Website: http: jebhpme.ssu.ac.ir
EBHPME 2020; 4(2): 82-8 pISSN: 2538-5070

*EBHPME*

**ORIGINAL ARTICLE**

**Evidence Based Health Policy, Management & Economics**
Health Policy Research Center, Shahid Sadoughi University of Medical Sciences

# Examining the Amount of Unnecessary Knee MRI Prescription in the MRI Center of Bushehr University of Medical Sciences in 2018

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***ARTICLEINFO***

**Article History:**
Received: 11 Mar 2020
Revised: 25 Apr 2020
Accepted: 20 Jun 2020

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***ABSTRACT***

**Background**: Many prevalent disorders were observed in and around the knee joint. Magnetic resonance imaging (MRI) was a modern and costly diagnostic technology that was progressively applied worldwide. This study was conducted in the Bushehr educational hospitals in 2018 with the purpose of determining the necessity of knee MRI prescriptions.

**Methods**: This paper was a kind of cross-sectional descriptive-analytical study. The statistical population of the study was all patients who were prescribed knee MRI due to the appearance of knee problems and referred to the MRI Center of Bushehr University of Medical Sciences in 2018. The sampling method was convenient sampling. The sample in this study included 274 patients. The indications and data collection form of Vojdani et al.'s study were used to specify the necessity of the mentioned prescriptions. In this study, SPSS 22 software was applied to analyze data. Also, the Chi-Square test was used to for analyzing the data.

**Results**: Among the total studied population in this study, MRI prescription was evaluated inappropriately for approximately 24 % of patients. In this study, the appropriateness of the prescriptions had a significant relationship with age, job, education level, physician prescribing, and requesting MRI (P-value < 0.05).

**Conclusion**: It could be deduced that about a quarter of MRI was not appropriate to clinical prescription. Regarding the high cost of hospital and the necessity of their reduction, induced demand would be prevented by using valid indications. Therefore, reducing unnecessary prescriptions yielded to fewer costs of the health system and patients.

**Key words:** Clinical Appropriateness, Knee Disorder, Clinical Practice Guidelines, Overuse.

## Citation

**This paper should be cited as:** Salari H, Omranikhoo H, Amini A, Amiri M, Bayyenat S, Azmal M, et al. **Examining the Amount of Unnecessary Knee MRI Prescription in the MRI Center of Bushehr University of Medical Sciences in 2018.** Evidence Based Health Policy, Management & Economics. 2020; 4(2): 82-8.





[ DOI: 10.18502/jebhpme.v4i2.3433 ]

## Introduction

The knee joint, one of the most important joints in the body and responsible for weight-bearing, is under the mechanical pressure in all activities such as standing, walking, and even sitting. There are different prevalent disorders in and around the knee joint.These injuries can cause acute problems and even lead to disability.Therefore, proper diagnosis of these injuries before invasive intervention will be necessary for improving the final result (1).

One of the services growing rapidly in the healthcare industry is the diagnostic service. MRI technology is widely used to this end. Appropriate use of these technologies can be conductive to diagnosing and treating diseases (2). On the other hand, health systems are under pressure because of their financial burden (3). Iran, such as the other developing countries suffers from inadequate resources. With the existence of resource shortage, it is expected to use the available resources more profitably (4). Unsuitable and unnecessary care is an issue associated with the quality of services, payment systems, and care financing. Totally, the application of high-priced diagnostic services shows an incremental trend (5, 6). Reduction of such services is considered as a solution for reducing the costs of the medical services and increasing the quality of services (7, 8).

Due to the high cost of MRI and the importance of imaging findings as a diagnostic standard in patients, the conduction of studies in this regard would be necessitated. Previous studies in other cities in Iran indicated that a significant amount of MRI procedures was unnecessary, imposing a significant burden on insurers and patients.In this regard, studies were carried out around the world and Iran, some of which were mentioned in the following. The study of Salari et al. (9) was performed in Shiraz and revealed that about 50 % of MRI prescriptions of lumbar vertebrae were unnecessary. Also, Jahanmehr et al. (10) conducted a study in Tehran, calculating the financial burden of unnecessary prescriptions for knee MRI and lumbar vertebrae unnecessary prescriptions in public and private radiology centers. Jahanmehr et al.'s study cleared that at least about 10,000$ financial burden was imposed for the investigated patients with unnecessary prescriptions.

