



# The Frequency and Causes of Unnecessary Medical Services in Urmia, Iran: Strategies and Control

Zeinab Dindeh <sup>1</sup>, Salah Eddin Karimi <sup>2,\*</sup>, Seyede Mahboobeh Hosseini <sup>3</sup> and Ayoub Nafei <sup>4</sup>

<sup>1</sup>Department of Community and Family Medicine, Social Determinants of Health Research Center, Tabriz Medical School, Tabriz University of Medical Sciences, Tabriz, Iran

<sup>2</sup>Social Determinants of Health Research Center, Health Management and Safety Promotion Research Institute, Tabriz University of Medical Sciences, Tabriz, Iran

<sup>3</sup>Clinical Research Development Unit, Ayatollah Kashani Hospital, Shahrekord University of Medical Sciences, Shahrekord, Iran

<sup>4</sup>Department of Social Welfare Management, Social Welfare Management Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

\*Corresponding author: Social Determinants of Health Research Center, Health Management and Safety Promotion Research Institute, Tabriz University of Medical Sciences, Tabriz, Iran. Email: salahkarimi2009@gmail.com

Received 2021 May 10; Revised 2021 July 25; Accepted 2021 July 27.

## Abstract

**Background:** Unnecessary prescription, diagnosis, and medical services are increasing various health problems in the world. According to the World Health Organization (WHO), over-prescription and unnecessary services are the measures that cause significant damages rather than benefits.

**Objectives:** The present study aimed to evaluate the perspective of Urmia medical system members regarding the frequency and causes of unnecessary medical services and their control and prevention strategies in Urmia, Iran.

**Methods:** This descriptive-analytical, cross-sectional research was performed on 102 specialist physicians selected from the Urmia Medical Association, and the selected individuals participated in the survey online. Outcome measures included the percentage of unnecessary medical care and common causes of overtreatment. Data were collected using Johns Hopkins University Unnecessary medical services checklist. Data analysis was performed in SPSS version 22 using descriptive statistics (frequency and mean) and chi-square.

**Results:** In total, 41% of the participants (n = 43) were family physicians, and 59% (n = 59) were specialists of other medical fields. In terms of gender, 53% were male, and the others were female. The main causes of unnecessary medical services at a national level included pressure from patients (66.7%; n = 68), fear of medical malpractice (54.9%; n = 56), pressure from colleagues (23.5%; n = 24), and achieving a high rank in a performance appraisal (40.2%; n = 41). According to the participants, the development of more guidelines and instructions (47.1%; n = 48) and training residents on the appropriate use of diagnostic criteria (50%; n = 51) could be effective approaches to preventing unnecessary medical services. In addition, significant differences were observed between the perspective of the family physicians and the specialists in terms of the fear of malpractice (P = 0.002), lack of medical history (P = 0.17), pressure from patients (P = 0.25), training of residents on the use of diagnostic criteria (P = 0.001), and easier access to medical files (P = 0.001).

**Conclusions:** From the physicians' perspective, overtreatment is highly common in Iran. In order to solve this problem, efforts should be dedicated to areas such as medical file availability, diminishing the fear of malpractice, and more training of residents. Moreover, it is recommended that patients' awareness be raised regarding the damages caused by unnecessary prescriptions so that they would not request frequent visits.

**Keywords:** Unnecessary Medical Care, Medical Malpractice, Physician, Overuse of Medical Services, Overdiagnosis

## 1. Background

Easy and extensive access to examination, diagnosis, and treatment has improved the health status of the world's population. Nevertheless, the frequency and diversity of access, which is associated with the increased use of tests and techniques with strong marketing and poor monitoring, has caused a challenge for physicians, who are faced with the risk of excessive requests for unnecessary services (1). Unnecessary prescription, diagnosis, and ser-

vices are pressing issues in the field of health care. According to Chassin and Galvin, medical service overuse is defined as the provision of medical services for which the potential of harm exceeds the potential of benefit (2). According to the World Health Organization (WHO), unnecessary health measures may do more harm than good (2, 3).

Some studies have addressed the overprescribing of antibiotics, excessive diagnostic procedures and tests (e.g., pap test and colonoscopy), and some inherent surgical

complications as unnecessary diagnostic measures (4-7). Medicine, especially Western medicine, is blamed for the injury and even death of patients and malpractice despite multiple ethical considerations. Critics have emphasized focusing on unnecessary services before incurring irreparable costs and losses. These concerns urged Patterson in the early 21st century to dedicate efforts to forming systems that would provide efficient healthcare services (8).

According to the American Medical Association (2010), unnecessary services are the most important issue regarding the losses of American health care. This association estimates that \$1.3 billion is wasted on health care every year (2). In addition, several studies have shown that 12% - 30% of valuable resources are wasted (9-11). The choosing wisely (CW) campaign, which was launched in 2012 by the American Board of Internal Medicine Foundation, is an initiative to reduce unnecessary conduct in clinical practice (12). To date, more than 20 countries have joined the campaign (13). The main goal of the campaign is to talk with patients and their families about the potential risks and expectations of medical services. In addition, the campaign offers advice to medical associations about performing diagnostic tests more accurately in order to prevent resource waste and medical service overuse (14).

