**Full title:** The prevalence of defensive medicine and associated risk factors among surgeons in the Iran

**Abstract**

**Background:** Defensive medicine (DM) is defined as the deviation of a physician from normal behaviour or what is good practice aimed at reducing or avoiding the risk of legal litigation from patients or their families. The purpose of this study was to determine the prevalence of DM behaviours and associated risk factors in Iran among surgeons.

**Methods:** In this cross-sectional study, 235 surgeons were selected using the systematic random sampling method. The data gathering tool was a researcher-made questionnaire which was confirmed as reliable and valid. Factors associated with DM behaviours were identified using logistic regression analysis.

**Results:** The prevalence of DM behaviours ranged from 14.9% to 88.9%. The most common positive DM behaviours including unnecessary biopsy (78/7%), imaging and laboratory tests (72.4% and 70.6%), and refusing high-risk patients (61.7%) were the most common negative DM behaviours among surgeons. The majority of participants believed that DM behaviours resulted in a weakened physician-patient relationship, increased costs of health services, and low access of people to health services. The likelihood of DM behaviours was more in young and less experienced surgeons. Other variables such as gender, specialty and lawsuit history had a positive effect on the occurrence some DM behaviours (p <0.05).

**Conclusion:** Our findings demonstrated that overall attitudes of surgeons towards DM were negative and the occurrence of DM behaviours was high. Therefore, strategies including reforming the rules and regulations for medical errors and litigations, developing and implementing medical guidelines and evidence-based medicine, and reforming the medical liability insurance system are effective in reducing DM behaviours and thus preventing its adverse effects on the health system and patients.

**Keywords:** Defensive medicine, legal litigation, Medical Ethic, Surgery, Iran

**Background**

Defensive medicine (DM) is defined as the deviation of a physician from normal behaviour or what is good practice aimed at reducing or avoiding the risk of legal litigation from patients or their families ([1](#_ENREF_1)). In other words, DM is the protection of physicians through prescription of certain treatments, medical tests, and additional procedures against the patient's criticism in relation to diagnosis or treatment ([1-3](#_ENREF_1)). What lies behind this idea is that if there is litigation against physicians, they have necessary documentations to defend themselves.

DM behaviours are classified as positive or assurance behaviours and negative or avoidance behaviours. Positive behaviours are primarily performed to minimize malpractice liability such as unnecessary prescriptions of drugs and diagnosis tests, unnecessary referral of patients to other specialists, etc. Negative behaviours protect physicians against risk sources including avoiding use of dangerous procedures, although they may be helpful for the patient, and avoiding treatment of high-risk patients ([4-7](#_ENREF_4)).

Since medical litigations are increasing, the culture of DM is growing worldwide ([4](#_ENREF_4), [8](#_ENREF_8)). In the United States, about 93% of physicians perform DM behaviours ([9](#_ENREF_9)). Moreover, ‏78% and 59.8% of physicians in the UK’s ([1](#_ENREF_1)) and Italy’s ([10](#_ENREF_10)) hospitals, respectively, use some kind of DM behaviours in their medical practice. The prevalence of DM has also been reported in 62% of psychiatrists in Israel ([11](#_ENREF_11)), 71.8% of obstetricians and gynecologists in Sudan ([12](#_ENREF_12)), 72% of neurosurgeons in Turkey ([13](#_ENREF_13)), and about 98% of orthopedic surgeons in Austria ([14](#_ENREF_14)). According to the findings of two studies in Iran, almost all general practitioners and residents have experienced DM ([15](#_ENREF_15), [16](#_ENREF_16)). DM is common, even among non-medical professions such as nursing and midwifery, and the main reason is the fear of litigation ([8](#_ENREF_8)). In general, it appears that the prevalence of DM is higher in surgical specialties, possibly due to the risky nature of surgical procedures and, consequently, possible errors and medical lawsuits.