The study fulfilled by Bruce E. Lehnert et al. in America in 2007, entitled "Analysis of Appropriateness of Outpatients CT and MRI Referred fromPrimary Care Clinics at anAcademic Medical Center: How Critical Is the Need for Improved Decision Support", was aimed at investigating the clinical appropriateness of a large group of CT and MRI examinations based on retrospective evidence-based guidelines.This study investigated the medical records of 459 elective outpatient CT and MR examinations. After analyses of the 459 reviewed examinations, 284 (62 %) were CT, and 175 (38 %) were MRI .Of these, 341 requests (74 %) were considered clinically appropriate, and 118 (26 %) were not considered clinically appropriate. Inappropriate examinations included brain CT for chronic headaches, lumbar spinal MRI in acute back pain; knee MRI in patients with osteoarthritis, and CT to examine hematuria in a urinary tract infection (11).

Therefore, reviews exhibited that various studies were carried out in Iran and around the world. But so far, there was no research conducted in Bushehr on the issue of unnecessary prescriptions. Knee MRI was one of the most common MRI procedures. So, this study, which attempted to determine the amount of unnecessary knee MRI prescription in the MRI Center of Bushehr University of Medical Sciences in 2018, was performed for the utilization of managers and policymakers.

## Materials and Methods

This paper was a kind of cross-sectional descriptive-analytical study conducted in Bushehr in 2018. There were two hospitals, Persian Gulf Martyrs and Al-Zahra Heart, in Bushehr. Also, there was only one MRI center in Al-Zahra Heart Hospital. The statistical population of the study was all patients who were prescribed knee MRI due to the appearance of knee problems and referred to the MRI Center of Bushehr University



[ DOI: 10.18502/jebhpme.v4i2.3433 ]

of Medical Sciences in 2018. The sample in this study included 274 patients. Sampling in this study was conducted through an convenient sampling. A general practitioner, who was also a member of the research team, attended the MRI center as a questioner and examiner and attempted to collect information from the patients.

The inclusion criteria were having a prescription for knee MRI and admission to the center, as well as their consent. No patient was included in the study without his/her consent. The general practitioner used the data collection form and began questioning and examining the patients. The indications and data collection form of Vojdani et al.'s study (1) were used in order to specify the necessity of the mentioned prescriptions. The data collection form encompassed the questions related to the patient's demographic status and the questions related to the MRI prescription. SPSS 22 software was applied in order to analyze data. Descriptive statistics (tables and graphs) were used in order to describe the data as well as the Chi-Square test for analyzing the data.

It was worth mentioning that the Vice-Chancellor approved this study for Research (VCR) of the University of Medical Sciences with the code of ethics IR.BPUMS.REC.1397.018.

## Results

In the descriptive results part, some reported demographic variable were: age, sex and other variables such as education level, job, monthly income,patient insurance status and supplementary insurance, patient examination status, reviewing the MRI requester, the referral institute, specializing the prescribing physician, the appropriateness of prescription and the result of MRI.

The demographic results were presented in Table 1. Of the 274 patients referred to the center, 79 % were male, and 21 % were female. In terms of age, 88 % of them were between 21 and 50 years old, 50 % had a university degree, and approximately 54% were self-employed.

The results related to prescriptions were showed in Table 2. Of the 274 research samples, MRI was performed on 42 patients (about 15 %) without clinical examination. MRI prescription was seen for 190 patients (69.3 %) at the physician's request. Of the 274 research samples, 215 (78.5 %) patients were referred to by the private clinic. 260 (94.8 %) patients were prescribed at orthopedics' request. But the most important finding, which was related to the percentage of the appropriateness of the prescriptions, represented that 24.8 % of them were inappropriately prescribed.