Unnecessary treatment increases the interference between necessary and effective actions with unnecessary actions. On the other hand, reducing unnecessary services could lead to important outcomes such as less patient harm, lower resistance of infections to drugs and antibiotics, fewer surgical outcomes, lower out-of-pocket expenses, and reduced costs in the healthcare sector (5, 6, 14, 15). The other disadvantages of unnecessary medical services include needless breast surgeries (16), stigmatization, unnecessary diagnostic measures, excessive treatment, and recurrent follow-ups after unnecessary diagnoses, which could lead to the waste of financial, psychological, and physical costs (17, 18), as well as excessive costs imposed on governments and the private sector investors presenting these services (1).

While physicians play a key role in the prevalence of medical service overuse (2, 8), few studies have assessed this issue from the perspective of these individuals. According to Lyu et al. (2), 21% of the entire medical services in the United States are reported to be unnecessary from the perspective of physicians. Furthermore, Sirovich et al. (19) conducted a research to examine physicians' perspectives regarding unnecessary measures and stated that physicians have always been at the forefront of the battle against unnecessary services, playing a pivotal role in recommendation and management, observations, tests, procedures, and treatment. In another survey performed by the American Board of Internal Medicine (2014), 73% of

physicians considered unnecessary tests, which were demanded at least once a week, to be an important issue. Based on the opinions of these individuals, 47% of unnecessary tests were performed upon the request of patients. Notably, these prescriptions were more common among general practitioners. Although patients were informed of the non-necessity of these tests, 53% demanded to receive relevant services. According to the obtained results, the smaller number of the patients visited by a physician per week was associated with the higher possibility of resisting the request for unnecessary tests. Moreover, fear of complications was found to be the most common cause of demanding unnecessary tests by physicians (20).

Despite adequate information about the causes of unnecessary medical services, some studies have shown a lack of awareness about optimal diagnostic methods or financial incentives of physicians to provide unnecessary services. A literature review in this regard revealed that political, cultural, and social factors (e.g., money flow and its impact on motivation and care), the gap between psychological knowledge and misbeliefs, and a lack of understanding between patients and healthcare providers ultimately led to the overuse of medical services (21-23). According to the WHO, educational networks must attempt to reduce unnecessary care and increase quality development and accumulation of medical services. In addition, countries must identify and minimize unnecessary care measures by increasing quality development. Domestic clinical guidelines must be established as well.

The general principles of the health policies in Iran highlight the importance of this issue (1, 22). Given the key role of physicians in providing unnecessary services due to their direct relationship with patients as a reliable professional (recommendation to undergo different tests, using drugs or admission to a hospital after clinical observation by a physician), their perspective toward unnecessary care and medical service overuse is paramount.

## 2. Objectives

With this background, the present study aimed to evaluate the perspective of medical system members toward the frequency and causes of unnecessary medical services in Iran and propose preventive and control strategies in this regard.

## 3. Methods

This descriptive-analytical study was carried out using the unnecessary measures assessment checklist developed by Martin Makary from Johns Hopkins University (2).

The instrument was assessed in terms of face validity after forward-backward translation. This assessment sufficed at this stage since the checklist did not measure any conceptual constructs or one that depended on a specific culture or setting.

The tool was completed by 14 physicians at a two-week interval to confirm reliability, and the internal consistency and Cronbach's alpha of 0.9 and internal consistency coefficient of 0.92 were obtained. The checklist had two sections of demographic characteristics (age, gender, type of specialty, work experience, and workplace), qualitative items (yes/no), and poll items with pre-specified and structured responses regarding the frequency of unnecessary medical services (drugs, diagnostic, laboratory, and radiological tests and small surgeries in hospitals). Moreover, the participants answered questions regarding the causes of overusing diagnostic measures (fear of malpractice, pressure from colleagues, insufficient time devoted to patients, gaining ranking in evaluations, and pressure and demand from patients) and the associated preventive and control strategies (developing more guidelines and instructions, training residents, increasing government monitoring, and easy access to patients' medical files) by selecting multiple responses. Ultimately, the frequency of each factor was determined and analyzed.

The validated checklist was generated via online questionnaire software ([www.cafepardazesh.ir](http://www.cafepardazesh.ir)) and provided to the participants via a link on the medical system website of Urmia, Iran. All the medical system members of Urmia were asked to partake in the survey voluntarily and complete the electronic checklist during August-November 2019 through mass media. In total, 102 individuals completed the checklists. The inclusion criterion of the present study was being a specialist, and the exclusion criteria were not being a physician and incomplete questionnaires.

Descriptive statistics were used to determine the physicians' perspective toward unnecessary services, as well as the associated causes and solutions, by calculating the percentage and reporting the range, mean, and standard deviation in the form of tables and diagrams. Given the qualitative variables of the study, chi-square was applied to compare two groups of family physicians and physicians with other specialties. In addition, family physicians were compared to the specialists of other medical fields given the importance of the difference in spending more time visiting and treating patients and improving the living standards of patients and their families. This was mainly due to the belief that specialists pay more attention to diseases and their treatment. In other words, family physicians have a holistic view of patients, their family, and the community, while other specialists are more focused on the disease and

its treatment.