DM has negative consequences for the patient, the physician, and the health system. One of the negative consequences of DM is increased costs. For example, the cost of tests and procedures due to the fear of malpractice litigation in the United States is estimated at 46 billion dollars annually ([17](#_ENREF_17)). Moreover, 25% of imaging costs, 23% of laboratory test costs, and 14% of pharmaceutical costs in Italy are attributed to DM ([18](#_ENREF_18)). Damage to the physician-patient’s relationship, unnecessary use of scarce health care resources, increase in length of stay in the hospital, and inability of other patients to receive health care are also among negative consequences of DM ([19-22](#_ENREF_19)). DM behaviours may endanger the patient's safety as well. For example, unnecessary use of magnetic resonance imaging (MRI), computed tomography (CT) scan, biopsy, and other invasive and noninvasive interventions can be harmful to patients’ health due to exposing them to radiation and placing them at risk of infections ([5](#_ENREF_5)).

Some of the probable reasons for DM identified in previous studies are as follows: concerns about the claim for compensation of injuries imposed on a patient following treatment failure, concerns about legal litigation from patients, fear of disciplinary actions by medical councils, fear of negative publicity and damage to reputation, having previous medical lawsuits, lack of liability insurance, compliance with clinical standards, and increased patient's awareness ([15](#_ENREF_15), [23](#_ENREF_23), [24](#_ENREF_24)). According to the literature, some demographic and environmental factors affect the practice of DM behaviours ([25](#_ENREF_25)), being a second victim ([23](#_ENREF_23), [26](#_ENREF_26), [27](#_ENREF_27)), the physician's age ([23](#_ENREF_23)) and experience ([1](#_ENREF_1), [15](#_ENREF_15), [23](#_ENREF_23), [28](#_ENREF_28)), education ([26](#_ENREF_26), [29](#_ENREF_29)), risk of specialty ([1](#_ENREF_1), [23](#_ENREF_23), [26](#_ENREF_26), [27](#_ENREF_27)), activity volume (procedures/visits per week) ([23](#_ENREF_23)), and gender ([15](#_ENREF_15), [23](#_ENREF_23), [26](#_ENREF_26), [27](#_ENREF_27)) are some risk factors for DM.

As mentioned, DM is becoming increasingly common around the world. Given the negative consequences of these behaviours, policymakers need to be aware of the current situation and adopt appropriate policies to control it. Studies in this area can be informative and warning for managers, policymakers, and the community. Few studies were conducted on DM in Iran, and we need to perform more research in this area ([15](#_ENREF_15), [16](#_ENREF_16)). Therefore, the purpose of this study was to determine the prevalence of DM behaviours and associated risk factors in Iran among surgeons

**Methods**

*Study design and sampling*

The current cross-sectional study was conducted in Tehran, 2017, and the study population included about 1800 surgeons participating at the 41st Iranian Association of Surgeons Congress. Based on previous studies, the prevalence of DM was estimated 80% ([1](#_ENREF_1), [10](#_ENREF_10)). Therefore, taking into account p=0.8 and d =0.05, the sample size was estimated 245.

A systematic random sampling method was used, and the sampling frame was the list of participating surgeons at the congress. First, the sampling interval (k) was determined (dividing the population size by the sample size, N/n=k). Second, by selecting a random number as a starting point, our first participant was identified, and then, every *k*th participant in the list was selected. Thus, names of the selected surgeons for our study were identified. On the first day of the congress, one of the researchers (FA) attended at the reception desk of the congress site and distributed the questionnaire among the study’s participants based on the predefined list. After the questionnaire was completed, it was collected on the same day. A total of 250 copies of the questionnaire were distributed among the participants, from which 235 copies were completed and returned (the response rate=94%).

*Instrument*

The data collection tool was a questionnaire, which consists of three parts. The first part includes several demographic characteristics of participants (i.e., age, gender, work experience, work place, specialty, and previous medical lawsuits). The second part contains 13 items on the amount and type of DM behaviours (11 positive behaviours and two negative DM behaviours). The five-option Likert scale (always, often, sometimes, rarely, and never) was used to score the items. Common DM behaviours were extracted from the literature ([1](#_ENREF_1), [6](#_ENREF_6), [7](#_ENREF_7), [15](#_ENREF_15)). The third part includes six items on surgeons' perceptions of DM with yes/no responses were also adapted from previous studies ([1](#_ENREF_1), [6](#_ENREF_6), [7](#_ENREF_7), [15](#_ENREF_15)).

The validity of the tool was measured and confirmed using item-level content validity index (I-CVI). The primary version of the questionnaire was sent to five medical ethics experts and five responsible physicians in the Medical Council of Iran (due to the scientific and work relation to the study’s subjects). After a week, the copies of the questionnaire were returned, and the experts’ opinions on the questionnaire were applied to modify the content and wording of the items.