The results obtained by the Chi-Square test revealed that there was a statistically significant relationship between some variables with the appropriateness (necessity) of prescribing, which was addressed here (P-value < 0.05). In terms of age, it was determined that 86 % of inappropriate prescriptions were associated with the age group of 51 to 60 years (P-value = 0.001). Inappropriate prescriptions performed at the patient's request and physician's request were 80 % and 13 %, respectively (P-value = 0.001). The other remarkable finding was the necessity and non-necessity of prescribing, according to a physician specialist. Based on the collected data, inappropriate prescriptions in the orthopedic group and other specialists group was about 22 % and 100 %, respectively.



[ DOI: 10.18502/jebhpme.v4i2.3433 ]

**Table 1.** Demographic characteristics of patients referred to MRI Center of BUMS

| Variable | Variable grouping | Frequency (Percentage) | Variable | Variable grouping(Toumans) | Frequency (Percentage) |
|---|---|---|---|---|---|
| Gender | Female | 57(2) | Income | Under 250000 | 64 (23,4) |
| | Male | 217(7) | | 250000 to 500000 | 7 (2,6) |
| Age | 20-11 | 17(6.2) | | 500000 to 1000000 | 8 (2,9) |
| | 30-21 | 104(38) | | 1000000 to 2000000 | 53 (19,3) |
| | 40-31 | 109(39.8) | | Over 2000000 | 142 (51,8) |
| | 50-41 | 30(10.9) | | illiterate | 8 (2.8) |
| | 60-51 | 7(2.6) | | | |
| | Up to 60 years old | 7(2.5) | Educational Level | Elementary & Intermediate | 18 (6.5) |
| Employment Status | Employee | 84(30) | | Diploma | 118 (43.1) |
| | housekeeper | 27(9) | | University | 138 (50.4) |
| | student | 20(7.1) | | | |
| | Free | 149(54) | | | |
| | Worker | 13(4) | | | |
| Insurance Status | Having insurance | 225(93.1) | Supplementary insurance | Having insurance | 71 (25.9) |
| | Not having insurance | 18 (6.6) | | Not having insurance | 203 (74.1) |

**Table 2.** Distribution frequency of variables related to MRI prescriptions of BUMS and their relationship with the necessity of prescribing

| Variable | | Frequency (Percentage) | Appropriate | Inappropriate | P |
|---|---|---|---|---|---|
| Examination Status | Examined | (84,7) 232 | 176 | 56 | 0.43 |
| | Not examined | (15,3) 42 | 33 | 9 | |
| Prescription Status | Physician | (69,3) 190 | 164 | 26 | 0.001* |
| | At the request of the patient | (12.7) 35 | 7 | 28 | |
| | At the request of both | (17.9) 49 | 38 | 11 | |
| Institution Status | Public hospital | (15.3) 42 | 35 | 7 | 0.37 |
| | Private hospital | (5.1) 14 | 7 | 1 | |
| | Private clinic | (78.4) 215 | 159 | 56 | |
| | Health Center | (1.2) 3 | 8 | 1 | |
| Total | | (100) 274 | (76.3) 209 | (23.7) 65 | |

*Statically significant > 0.05

**Table 3.** The appropriateness of the knee MRI according to the prescribing physician

| The specialty of the prescribing physician | Appropriate | Inappropriate | Total | P |
|---|---|---|---|---|
| Expert | Frequency (Percentage) | Frequency (Percentage) | Frequency | |
| Orthopedics | 202(78) | 58(22) | 260(100) | 0.04* |
| Rehabilitation and physical medicine | 5(72) | 2(28) | 7(100) | |
| Rheumatology | 2(67) | 1(23) | 3(100) | |
| Others | 0(0) | 4(100) | 4(100) | |
| Total | 209(76) | 65(24) | 274(100) | |

*Statically significant > 0.05



[ DOI: 10.18502/jebhpme.v4i2.3433 ]

## Discussion

The current study was conducted to review the clinical appropriateness of knee MRI in patients with knee problems referring to the MRI Center of BUMS in 2018. Statistical analyses illustrated that almost a quarter of performed knee MRI was not appropriate to clinical prescription. This result was in line with the study carried out by Salioti et al., who examined the appropriateness of knee MRI: economic and technical clinical issues in 400 patients. In this study, the highly inappropriate prescription was 21 % (12).

In a study conducted by Ebrahimipour et al. (13) from 115 cases administered by MRI Knee 63 cases (8.54 %) unsuitable and 17 cases (8.14 %), it was uncertain and only 35 cases namely 4.30 % of the total prescribed were considered suitable.