The study protocol was approved by the Ethics Committee of Tabriz University of Medical Sciences (ethics code: IR.TBZMED.REC.1397.032). Data analysis was performed in SPSS version 22, and a P-value of 0.05 was considered statistically significant.

#### 4. Results

All the participants were specialists, including 53.9% males, 41% family physicians, and 59% specialists of other medical fields. Moreover, 20.6% of the respondents had 5 - 10 years of work experience, and 68.6% worked in the public sector. In the sample population, 12% of the subjects worked in rural areas (Table 1). According to the subjects, 15% - 30% of medications, 15% - 30% of diagnostic assessments, 30% - 45% of laboratory tests, 45% - 60% of prescribed radiological evaluations, less than 15% of in-hospital practices, less than 15% of outpatient surgeries, and less than 15% of medical care were unnecessary (Figure 1).

**Table 1.** Demographic Characteristics of Participants

Variable	No. (%)
<b>Gender</b>	
Male	55 (53.9)
Female	47 (46.1)
<b>Specialty</b>	
Family physician	43 (41)
Specialized in other medical fields	59 (59)
<b>Work experience, y</b>	
> 5	42 (41.2)
5 - 10	21 (20.6)
10 - 15	17 (16.7)
> 15	12 (21.6)
<b>Occupation status</b>	
Government	70 (68.6)
Private	13 (12.7)
Both	19 (18.6)
<b>Workplace</b>	
Rural	13 (12.7)
Urban	89 (87.3)

Based on the perspectives of the participants, the main causes of unnecessary medical care were the fear of malpractice (54.9%), pressure from colleagues (23.5%), inadequate time for visiting patients (40.2%), gaining ranking

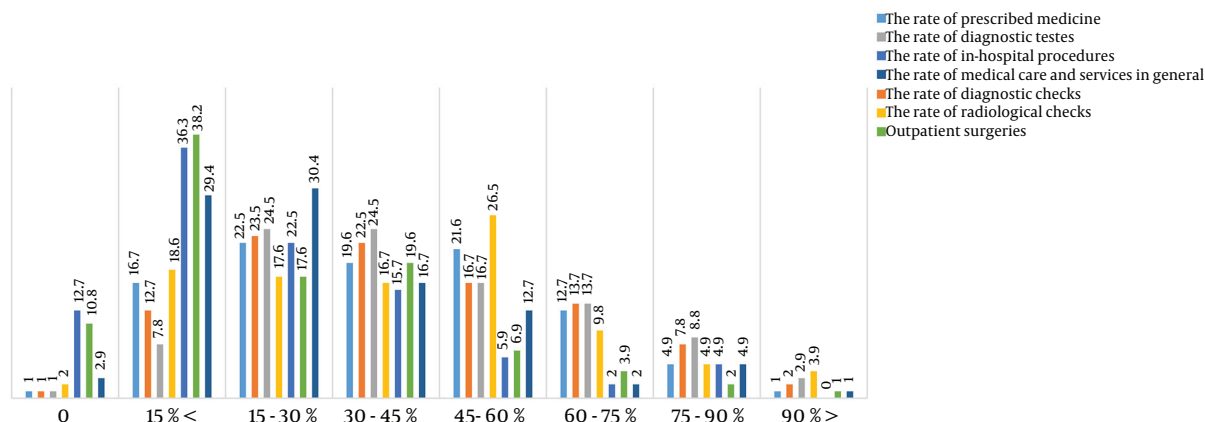


Figure 1. Level of unnecessary services from perspective of participants

in evaluations (16.7%), pressure from hospital/clinic’s management (17.6%), pressure/demands of patients (66.7%), financing physicians (24.5%), difficulty in consulting with other physicians (11.8%), lack of access to patients’ medical history (33.3%), difficult access to the medical files of patients (34.3%), and uncertain indications for receiving paraclinical services and medications (10.8%) (Table 2). In this respect, some of the preventive measures suggested by the subjects included developing more guidelines and instructions (47.1%), training residents on the appropriate use of diagnostic benchmarks (50%), increasing government monitoring (28.4%), easier access to the medical history of patients (46.1%), considering the price of diagnostic measures (20.6%), increasing the base payment of physicians (46.7%), involving patients in decision-making (21.6%), and consulting more with colleagues (37.3%) (Table 3).