A value of item-level content validity index (I-CVI) was assessed by five experts, who were asked (1) to give suggestions on the relevancy of each item to the definition, (2) to evaluate clarity and conciseness of the wording. The experts were recruited from the area of interest of this study, including five medical ethics experts, and five responsible physicians in the Medical Council of Iran (due to the scientific and work relation to the study’s subjects). The evaluation followed the process suggested by Polit *et al.* (2007) in having experts rate each item on a 4-point Likert scale (not relevant, somewhat relevant, quite relevant, and very relevant) based on item clarity and conciseness. The ratings were used to calculate an item-level content validity index (I-CVI) and to determine if items should be revised or deleted. A criterion of 0.80 of I-CVI among the experts was selected for inclusion in the list of items ([30](#_ENREF_30)). During this step, the content validity of the items with a score of 0.86% was approved for the I-CVI indices.

Finally, a pilot test of the preliminary instrument was conducted on surgeons who had similar characteristics of the sample. Some 32 samples were selected to complete the pilot survey. Cronbach’s alpha coefficient was examined to determine the internal consistency of the scale which indicates how well the items fit together conceptually ([31](#_ENREF_31)), with the acceptable value of ≥0.70 ([32](#_ENREF_32)). The Cronbach's alpha coefficient was measured, and α=0.805 for behaviours and α = 0.827 for attitude indicated the stability and reliability of the tool, respectively.

*Data analysis*

Data analysis was performed with IBM SPSS version 20. First, using Fisher’s exact test and the chi-square test, a bivariate analysis was performed, and the relationship between each demographic variable and DM behaviours was examined. Second, to investigate the relationship between DM behaviours and the demographic variables simultaneously, the logistic regression test was used. To this end, Frequencies of DM behaviours was dichotomized into “never experienced = 0” (response of never and rarely) and “had experienced = 1” (response of always, often, and sometimes). A separate regression test was conducted for each DM behaviour. In the regression model, only variables with a significant level of p<0.2 in the bivariate analysis were included. P-value of ≤ 0.05 was considered significant.

**Results**

The characteristics of participants are shown in Table 1. The sample consisted of 235 participants, of which 77.5% were male. The average age of respondents was 49.8 (SD = 12.1) years and 57% were lower 50 years old. Most of the sample (54.9%) had below 15 years of surgery experience, and 41.7% worked for both public and private sectors, simultaneously.

Table1. Characteristics of respondents (235)

|  |  |  |
| --- | --- | --- |
| Variables | Number | % |
| **Age** | | |
| 50> | 134 | 57 |
| 50≤ | 101 | 43 |
| **Gender** | | |
| Female | 53 | 22.5 |
| Male | 182 | 77.5 |
| **Specialist** | | |
| General surgery | 57 | 24.2 |
| Gynecology | 35 | 14.9 |
| Orthopedic | 34 | 14.5 |
| Neurosurgery | 36 | 15.3 |
| Others | 73 | 31.1 |
| **Working setting** | | |
| Public hospital | 90 | 38.3 |
| Private hospital | 47 | 20 |
| Both | 98 | 41.7 |
| **Work experience** | | |
| 15> | 129 | 54.9 |
| 15≤ | 106 | 45.1 |
| **Working place** | | |
| Tehran(capital) | 125 | 53.2 |
| Other cities | 110 | 46.8 |
| **Pervious Lawsuit** | | |
| Yes | 136 | 57.9 |
| No | 99 | 42.1 |

Table 1 shows attitude of Iranian surgeons to toward defensive medicine. The majority of the surgeons (96.3%) believed that the rate of legal litigation increased in recent years.

Most of participants reported that DM behaviours resulted in a weakened physician-patient relationship (90.6%), increased costs of health services (89.7%), and low access of people to health services (82.5%). In addition, 74.4% of the surgeons believed that each patient could be a threat for medical lawsuits. Most of respondents (67.2%) stated that DM behaviours may be risky for patient safety. About 58% were familiar with the DM concept, and 57.9% of the surgeons had a history of malpractice lawsuits from patients.

