in NHIF and the working years.

### **Results:**

Females accounted to 71.4%, 48.4% were specialists of Computed tomographic scan and paediatric radiology. Perceived causes of overuse were new radiological technology (71.4%), availability of radiological resources (57.1%), larger payment from NHIF (57.1%) and patients` demands (57.1%). Factor analysis yielded five causes of overuse. Insufficient clinical examination (90.4%) and give comfort to the patients (61.9%) were causes of unnecessary imaging. Doubtful imaging request was not performed because of serious complications of radiation (71.4%). The cause, insufficient clinical examination was not significantly associated with time being working in NHIF and the working years P-value > 0.05.

### **Conclusion:**

Insufficient clinical examination and comfort the patients were the causes of unnecessary radiology imaging .Radiologists did not respond to doubtful imaging request for the serious complications of radiation..

**Key words:** radiological imaging, overuse, factor analysis, health insurance, Khartoum

### **1. Introduction**

Most of the national and international associations and federations of radiology considered the existence of overutilization of imaging tests. It acknowledge several contributory factors such as self-referral of patients , patients` desires and lack of awareness (Rehani 2006). Clinical assessment is of great value to direct the physician and the radiologist on the type of radiological imaging needed as an objective diagnostic tool (Rehani 2006 ).

Overuse or unnecessary care refers to medical services that are provided with a higher volume or prescriptions of costly services. It could be due to factors related to physicians and or to the patients (Emanuel and Fuchs2008). Regarding overuse in health system in Sudan, the annual statistical reports issued from Sudan Ministry of Health showed an increase trend in X-Ray utilization in hospitals( MOH2010). Most of physicians request radiological imaging without written details in the request form which (Yousef, Ayad et al. 2011).

National Health Insurance Fund (NHIF) in Sudan was established in 1994. It is a parallel health system provides high technology radiological and diagnostic imaging. It is an insurance health system organization run by government and it contributes to improve affordability for a large sector of population to access health services at primary health care level. It is a tool for values, equity, social solidarity and community participation (WHO 2014). The client is a contributor in NHIF organization and purchases health services for free and partially pays for the drugs (NHIF 2014).

The aim of the study was to identify causes of overuse, unnecessary radiological imaging, and the responses of radiologist towards doubtful imaging requests.

## **2. Materials and Methods**

A cross sectional analytical study was carried out in four reference diagnostic centres in Khartoum state. The centres are exclusively providing diagnostic investigation as outpatient clinics. It is providing X-Ray imaging, Computed tomography scan (CT), Magnetic resonance image (MRI), Ultra- sound, Doppler scan, Mammography and therapeutic Laparoscopic and Endoscopy. The centres are well equipped with sophisticated imaging machines and have outpatient's clinics of different specialties run by qualified consultants. These centres accept patient referred from the health institutions that provide paid health services for National Health Insurance Fund.

A total coverage of 133 radiologists with different sub-specialities and qualifications in radiology were consented to fill self-administered. The questionnaire was adapted and composed of three sections(Lysdahl and Hofmann 2009). The first section included gender, sub-speciality in radiology, the percent of time being working in NHIF and the working years. The second section composed of two questions. The first question was about the factors of overuse of radiological imaging in NHIF. Eleven potential factors were listed. The second question was about factors that account for unnecessary radiological imaging requests for patients referred from NHIF. Five potential factors were listed. Five points Likert scale was used to assess the level of agreement by radiologists for the factors in section two. The level of agreement was classified into very small, small, to some extent, large and very large extent. The third section was for the responses of radiologist towards doubtful imaging requests. Seven potential causes were listed.

Data was cleaned and entered in SPSS software version 20. Characteristics of the radiologists and causes of overuse were presented as descriptive statistic. More than fifty per cent frequency was set as the most frequent response of perceived cause of overuse and or unnecessary radiological imaging factors. Cronbach's Alpha was

used to test reliability of the scale and subscales at  $\geq 0.7$ . Factor analysis with Varimax rotation was carried out to extract the factors reflecting the domain causes. Eigen value  $>1$  and factor loading  $> 0.3$  were selected respectively during factor analysis. Internal reliability and contribution to the variance of domain causes were considered. Fisher exact test was carried out at 95% confidence level to test the association of the factor, insufficient clinical examination, with percent of time being working in NHIF and the working years.

### 3. Results

The overall response rate was 94.7% (126 out of 133). Six radiologists were travelling out of the country and one questionnaire was cancelled because it was not filled properly. The study showed 71.4% of radiologists in NHIF were females compared to 28.6% males [table1]. The most frequent subspecialties were general radiology (65.1%), Computed tomographic scan (56.3%), Ultra- sound (31.0%) and Magnetic resonance image (29.4%) [table1]. Subspecialties of females were Computed tomographic scan (32.5%), paediatric radiology (15.9%) and 32.2% general radiology [table1]. Regarding working years, 86.5% of study population had duration between 10-20 years (median 5 years and interquartile range 12 years) and 77.8% of them had full-time being working in NHIF [table1].