According to the chi-square results and the significance level in Table 4, there were no significant differences between the perspective of the family physicians and other specialists regarding the relative frequency of unnecessary medical services and the variables of pressure from colleagues (P = 0.11), inadequate time devoted to each patient (P = 0.44), gaining ranking in evaluations (P = 0.65), financing physicians (P = 0.10), pressure from the hospital/clinic’s management (P = 0.5), difficulty in consulting with other physicians (P = 0.74), uncertain indications for receiving medications (P = 0.06), and unnecessary referrals in exchange for money (Table 4). However, a difference was observed between the perspective of the family physicians and other specialists regarding the relative frequency of the fear of malpractice (P = 0.002), lack of access to medical history (P = 0.017), and pressure/demands of patients

Table 2. Frequency of Causes of Unnecessary Medical Services from Perspective of Participants

Variable	Response	No. (%)
Fear of malpractice	Yes	56 (54.9)
	No	46 (45.1)
Pressure from colleagues	Yes	24 (23.5)
	No	78 (76.5)
Gaining a high ranking in performance evaluations	Yes	41 (40.2)
	No	61 (59.8)
Pressure from hospital/clinic’s management	Yes	18 (17.6)
	No	84 (82.4)
“I do not believe that medical services are overused”.	Yes	12 (11.8)
	No	90 (88.2)
Pressure or demands of patients	Yes	68 (66.7)
	No	34 (33.3)
Difficulty of consulting with other physicians	Yes	12 (11.8)
	No	90 (88.2)
Inadequate information/medical history of patients	Yes	34 (33.3)
	No	68 (66.7)
Difficult access to medical history	Yes	35 (34.3)
	No	67 (65.7)
Uncertain indications for receiving paraclinical services and medications	Yes	11 (10.8)
	No	91 (89.2)
Unnecessary referral by centers in exchange for money	Yes	11 (10.8)
	No	91 (89.2)

(P = 0.25; 95% confidence interval). Accordingly, the main causes of unnecessary medical services were the fear of

**Table 3.** Frequency of Preventive Strategies for Unnecessary Medical Services from Perspective of Participants

Variable	Response	No. (%)
Developing more guidelines and instructions about use and prescription of services	Yes	48 (47.1)
	No	54 (52.9)
Training residents about appropriate use of diagnostic benchmarks	Yes	51 (50)
	No	51 (50)
Increasing government control	Yes	23 (28.4)
	No	73 (71.6)
Easier access to medical history of patients	Yes	47 (46.1)
	No	55 (53.9)
Considering costs of diagnostic measures on demand	Yes	21 (20.6)
	No	81 (79.4)
Increasing base payment of physicians and reducing income through fee-for-service	Yes	47 (46.1)
	No	55 (53.9)
Involving patients in decision-making	Yes	22 (21.6)
	No	80 (78.4)
Consulting more with colleagues	Yes	38 (37.3)
	No	64 (62.7)

**Table 4.** Difference of Opinion of Physicians About Causes of Unnecessary Medical Services

Variable	Chi-Square; P-value
Difficult access to medical history	$\chi^2 = 1.712$ ; $P = 0.191$
Uncertain indications for receiving medication	$\chi^2 = 3.524$ ; $P = 0.060$
Unnecessary referral by centers in exchange for money	$\chi^2 = 0.468$ ; $P = 0.494$
Financing physicians	$\chi^2 = 2.642$ ; $P = 0.104$
Pressure from hospital or clinic management	$\chi^2 = 0.455$ ; $P = 0.5$
Difficulty of consulting with other physicians	$\chi^2 = 0.107$ ; $P = 0.744$
Pressure from colleagues	$\chi^2 = 2.052$ ; $P = 0.115$
Insufficient time devoted to each patient	$\chi^2 = 0.588$ ; $P = 0.443$
Gaining ranking in evaluation	$\chi^2 = 0.197$ ; $P = 0.657$

malpractice, pressure and demands of patients, and lack of access to the medical history of patients (Table 5).

## 5. Discussion

In the present study, 30.4% of the physicians believed that 15-30% of medical services were unnecessary, which is in line with the previous studies in this regard. In a research conducted by Lyu et al. (2), 64.7% of the participants believed that 15% - 30% of medical services were unnecessary. In the study by Soshi et al. (24), 46% of the

subjects reported that 30% of medical tests were unnecessary, whereas 8.6% believed that no service was unnecessary. While the sample sizes of the aforementioned studies were larger compared to our research, the physicians' perception of the level of unnecessary services was worthy of attention since it would definitely lead to a loss of resources and high health system costs, requiring immediate interventions (24).

According to the current research, 15% - 30% of medications, 15% - 30% of diagnostic evaluations, 30% - 45% of laboratory tests, 45% - 60% of prescribed radiological evaluations, less than 15% of in-hospital practices, less than 15% of outpatient surgeries, and less than 15% of general medical services and care were unnecessary. Consistent with our findings, Lyu et al. (2) reported that 20.6% of general medical care, 22% of prescribed medications, 24.9% of tests, and 11.1% of procedures were prescribed unnecessarily. In addition, pressure and demands of patients, fear of medical malpractice, and inadequate time devoted to patients were the three most important causes of unnecessary medical care in the present study.