Table2. Attitude of Iranian surgeons toward Defensive Medicine

|  |  |  |
| --- | --- | --- |
| Statements | Yes | No |
| n(%) | n(%) |
| The number of patient's legal litigation against the physicians increased in the recent years | 226 (96.3) | 9 (3.7) |
| DM behaviours can negatively affect the physician- patient relationship | 213 (90.6) | 22 (9.4) |
| DM behaviours lead to increased health care costs | 211 (89.7) | 24 (10.3) |
| DM practices can lead to fewer people access to health services | 194 (82.5) | 41 (17.5) |
| Any patient can potentially be a threat to sue | 175 (74.4) | 60 (25.6) |
| DM behaviours (including MRI, CT scan, biopsy, etc.) can be risky for patient safety | 158 (67.2) | 77 (32.8) |

The occurrence of DM behaviours is reported in in Table 3. The highest rate of DM behaviours was attributed to the description of details and patient participation in treatment selection (94.5%), followed by emphasis on recording the treatment process details and the patient’s specific statements in their file (88.9%), biopsy ordering (78.7%), imaging test ordering (72.4%), and order for laboratory tests (70.6%). The lowest rate of DM behaviours was related to unnecessary transfer of the patient to the emergency department (14.9%), followed by prescription of unnecessary drugs (18.3%), and emphasis on unnecessary and frequent visits in health care centers (22.9%).

Table3. The occurrence of medical defensive behaviours

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DM** behaviours | **Had experienced** | | **Never experienced** | |
| **N** | **%** | **N** | **%** |
| Description of details and patient participation in treatment selection | 222 | 94.5 | 13 | 5.5 |
| Emphasis on recording the treatment process details and the patient’s specific statements in his/her file | 209 | 88.9 | 26 | 11.1 |
| Unnecessary Biopsy | 185 | 78.7 | 50 | 21.3 |
| Unnecessary Imaging | 170 | 72.4 | 65 | 27.6 |
| Unnecessary Laboratory tests | 166 | 70.6 | 69 | 29.4 |
| Refusing to accept high-risk patients\* | 145 | 61.7 | 90 | 38.3 |
| Avoiding to perform risky intervention\* | 103 | 43.8 | 132 | 56.2 |
| Unnecessary counseling | 101 | 42.9 | 134 | 57.1 |
| Use of multiple treatment procedures | 81 | 34.5 | 154 | 65.5 |
| Unnecessary hospitalization | 73 | 31.1 | 162 | 68.9 |
| Emphasis on unnecessary and frequent visits in health care centers | 54 | 22.9 | 181 | 77.1 |
| Unnecessary drug prescription | 43 | 18.3 | 192 | 81.7 |
| Unnecessary transfer of patient to emergency department | 35 | 14.9 | 200 | 85.1 |
| \* Negative DM behaviours |  |  |  |  |

The logistic regression analysis of predictor variables for DM behaviours is presented in Table 4. Results showed that the likelihood of ordering laboratory tests by female surgeons was 4.6 times more than that by male surgeons. The likelihood of applying imaging was 3.8 times greater in female surgeons than in male surgeons. This was 1.5 times higher among surgeons of younger than 50 years old compared to older surgeons. The biopsy order rate was 1.1 times higher in general surgeons than in other surgeons, and the chance for prescription of unnecessary drugs was 2.9 times greater in younger surgeons than in older ones. Unnecessary hospitalization of the patient was 3.4 times more probable among surgeons with a malpractice lawsuit history compared to other surgeons. The likelihood of unnecessary hospitalization was 2.9 times more in less experienced surgeons than experienced ones. Less experienced (odds ratio; OR=4.6) and younger surgeons (OR=1.5) were more likely to order unnecessary consultation. Failure to perform risky intervention was more among neurosurgeons, female surgeons, and less experienced surgeons compared to other surgeons. The likelihood of avoiding treatment of high-risk patients was greater in less experienced (OR=1.5) and younger (OR=1.7) surgeons.