**Table 1: Characteristics of radiologists working in NHIF centres**

Characteristics	Number (%)	
Gender	Male	36 (28.6)
	Female®	90 (71.4)
Speciality in radiology#	General radiology	82 (65.1)
	Angio/intervention	5 (4.0)
	Paediatric radiology	17 (13.5)
	Neuroradiology	17 (13.5)
	Computed tomographic scan(CT)	71 (56.3)
Years working as radiologist*	Magnetic resonance image(MRI)	37 (29.4)
	Ultra- sound	39 (31.0)
	Mammography	10 (7.9)
	Less than 10 years	75 (59.5)
Percent time spent as radiologist in NHIF	10-20 years	34 (27.0)
	More than 20 Years	17 (13.5)
	50% -75% of the time	28(22.2)
	More than 75% of the time	98 (77.8)

® Females were specialized in Computed tomographic scan (32.5%), paediatric radiology (15.9%) and 32.2% general radiology

# Multiple responses frequency

\*Median working duration as radiologist was 5 years and interquartile range (IQR) was 12 years

Table 2 showed eleven items reflecting the perceived causes of radiological imaging overuse in NHIF. The highest scored causes were four out of the eleven. These are new radiological technology (71.4%), availability of radiological resources (57.1%), larger payment from NHIF (57.1%) and patients' demands (57.1%)

**Table 2: Causes of overuse of radiological imaging In NHIF centres**

Perceived causes by radiologists	To a small-To some extent		To a large-No response	
	very extent	small extent	very extent	large
The patient rights	42(33.3%)	36(28.6%)	48(38.1%)	
Demand on health care	12(9.5%)	42(33.3%)	54(42.9%)	30(23.8%)
Insufficient clinical assessment	54(42.9%)	18(14.3%)	48(38.1%)	6(4.8%)
Illiteracy about use of radiology	36(28.6%)	42(33.3%)	49(38.1%)	
New radiological technology	0(0.0%)	36 (28.6%)	90 (71.4%)	
Availability of radiological resources	6(4.8%)	48(38.1%)	72(57.1)	
Fascination for technology	72(57.1%)	30(23.8%)	24(19%)	
Physicians' competition for patients	42(33.3%)	54(42.9%)	30(23.8%)	
Larger payment from NHIF	30(23.8%)	24(19%)	72(57.1%)	
Demands for NHIF documentation	54(42.9%)	54(42.9%)	12(9.5%)	6(4.8%)
Patients` demands	18(14.3%)	36(28.6%)	72(57.1%)	

Cronbach's Alpha= 0.7

Table 3 showed factor analysis of items which identified five domain causes accounted to 80.6% of the total variance. The causes are patient rights, patients` demands, poor clinical assessment, new radiological technology and ignorance about radiology. The first three causes showed high reliability, Cronbach's alpha  $\geq 7$  and accounted to 60% of the variance.

**Table 3: Factor loadings<sup>1</sup> and Varimax rotation of causes of over use of radiological imaging**

Perceived causes	Factors				
	Patient rights	Patients` demands	Insufficient clinical assessment	New radiological technology	Ignorance about radiology
Insufficient clinical assessment	.900				
Ignorance about radiology	.767			.382	
Demand on health care		.846		.358	
New radiological technology		.828			
The patient rights	.647	.655			
Availability of radiological resources		.523			.451
Demands for NHIF documentation			.834		
Patients` demands			.764		
Physicians' competition for patients	.534		.659		
Fascination for technology				.923	
Larger payment from NHIF					.899
Cronbach's alpha <sup>2</sup>	0.8	0.7	0.7	0.2	0.4
Factor Percentage of variance	26.3%	21.6%	12.1%	10.8%	9.8%

<sup>1</sup>Factor loadings > 0.3 .Principal Component Analysis.

<sup>2</sup>Cronbach's alpha is acceptable if > 0.7

Table 4 showed five factors of unnecessary radiological imaging in NHIF. The causes were repeating investigations; give comfort to the patients, frequent imaging for follow up, request wrong imaging and insufficient clinical examination. The five factors showed high internal reliability (Cronbach's Alpha = 0.8). The most frequent factors were insufficient clinical examination (90.4%) and give comfort to the patients (61.9%)