To the best of our knowledge, this was the first study conducted in Iran to assess the unnecessary prescription of medical services. At an international level, Lyu et al. (2) evaluated unnecessary prescriptions in various medical fields, reporting the fear of malpractice and request of patients as the most important causes of unnecessary medical services. In the research performed by Soshi et al. (24), the main causes of unnecessary medical services were reported to be the fear of malpractice (69%), demands of patients (62%), difficult access to medical history (22%), and pressure from hospital and clinic's management (19%). According to Torjesen (25), the most common causes of over-prescription were the fear of malpractice (76%) and inadequate time for visiting patients (40%) (19). Furthermore, 66.7% of the respondents in the mentioned study believed that pressure and insistence of patients were the most common cause of unnecessary medical services (25).

In most cases, patients' understanding of more prescriptions is equivalent to better care and also the unawareness of effective medical services. According to the literature, educating and involving patients in informed decision-making about medical care could reduce unnecessary care services. In addition, patient-assisted decision-making may result in receiving 19% fewer antibiotics, as well as a smaller number of surgeries (26-28). Patient-assisted decision-making has also been associated with 8.7%, 9.1%, and 13% reduction in the number of CT-scans, ultrasounds, and chest X-rays, respectively (29). Therefore, it seems that patient-assisted decision-making could be a potent tool for reducing overprescription.

In a study by Bell et al. (30), 54.9% of the participants

**Table 5.** Difference of Opinion of Physicians About Causes of Unnecessary Medical Services

Variable	Physicians	Yes	No	Chi-Square; P-Value
Fear of malpractice	Family physicians	18 (38, 3)	29 (61, 7)	$\chi^2 = 9.760$ ; P = 0.002
	Other specialists	38 (69, 1)	17 (30, 9)	
Pressure or demands of patients	Family physicians	26 (55.3)	21 (44.7)	$\chi^2 = 5.052$ ; P = 0.025
	Other specialists	42 (76.4)	13 (23.6)	
Inadequate medical history or lack of information	Family physicians	10 (21.3)	37 (78.7)	$\chi^2 = 5.702$ ; P = 0.017
	Other specialists	24 (43.6)	31 (56.4)	

introduced the fear of malpractice as the main cause of unnecessary medical care, while fear of complaints against physicians also led to unnecessary medical services. Nevertheless, the mentioned study indicated that less than 5% of injured patients filed a complaint against a physician due to negligence, half of whom succeeded in proving their claim and receiving compensation or banning the physician from practicing medicine (30). A physician's acknowledgment of their negligence is one of the reasons for the patient's petition, which greatly reduces the probability of noticing the negligence by the patient (30). Nevertheless, unnecessary prescription remains highly common due to the fear of complaints and malpractice.

In a competitive medical market, maintaining patient satisfaction seems to be in the best interest of physicians as it strengthens patients' subsequent visits. According to the results of the present study, 79.4% of the participants believed that physicians prescribe unnecessary medical services to receive benefits. With regard to the fee-for-service system in the private sector of Iran, unnecessary prescriptions could occur in receiving fee-for-service and salary. Previous studies have shown that more payments are earned by more services, as well as more visits and primary care (31). Profit motivation may lead to more unnecessary services through other reasons and methods. For instance, pressure from the clinic's management, owning radiotherapy or ultrasound centers, and receiving a commission from these centers may increase unnecessary medical services (32). Therefore, the regular monitoring of these issues and payment systems could help reduce the rate of unnecessary medical services by insurance companies and governments.

In the current research, the most important solutions proposed by the physicians to prevent unnecessary prescriptions were providing more guidelines and instructions for using and prescribing services, training residents on the appropriate use of diagnostic benchmarks, easier access to the medical history of patients, and considering the costs of diagnostic measures upon request. In this regard, our findings are congruent with the results obtained

by Soshi et al. (24), which indicated resident training, easier access to medical files, and developing guidelines and instructions to be the most effective solutions to prevent unnecessary services.

It is recommended that measures such as designing guidelines for medical prescriptions and screening be taken so that physicians could have a better understanding of the time of prescribing medical services at national and international levels. It is also possible to assess and diagnose common tests and procedures through relevant investigations. As a result, the factors involved in unnecessary prescription could be determined, and proper solutions could be developed for their prevention. It is also suggested that policymakers and medical students be informed of the factors affecting unnecessary prescriptions and proper interventions be considered in their training to reduce unnecessary medical services, which will in turn decrease the socioeconomic burden and costs of medical services.

### 5.1. Limitations of the Study

One of the limitations of the present study was that most of the participants worked in the public sector. Since most patients are referred to the public sector by physicians, the provided services might have been identified as unnecessary. Another limitation was assessing only the factors that affect over-prescription, and incorrect prescription was not evaluated in this context, which may cause complications in patients and impose more unwanted costs on patients and the health system due to the poor quality of care services. In addition, the sample size of our study was rather small to evaluate the results and responses with high statistical accuracy. Another limitation was the lack of random sampling due to difficulty in access to physicians, which could have led to biased results. Due to the social utility bias, it is possible that the respondents answered the questions with less honesty.