Table 4. Logistic regression analysis of factors associated with medical defensive behaviours

|  |  |  |  |
| --- | --- | --- | --- |
| **DM Behaviours** | **variables** | **OR (SE)** | **p** |
| Unnecessary Laboratory tests | Gender (ref: Male) | 4.6 (0.657) | 0.004 |
| Unnecessary Imaging | Age (ref: 50≤ ) | 1.6 (0.424) | 0.041 |
| Gender (ref: Male) | 3.8 (0.659) | 0.013 |
| Unnecessary Biopsy | Specialty (ref: Other) |  | 0.019 |
| General surgery | 1.2 (0.706) |
| Gynecology | 0.5 (0.736) |
| Orthopedic | 0.3 (0.656) |
| Neurosurgery | 0.2 (0.710) |
| Unnecessary drug prescription | Age (ref: 50≤ ) | 2.9 (0.394) | 0.038 |
| Unnecessary hospitalization | Work experience (ref: 15≤) | 2.9 (0.397) | 0.025 |
| Previous lawsuits (ref: No) | 3.5 (0.408) | 0.008 |
| Unnecessary specialist consultations | Age (ref: 50≤ ) | 1.5 (0.527) | 0.031 |
| Work experience (ref: 15≤) | 4.6 (0.544) | <0.001 |
| Avoiding to perform risky intervention | Gender (ref: Male) | 3.9 (0.570) | 0.003 |
| Work experience (ref: 15≤) | 3.9 (0.595) | 0.01 |
| Specialty (ref: Other) |  | 0.011 |
| General surgery | 2.0 (0.530) |
| Gynecology | 0.4 (0.805) |
| Orthopedic | 1.5 (0.594) |
| Neurosurgery | 2.2 (0.631) |
| Refusing to accept high-risk patients | Age (ref: 50≤ ) | 1.76 (0.470) | 0.009 |
| Work experience (ref: 15≤) | **1.5 (**0.470**)** | 0.011 |

**Discussion**

This is the first study on DM among Iranian surgeons, and the findings showed that the prevalence of DM behaviours ranged from 14.9% to 88.9%. The prevalence of DM behaviours across the world has been reported from 30% to 98%, including 30% of psychiatrists in Middle Eastern countries ([29](#_ENREF_29)), 59.8% of Italian physicians ([10](#_ENREF_10)), 60% of physicians in Israel ([26](#_ENREF_26)), 62.1% of Israeli psychiatrists ([11](#_ENREF_11)), 71.8 % of obstetricians and gynecologists in Sudan ([12](#_ENREF_12)), 72% of neurosurgeons in Turkey ([13](#_ENREF_13)), 75% of radiation oncologist physicians in Italy ([24](#_ENREF_24)), 78% of hospital doctors in the UK ([1](#_ENREF_1)), 89.2% of spine neurosurgeons in the US ([33](#_ENREF_33)), 97.7% of orthopedic surgeons, trauma surgeons and radiologists in Austria ([14](#_ENREF_14)), 98% of gastroenterologists in Japan ([28](#_ENREF_28)), and 98% of general practitioners in Iran ([15](#_ENREF_15)). One of the main reasons for this diversity in prevalence rates is specialty. Accordingly, the rate of DM behaviours is higher in some specialties such as surgery due to the high risk nature of interventions on the patient and the greater probability of malpractice lawsuits. Variety in the results can also be attributed to the following reasons: time of study (in recent years, the prevalence of these behaviours has increased), study’s method (study design as well as time and location of filling out questionnaires), and context (physicians' caution in answering questions influenced by cultural contexts).

The increased rate of legal litigations and costs of liability insurance have caused physicians to fear from malpractice. This may force them to show defensive behaviours to avoid the risk of legal litigations ([34](#_ENREF_34), [35](#_ENREF_35)). The current study findings confirmed this claim. In the current study, 74% of the surgeons believed that every patient was a potential threat for legal litigation, and almost all of them believed that the rate of legal litigation increased in recent years. Evidence suggested that the number of legal litigations against physicians in Iran increased due to increased awareness of patients in recent years ([15](#_ENREF_15)). Almost all the surgeons believed that DM behaviours, especially diagnostic tests, led to higher health costs and discontinuation of treatment, or even, put patients at high risk including exposure to radiation. In addition, more than half of Iranian surgeons were aware of DM, which is consistent with the findings of the studies from Sudan ([12](#_ENREF_12)) and UK ([1](#_ENREF_1)).