**Table 4: Causes of unnecessary radiological imaging among referred patients from NHIF**

Perceived causes by radiologists	To small-very	To some extent	To large- very large
	small extent		extent
Repeating investigations	30(23.8%)	66(52.4%)	30(23.8%)
Give comfort to the patients	18(14.3%)	30(23.8%)	78(61.9%)
Frequent imaging for follow up	6(4.8%)	78(61.9%)	42(33.3%)
Request wrong imaging	42(33.3%)	24(19%)	60(47.7%)
Insufficient clinical assessment ≠	6(4.8%)	6(4.8%)	114(90.4%)

**Cronbach's Alpha= 0.8**

≠ Insufficient clinical assessment was insignificantly associated with the duration of work as radiologist and the time spent in NHIF doing radiology

Table 5 showed the responses of the radiologist regarding doubtful radiological imaging requests. Radiologists perform doubtful imaging requests for three causes which were the desire of the patient; the patient already arrived for imaging and the fear from legal consequences. The causes of not performing doubtful imaging requests were serious complications of radiation, the patient is young, the high radiation dose and false positive/negative results.

**Table 5: Response of radiologists towards doubtful radiological imaging requests**

Causes	Response towards doubtful radiological imaging requests	
	Perform the image	Not perform
The desire of the patient	66(52.4%)	
The patient already arrived for imaging	52(61.9%)	
Fear from legal consequences	72(57.1%)	
Serious complications of radiation		90(71.4%)
The patient is young (child, youth)		72(57.1%)
The high radiation dose		72(57.1%)
False positive/negative results		72(57.1%)

#### **4. Discussion**

We studied the perception of radiologists working in NHIF about the causes of overuse and unnecessary radiological imaging and their responses towards doubtful imaging requests.

In this study, female radiologists were 90 (71.4 %). This is similar to gender features in developed countries (Riska 2001). In Sudan, it may be explained by the gross intake of females into medical schools and the brain drain of professional males.

Four perceived causes of overuse out of eleven were agreed upon by radiologists (frequency >50%). New radiological technology showed the highest frequency cause of overuse in our study (71.4%). This was noticeable during the last two decades and the use of high-technology imaging (CT and ultrasound) as a new technology for diagnosis of acute appendicitis was increasing (Bhargavan and Sunshine 2005, Semin, Demiral et al. 2006, Wong, Cheung et al. 2008, Hendee, Becker et al. 2010). Other causes of overuse in our study were availability of radiological resources in NHIF, patients` demands and larger payment from NHIF. Availability of radiological resources could be an explanatory factor for utilization rates of radiological imaging (Wong, Cheung et al. 2008). Patients` demand, autonomy and the payment for physicians and institutions were supported in the literature as factors of overuse in radiological imaging (Lee and Levy 2012).

In our study, factor analysis yielded five domain causes of overuse of radiological imaging in NHIF. Patient rights, patient demands, insufficient clinical assessment, new radiological technology and ignorance about radiology. These causes contributed to more than 80% of the variance in factor analysis which is higher than a Norway study (Lysdahl and Hofmann 2009).

Give comfort to the patient and insufficient clinical assessment are the common shared causes of unnecessary imaging in our study. However; unnecessary imaging may produce normal findings in 17.2% and exposes the patients to unnecessary radiations (Saadat, Ghodsi et al. 2008, Bogdanich and McGinty 2011). Conduct clinical assessment only and avoiding unnecessary radiology in children with acute bronchitis could save \$59 per patient (Yong, Schuh et al. 2009).

Clinicians and radiologists agreed to have sufficient clinical examination and clear clinical question to be answered by radiology (Bosmans, Weyler et al. 2011). A study of radiological request forms in Khartoum hospitals showed incompleteness of all items including clinical assessment particularly among public hospitals (Yousef, Ayad et al. 2011). The radiologists are more knowledgeable about the use of radiology and could prevent unnecessary radiation and save the life of patients if the request forms are adequately filled (Levin and Rao 2004, Yousef, Ayad et al. 2011). The delay to provide care to patients and exposing them to harm could be

due to insufficient and missed clinical information (Burnett, Deelchand et al. 2011). Although insufficient clinical examination is the common perceived cause of unnecessary radiological imaging in NHIF, it is not significantly associated with the duration of work and the time spent doing radiology ( p-value >0.05).

In our study, the radiologists perform doubtful imaging requests for three causes which were the desire of the patient; the patient already arrived for imaging and the fear from legal consequences. Request referral forms which do not conform to the standards will lead to doubtful information (Espeland, Albrektsen et al. 1999). It affects the clinical decisions and care outcome (Afolabi, Fadare et al. 2013).

In this study, 71.4% of radiologists to the very large extent did not carried out doubtful radiological imaging requests because of serious complications of radiation. Trained care provider on standards of radiology produce clinically relevant reports and decrease unnecessary imaging (Qureishi, Garas et al. 2014).

## 5. Conclusion

Patient rights, patient demands, insufficient clinical assessment, new radiological technology and ignorance about radiology are the five domain causes of overuse of radiological imaging in NHIF. Radiologists did not respond to doubtful imaging request for the serious complications of radiation and responded when the patients arrived to radiology unit.