### 5.2. Conclusions

According to the results, a large part of medical services is prescribed unnecessarily, and prescribing unne-

essary tests and procedures is a serious issue in the health system of Iran. Some of the main reasons in this regard are the inadequate knowledge of physicians and issues such as conflicts of interest, which may lead to the unnecessary prescription of medical services. Since patients' pressure and insistence increase unnecessary prescription, attention should be paid to these areas as unnecessary prescription decreases patient safety and imposes heavy costs on the community and government. Therefore, it is recommended that public and physicians' awareness be raised in this regard. We should also focus on retraining and informing physicians on the disadvantages of unnecessary medical services. Public awareness should also be raised by using proper educational content, advertising, and mass media so that they would not insist on the unnecessary prescription of medical services.

### Footnotes

**Authors' Contribution:** ZD, MH, AN, and SEK drafted the manuscript. ZD, MH, and AN commented on and suggested revisions to the manuscript. SEK analyzed the data. All authors approved the final revision of the manuscript.

**Conflict of Interests:** There is no conflict of interests.

**Ethical Approval:** The study protocol was approved by the Ethics Committee of Tabriz University of Medical Sciences (ethics code: IR.TBZMED.REC.1397.032).

**Funding/Support:** There is no funding or support.

### References

- Brownlee S, Chalkidou K, Doust J, Elshaug AG, Glasziou P, Heath I, et al. Evidence for overuse of medical services around the world. *Lancet*. 2017;**390**(10090):56-68. doi: [10.1016/S0140-6736\(16\)32585-5](https://doi.org/10.1016/S0140-6736(16)32585-5). [PubMed: [28077234](https://pubmed.ncbi.nlm.nih.gov/28077234/)]. [PubMed Central: [PMC5708862](https://pubmed.ncbi.nlm.nih.gov/PMC5708862/)].
- Lyu H, Xu T, Brotman D, Mayer-Blackwell B, Cooper M, Daniel M, et al. Overtreatment in the United States. *PLoS One*. 2017;**12**(9). e0181970. doi: [10.1371/journal.pone.0181970](https://doi.org/10.1371/journal.pone.0181970). [PubMed: [28877170](https://pubmed.ncbi.nlm.nih.gov/28877170/)]. [PubMed Central: [PMC5587107](https://pubmed.ncbi.nlm.nih.gov/PMC5587107/)].
- Guglielmin M, Muntaner C, O'Campo P, Shankardass K. A scoping review of the implementation of health in all policies at the local level. *Health Policy*. 2018;**122**(3):284-92. doi: [10.1016/j.healthpol.2017.12.005](https://doi.org/10.1016/j.healthpol.2017.12.005). [PubMed: [29305241](https://pubmed.ncbi.nlm.nih.gov/29305241/)].
- Grady D, Redberg RF. Less is more: how less health care can result in better health. *Arch Intern Med*. 2010;**170**(9):749-50. doi: [10.1001/archinternmed.2010.90](https://doi.org/10.1001/archinternmed.2010.90). [PubMed: [20458080](https://pubmed.ncbi.nlm.nih.gov/20458080/)].
- Almeida CM, Rodriguez MA, Skoostsky S, Pregler J, Steers N, Wenger NS. Cervical cancer screening overuse and underuse: patient and physician factors. *Am J Manag Care*. 2013;**19**(6):482-9. [PubMed: [23844709](https://pubmed.ncbi.nlm.nih.gov/23844709/)].
- Kruse GR, Khan SM, Zaslavsky AM, Ayanian JZ, Sequist TD. Overuse of colonoscopy for colorectal cancer screening and surveillance. *J Gen Intern Med*. 2015;**30**(3):277-83. doi: [10.1007/s11606-014-3015-6](https://doi.org/10.1007/s11606-014-3015-6). [PubMed: [25266407](https://pubmed.ncbi.nlm.nih.gov/25266407/)]. [PubMed Central: [PMC4351286](https://pubmed.ncbi.nlm.nih.gov/PMC4351286/)].
- Epstein NE, Hood DC. "Unnecessary" spinal surgery: A prospective 1-year study of one surgeon's experience. *Surg Neurol Int*. 2011;**2**:83. doi: [10.4103/2152-7806.82249](https://doi.org/10.4103/2152-7806.82249). [PubMed: [21776403](https://pubmed.ncbi.nlm.nih.gov/21776403/)]. [PubMed Central: [PMC3130462](https://pubmed.ncbi.nlm.nih.gov/PMC3130462/)].
- Hadler NM. Medical Overtreatment: Friend or Foe? *Gerontology*. 2018;**64**(3):222-8. doi: [10.1159/000486895](https://doi.org/10.1159/000486895). [PubMed: [29428953](https://pubmed.ncbi.nlm.nih.gov/29428953/)].
- Hecker MT, Aron DC, Patel NP, Lehmann MK, Donskey CJ. Unnecessary use of antimicrobials in hospitalized patients: current patterns of misuse with an emphasis on the antianaerobic spectrum of activity. *Arch Intern Med*. 2003;**163**(8):972-8. doi: [10.1001/archinte.163.8.972](https://doi.org/10.1001/archinte.163.8.972). [PubMed: [12719208](https://pubmed.ncbi.nlm.nih.gov/12719208/)].
- Lehnert BE, Bree RL. Analysis of appropriateness of outpatient CT and MRI referred from primary care clinics at an academic medical center: how critical is the need for improved decision support? *J Am Coll Radiol*. 2010;**7**(3):192-7. doi: [10.1016/j.jacr.2009.11.010](https://doi.org/10.1016/j.jacr.2009.11.010). [PubMed: [20193924](https://pubmed.ncbi.nlm.nih.gov/20193924/)].