About two-thirds of the surgeons in our study ordered more laboratory and imaging tests for more accurate diagnosis, as similar to the results of previous studies ([1](#_ENREF_1), [19](#_ENREF_19), [36](#_ENREF_36)). Appropriate care and treatment along with clinical judgment require diagnostic tests, which, in turn, needs physicians to be knowledgeable, skilled, and responsible ([37](#_ENREF_37)). The likelihood of laboratory tests and imaging orders was more in female surgeons than in male ones, which is consistent with the findings of previous studies ([15](#_ENREF_15), [36](#_ENREF_36)). The results of a study showed that female physicians ordered more laboratory tests than male ones, resulting in more costs in this area ([38](#_ENREF_38)). It appears that gender differences in practicing approaches affected this behavior.([39](#_ENREF_39)) In addition, the imaging order was more in younger surgeons. The findings of previous studies are in agreement with the findings of the current study with regard to the effect of age on DM behaviours ([1](#_ENREF_1), [13](#_ENREF_13), [23](#_ENREF_23)). Older and experienced physicians rely heavily on first clinical impressions, and therefore, they may use less diagnostic tests for their patients ([40](#_ENREF_40)).

About 80% of surgeons ordered additional biopsy, during which, given the invasive nature of the procedure, the patient was prone to further risks. The biopsy order was higher in general surgeons than other specialties. General surgeons faced with a wide range of diseases and conducted many surgical procedures for cancers such as breast cancer that requires biopsy for the diagnosis. Less than one-fifth of the surgeons prescribed unnecessary drugs. The irrational and unnecessary prescription of drugs is one of the most common problems in health systems, which, in addition to financial costs, has adverse effects on the patient. The World Health Organization estimated that about half of the prescribed medications were irrational ([41](#_ENREF_41)). The probability of prescribing unnecessary drugs was higher in younger surgeons, which appears to be due to less experience of surgeons to avoid liability arising from medical malpractice.

There was a significant relationship between the history of malpractice lawsuits, work experience, and unnecessary referral to the hospital. Physicians with previous malpractice lawsuits may lose their confidence or have fear of being sued ([23](#_ENREF_23)), which could distort their image and reputation. The likelihood of unnecessary referral for hospitalization was lower in experienced surgeons, which is consistent with previous studies ([13](#_ENREF_13), [15](#_ENREF_15), [23](#_ENREF_23)). Technical skills are one of the four components of successful surgical procedures, and experienced surgeons have more technical skills ([39](#_ENREF_39)).

The likelihood of unnecessary counseling in less experienced and young surgeons was higher, consistent with the findings of previous studies ([13](#_ENREF_13), [15](#_ENREF_15), [23](#_ENREF_23)). It appears that the experience of these surgeons led to implementation of a cautious approach to medicine, and therefore, additional advice is particularly required in complex cases.

The current study findings showed that 44% of the surgeons had the experience of avoiding risky interventions and procedures for their patients, which was higher in neurosurgeons than other surgeons. This can be attributed to the nature of neurosurgery that deals with the vital organs of the human body such as the brain and the nervous system. Therefore, given the elegance and risk of some brain surgeries that affect movement and speech, these surgeons are more cautious about performing risky procedures. The likelihood of avoiding risky interventions was higher in female surgeons. In general, the approach of male surgeons to solving complex problems was less thoughtful ([42](#_ENREF_42)) and female surgeons were less risk takers than male surgeons ([43](#_ENREF_43)). The likelihood of avoiding risky interventions was higher in less experienced surgeons, which is consistent with the findings of studies in Iran and Turkey ([13](#_ENREF_13), [15](#_ENREF_15)). Lack of experience may lead to implementation of a cautious approach to medicine, and less experienced surgeons prefer to avoid risky interventions as they refuse to ruin their own image in their early years.

More than half of the surgeons had an experience of refusing high-risk patients. Mortality is highly common in high-risk patients, especially in older patients with co-morbidity undergoing major surgeries ([44](#_ENREF_44)). A study in the UK showed that 80% of post-operative mortalities were related to the high-risk group ([44](#_ENREF_44)). Therefore, it appears that the main reason for rejection of high-risk patients is the treatment results and consequences. A study in Norway showed that gynecologists were susceptible to exposure to media since they cared for their reputation. These surgeons tended to be more likely to use defensive behaviours when the probability of negative promotions increased ([45](#_ENREF_45)). A good reputation is important to establish a reliable patient-physician relationship, which is a good basis for efficient medical practice. Denial to help patients is not compatible with the ethical principle of usefulness, since according to this principle, the patient's welfare is a priority, and care providers have a professional commitment to care for the patient. In Iran, according to the general guidelines on professional ethics of the Iran Medical Council, refusal to accept high-risk patients is prohibited because of fears of legal consequences and possible damages. As well as, our findings revealed the probability of refusing high-risk patients was more in younger and less experienced surgeons. Previous studies also reported similar results ([13](#_ENREF_13), [15](#_ENREF_15), [23](#_ENREF_23)). The treatment of high-risk patients may not be successful, and therefore, young surgeons prefer to record fewer unsuccessful operations in their career profile. Due to less experience, they may also have less ability to manage complex conditions in such patients and have less willingness to accept high-risk patients.