Heljäet al. (14) concluded in a study that 7 % of performed MRIs in a university hospital were considered inappropriate. This study examined 150 common MRIS, such as the upper abdomen or liver, back, knees, head, and head of children under anesthesia (30 for each area). Three of the 30 MRIs performed on the knee area, two of the 30 MRIs performed on the lumbar spine, and one of the 30 MRIs performed on the head was considered inappropriate based on the available criteria. All 30 MRIs performed on the head in children (under anesthesia) was occurred according to available criteria.In this study, the data of 150 patients were adopted to the determined criteria.

It was appeared that one of the reasons for unnecessary MRI prescriptions was observed to be the kind of service delivery and prescription culture. Sometimes, the presence of a doctor's behavior or the presence of a physician specialist in any of the specialties or the comfort that wascreated for patients after MRI performing might be a reason for this service increment. Apparently, unnecessary cases would be reduced in the case of performing nosography and clinical examinations of patients more accurately.

Over the conducted surveys, the majority of the job groups referred for receiving MRI services and related to self-employment jobs, consisted of students and young people. The highest percentage of sports trauma and the lowest percentage of inappropriate prescriptions were observed in these job groups, resulting from physical activity and related injuries.

The results of this study declared that a significant percentage of MRI prescriptions at a physician's requestwas clinically appropriate and was performed on the basis of the indication. Furthermore, the results represented that a statistically significant relationship was observed between the prescription requester and its appropriateness; in such a way that most prescriptions at patient's request were inappropriate. This result could be justified that the mentioned patients requested the physicians an MRI for passing through a series of administrative procedures, such as medical commissions, ensuring the health status, and receiving privileges (such as disability).

In this study, an MRI prescription was performed for about 15 % of patients without physical examination. The results showed no statistically significant relationship between the examination status of patients and the appropriateness of prescriptions. Such a situation could be justified concerning the significant percentage of patients with a specific history of trauma to the knee. Also, the high proficiency and experience of physicians were effective in clinical diagnosis.

In this study, most patients were referred from a private clinic for MRI performance.The results of this study showed that there was no statistically significant relationship between patient referral status and prescription appropriateness. However, a smaller percentage of patients referred to hospitals had inappropriate prescriptions. It appeared that hospitals spent more time examining patients than clinics.

In the current study, the highest MRI prescription was performed by an orthopedic specialist, accounted for more than 90 % of the samples. The results showed a statistically significant relationship between physicians' specialties and the appropriateness of the



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prescription. This reason would be because an orthopedic specialist performed about 90 % of prescribed MRIs, and the prescriptions for other prescriptions were very few, yielding the changes in the results of the study.

Limitations:

In the study the patients were physically examined by a general practitioner in order to determining the necessity of prescriptions. Performing this examination may be more exact by an orthopedic, but much more expensive.

## Conclusion

Totally, it should be mentioned as a conclusion that the health policymakers were required to consider this issue. Reviewing the findings of domestic studies revealed that the statistics of unnecessary prescriptions in our country were higher than the global statistics. Poor physician adherence to valid guidelinesor, in some cases, patients' insistence on prescriptions was among the problems that should be observed. Hence, the inappropriate prescriptions created long queues for MRI performance and prolonged the diagnosis and treatment process for patients requiring MRI.

In this regard, it was recommended to assign valid guidelines in the curriculum of general practitioners and residents. These valid guidelineswere even applied as a basis for payment methods to physicians. Moreover, it was suggested to conduct further researches to prepare appropriate local and global guidelines.

## Acknowledgements

We thank Al-Zahra Heart Center authorities for their good contributions in the process of data gathering.

## Conflict of interests

Authors declared that there was no conflict of interests.

## Authors' contributions

Salari H, Esfandiari A, Omranikhoo H, Amini A, Amiri M, Bayyenat S and Azmal M designed research; Salari H and Amiri M gathedred data; Salari H and Esfandiari A analyzed data; and Salari H, Esfandiari A wrote the manuscript. Salari H had primary responsibility for final content. All authors read and approved the final manuscript.

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