- Chan PS, Patel MR, Klein LW, Krone RJ, Dehmer GJ, Kennedy K, et al. Appropriateness of percutaneous coronary intervention. *JAMA*. 2011;**306**(1):53-61. doi: [10.1001/jama.2011.916](https://doi.org/10.1001/jama.2011.916). [PubMed: [21730241](https://pubmed.ncbi.nlm.nih.gov/21730241/)]. [PubMed Central: [PMC3293218](https://pubmed.ncbi.nlm.nih.gov/PMC3293218/)].
- Cassel CK, Guest JA. Choosing wisely: helping physicians and patients make smart decisions about their care. *JAMA*. 2012;**307**(17):1801-2. doi: [10.1001/jama.2012.476](https://doi.org/10.1001/jama.2012.476). [PubMed: [22492759](https://pubmed.ncbi.nlm.nih.gov/22492759/)].
- Born KB, Levinson W. Choosing Wisely campaigns globally: A shared approach to tackling the problem of overuse in healthcare. *J Gen Fam Med*. 2019;**20**(1):9-12. doi: [10.1002/jgf2.225](https://doi.org/10.1002/jgf2.225). [PubMed: [30631653](https://pubmed.ncbi.nlm.nih.gov/30631653/)]. [PubMed Central: [PMC6321837](https://pubmed.ncbi.nlm.nih.gov/PMC6321837/)].
- Stordal K, Wyder C, Trobisch A, Grossman Z, Hadjipanayis A. Overtesting and overtreatment-statement from the European Academy of Paediatrics (EAP). *Eur J Pediatr*. 2019;**178**(12):1923-7. doi: [10.1007/s00431-019-03461-1](https://doi.org/10.1007/s00431-019-03461-1). [PubMed: [31506723](https://pubmed.ncbi.nlm.nih.gov/31506723/)].
- Sullivan T. Antibiotic overuse and *Clostridium difficile*: a teachable moment. *JAMA Intern Med*. 2014;**174**(8):1219-20. doi: [10.1001/jamainternmed.2014.2299](https://doi.org/10.1001/jamainternmed.2014.2299). [PubMed: [24935617](https://pubmed.ncbi.nlm.nih.gov/24935617/)].
- Mukhtar RA, Wong JM, Esserman LJ. Preventing Overdiagnosis and Overtreatment: Just the Next Step in the Evolution of Breast Cancer Care. *J Natl Compr Canc Netw*. 2015;**13**(6):737-43. doi: [10.6004/jnccn.2015.0088](https://doi.org/10.6004/jnccn.2015.0088). [PubMed: [26085389](https://pubmed.ncbi.nlm.nih.gov/26085389/)].
- Heath I. Role of fear in overdiagnosis and overtreatment—an essay by Iona Heath. *BMJ*. 2014;**349**:g6123. doi: [10.1136/bmj.g6123](https://doi.org/10.1136/bmj.g6123). [PubMed: [25954986](https://pubmed.ncbi.nlm.nih.gov/25954986/)].
- Hicks LK. Reframing overuse in health care: time to focus on the harms. *J Oncol Pract*. 2015;**11**(3):168-70. doi: [10.1200/JOP.2015.004283](https://doi.org/10.1200/JOP.2015.004283). [PubMed: [25804988](https://pubmed.ncbi.nlm.nih.gov/25804988/)].
- Sirovich BE, Woloshin S, Schwartz LM. Too Little? Too Much? Primary care physicians' views on US health care: a brief report. *Arch Intern Med*. 2011;**171**(17):1582-5. doi: [10.1001/archinternmed.2011.437](https://doi.org/10.1001/archinternmed.2011.437). [PubMed: [21949169](https://pubmed.ncbi.nlm.nih.gov/21949169/)]. [PubMed Central: [PMC3184847](https://pubmed.ncbi.nlm.nih.gov/PMC3184847/)].
- Woloshin S, Schwartz LM. Overcoming overuse: the way forward is not standing still—an essay by Steven Woloshin and Lisa M Schwartz. *BMJ*. 2018;**361**:k2035. doi: [10.1136/bmj.k2035](https://doi.org/10.1136/bmj.k2035). [PubMed: [29789307](https://pubmed.ncbi.nlm.nih.gov/29789307/)].
- Ryskina KL, Holmboe ES, Bernabeo E, Werner RM, Shea JA, Long JA. US internists' awareness and use of overtreatment guidelines: a national survey. *Am J Manag Care*. 2017;**23**(7):420-7. [PubMed: [28817780](https://pubmed.ncbi.nlm.nih.gov/28817780/)]. [PubMed Central: [PMC5823021](https://pubmed.ncbi.nlm.nih.gov/PMC5823021/)].
- Saini V, Brownlee S, Elshaug AG, Glasziou P, Heath I. Addressing overuse and underuse around the world. *Lancet*. 2017;**390**(10090):105-7. doi: [10.1016/S0140-6736\(16\)32573-9](https://doi.org/10.1016/S0140-6736(16)32573-9). [PubMed: [28077230](https://pubmed.ncbi.nlm.nih.gov/28077230/)].
- Born KB, Coulter A, Han A, Ellen M, Peul W, Myres P, et al. Engaging patients and the public in Choosing Wisely. *BMJ Qual Saf*. 2017;**26**(8):687-91. doi: [10.1136/bmjqs-2017-006595](https://doi.org/10.1136/bmjqs-2017-006595). [PubMed: [28600453](https://pubmed.ncbi.nlm.nih.gov/28600453/)].
- Soshi M, Mizuta T, Tokuda Y. Overtesting in Japan. *J Gen Fam Med*. 2018;**19**(2):42. doi: [10.1002/jgf2.167](https://doi.org/10.1002/jgf2.167). [PubMed: [29600125](https://pubmed.ncbi.nlm.nih.gov/29600125/)]. [PubMed Central: [PMC5867106](https://pubmed.ncbi.nlm.nih.gov/PMC5867106/)].
- Torjesen I. Royal colleges issue list of 40 unnecessary interventions. *BMJ*. 2016;**355**:i5732. doi: [10.1136/bmj.i5732](https://doi.org/10.1136/bmj.i5732). [PubMed: [27784663](https://pubmed.ncbi.nlm.nih.gov/27784663/)].