## References

- Afolabi, O., Fadare, J., & Essien, E. (2013). Audit of Completion of Radiology Request Form in a Nigerian Specialist Hospital. *Annals of Ibadan Postgraduate Medicine* 10(2), 48-52.
- Bhargavan, M., & Sunshine, J., H. (2005). Utilization of Radiology Services in the United States: Levels and Trends in Modalities, Regions, and Populations 1. *Radiology* 234(3), 824-832.
- Bogdanich W., & McGinty J.C. (2011). Medicare claims show overuse for CT scanning. *The New York Times* (17).
- Bosmans, J. M., Weyler, J., De Schepper, A., M. & Parizel, P., M. (2011). The radiology report as seen by radiologists and referring clinicians: results of the COVER and ROVER surveys. *Radiology* 259(1), 184-195.
- Burnett, S. J., Deelchand, V., Franklin, B., D., Moorthy, K. & Vincent, C. (2011). Missing Clinical Information in NHS hospital outpatient clinics: prevalence, causes and effects on patient care. *BMC health services research* 11(1), 114.
- Emanuel, E. J., & Fuchs, V., R. (2008). The perfect storm of overutilization. *Jama* 299(23), 2789-2791.
- Espeland, A., Albrektsen, G., & Larsen J. L. (1999). Plain radiography of the lumbosacral spine. An audit of referrals from general practitioners. *Acta Radiol* 40(1), 52-59.
- Hendee, W. R., Becker, G. J, Borgstede, J. P, Bosma, J, Casarella, W. J, Erickson, B. A, Maynard, C. D, Thrall, J. H, & Wallner, P. E., (2010). Addressing Overutilization in Medical Imaging 1. *Radiology* 257(1), 240-245.
- Lee, D. W, and Levy, F. (2012). The sharp slowdown in growth of medical imaging: an early analysis suggests combination of policies was the cause. *Health Affairs* 31(8) 1876-1884.

- Levin, D. C., & Rao, V. M. (2004). Turf wars in radiology: the overutilization of imaging resulting from self-referral. *Journal of the American College of Radiology* 1(3), 169-172.
- Lysdahl, K. B., & Hofmann, B. M. (2009). What causes increasing and unnecessary use of radiological investigations? A survey of radiologists' perceptions. *BMC health services research* 9(1), 155.
- MOH (2010). Annual Statistical Report, MINISTRY OF HEALTH
- NHIF. (2014). "Background about NHIF" Retrieved 21 July 2014, from <http://www.nhif.gov.sd/fullstory.php?id=4#&panel1-4>.
- Qureishi, A., Garas, G. Shah, J., & Birchall, J. (2014). A two-cycle prospective audit of temporal bone computed tomography scan requests: improving the clinical applicability of radiology reports. *The Journal of Laryngology & Otology* 128(01), 49-52.
- Rehani, B. (2006). Imaging overutilisation: Is enough being done globally? *AJR Am J Roentgenol* 186(4), 937-942.
- Riska, E. (2001). Towards gender balance: but will women physicians have an impact on medicine? *Social Science & Medicine* 52(2), 179-187.
- Saadat, S., Ghodsi, S. M., Firouznia, K., Etminan, M., Goudarzi, K., & Naieni, K. H. (2008). Overuse or underuse of MRI scanners in private radiology centers in Tehran. *International journal of technology assessment in health care* 24(03), 277-281.
- Semin, S., Demiral, Y., & Dicle, O. (2006). Trends in diagnostic imaging utilization in a university hospital in Turkey. *International journal of technology assessment in health care* 22(04), 532-536.
- WHO. (2014). National Health Insurance Fund. Global Health Workforce Alliance Retrieved 26 May 2014, from [http://www.who.int/workforcealliance/members\\_partners/member\\_list/nhif/en/](http://www.who.int/workforcealliance/members_partners/member_list/nhif/en/).
- Wong, K. K., Cheung, T. W., & Tam, P. K. (2008). Diagnosing acute appendicitis: are we overusing radiologic investigations?. *Journal of pediatric surgery* 43(12), 2239-2241.
- Yong, J. H. E., Schuh, S., Rashidi, R., Vanderby, S., Lau, R., Laporte, A., Nauenberg, E., & Ungar, W. J. (2009). A cost effectiveness analysis of omitting radiography in diagnosis of acute bronchiolitis. *Pediatric Pulmonology* 44(2), 122-127.
- Yousef, M. O., Ayad, C. E., Elzaki A. A., & Sulieman, A. (2011). Evaluation of radiology request forms in diagnostic centers in Khartoum state. *Sudan Medical Monitor (SMM)* 6(3), 201-210