26. Behnke LM, Solis A, Shulman SA, Skoufalos A. A targeted approach to reducing overutilization: use of percutaneous coronary intervention in stable coronary artery disease. *Popul Health Manag.* 2013;**16**(3):164-8. doi: [10.1089/pop.2012.0019](https://doi.org/10.1089/pop.2012.0019). [PubMed: [23113635](https://pubmed.ncbi.nlm.nih.gov/23113635/)].
27. Walsh T, Barr PJ, Thompson R, Ozanne E, O'Neill C, Elwyn G. Undetermined impact of patient decision support interventions on healthcare costs and savings: systematic review. *BMJ.* 2014;**348**:g188. doi: [10.1136/bmj.g188](https://doi.org/10.1136/bmj.g188). [PubMed: [24458654](https://pubmed.ncbi.nlm.nih.gov/24458654/)]. [PubMed Central: [PMC3900320](https://pubmed.ncbi.nlm.nih.gov/PMC3900320/)].
28. McCullough JM, Zimmerman FJ, Rodriguez HP. Impact of clinical decision support on receipt of antibiotic prescriptions for acute bronchitis and upper respiratory tract infection. *J Am Med Inform Assoc.* 2014;**21**(6):1091-7. doi: [10.1136/amiajnl-2014-002648](https://doi.org/10.1136/amiajnl-2014-002648). [PubMed: [25002458](https://pubmed.ncbi.nlm.nih.gov/25002458/)]. [PubMed Central: [PMC4215050](https://pubmed.ncbi.nlm.nih.gov/PMC4215050/)].
29. Lammers EJ, Adler-Milstein J, Kocher KE. Does health information exchange reduce redundant imaging? Evidence from emergency departments. *Med Care.* 2014;**52**(3):227-34. doi: [10.1097/MLR.000000000000067](https://doi.org/10.1097/MLR.000000000000067). [PubMed: [24374414](https://pubmed.ncbi.nlm.nih.gov/24374414/)].
30. Bell SK, Smulowitz PB, Woodward AC, Mello MM, Duva AM, Boothman RC, et al. Disclosure, apology, and offer programs: stakeholders' views of barriers to and strategies for broad implementation. *Milbank Q.* 2012;**90**(4):682-705. doi: [10.1111/j.1468-0009.2012.00679.x](https://doi.org/10.1111/j.1468-0009.2012.00679.x). [PubMed: [23216427](https://pubmed.ncbi.nlm.nih.gov/23216427/)]. [PubMed Central: [PMC3530738](https://pubmed.ncbi.nlm.nih.gov/PMC3530738/)].
31. Gosden T, Forland F, Kristiansen IS, Sutton M, Leese B, Giuffrida A, et al. Capitation, salary, fee-for-service and mixed systems of payment: effects on the behaviour of primary care physicians. *Cochrane Database Syst Rev.* 2000;(3). CD002215. doi: [10.1002/14651858.CD002215](https://doi.org/10.1002/14651858.CD002215). [PubMed: [10908531](https://pubmed.ncbi.nlm.nih.gov/10908531/)].
32. Mitchell JM. Urologists' use of intensity-modulated radiation therapy for prostate cancer. *N Engl J Med.* 2013;**369**(17):1629-37.