According to the nature of the study, refusal of some surgeons to respond to the questionnaire was anticipated. Thus, the researcher, through describing the study objectives, attempted to assure them about the confidentiality of the participants' information. Second, the response to the questions was based on self-reporting and hence the study suffered from the bias of the self-reported data. Third, it should be noted that making decisions about the appropriateness or inappropriateness of a procedure or medical care is extremely difficult in many clinical conditions, especially where intervention is required. Hence, it is difficult to determine whether the provision of a care or procedure is considered a DM behaviour, and every physician may have their own judgment on the issue ([13](#_ENREF_13)).

**Conclusions**

The results of the current study showed that almost all the studied surgeons experienced at least one DM behaviours in their practice. The majority of participants believed that DM behaviours resulted in a weakened physician-patient relationship, increased costs of health services, and low access of people to health services. In addition, the probability of performing DM behaviours was higher among female, younger, and less experienced surgeons. Informing the health system and related health authorities about the existence of the DM phenomenon and its consequences, as well as conducting further studies on the prevalence and reasons of DM and solutions to reduce it, is among the first steps to reduce DM behaviours. Strategies such as reforming the rules and regulations for medical errors and litigations, developing and implementing medical guidelines and evidence-based medicine, and reforming medical liability insurance systems are effective in reducing DM behaviours and thus preventing its adverse effects on the health system and patients.

**Ethics and Consent to Participate statement**

The Ethics Committee of Shahid Beheshti University of Medical Sciences approved the current study protocol (Code: IR.SBMU.PHNS.REC.1396.14). Verbal consent was obtained from the study participants because the data were collected by using questionnaire and thus did not involve any human data. We attached a cover letter to each questionnaire informing nurses of our objectives and procedures, emphasizing that participation, while voluntary, would be very much appreciated and would remain anonymous.

**Disclosure**

The authors declare that they have no competing interests.

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**References**

1. Ortashi O, Virdee J, Hassan R, Mutrynowski T, Abu-Zidan F. The practice of defensive medicine among hospital doctors in the United Kingdom. BMC medical ethics. 2013;14:42.

2. Kainberger F. Defensive medicine and overutilization of imaging—an issue of radiation protection. Wiener klinische Wochenschrift. 2017;129(5-6):157-8.

3. Hvidt EA, Lykkegaard J, Pedersen LB, Pedersen KM, Munck A, Andersen MK. How is defensive medicine understood and experienced in a primary care setting? A qualitative focus group study among Danish general practitioners. BMJ open. 2017;7(12):e019851.

4. Kapp MB. Defensive medicine: No wonder policymakers are confused. International Journal of Risk & Safety in Medicine. 2016;28(4):213-9.

5. Frati P, Busardò FP, Sirignano P, Gulino M, Zaami S, Fineschi V. Does defensive medicine change the behaviors of vascular Surgeons? A qualitative review. BioMed research international. 2015;2015:170692.

6. Johnston WF, Rodriguez RM, Suarez D, Fortman J. Study of Medical Students' Malpractice Fear and Defensive Medicine: A “Hidden Curriculum?”. Western Journal of Emergency Medicine. 2014;15(3):293-8.

7. Fronczak SW. Defensive Medicine: A Tax/Surcharge for the Delivery of Healthcare. World neurosurgery. 2016;95:594-6.

8. Rinaldi C, d’Alleva A, Leigheb F, Vanhaecht K, Knesse S, Di Stanislao F, et al. Defensive practices among non-medical health professionals: An overview of the scientific literature. Journal of healthcare quality research. 2019;34(2):97-108.

9. Studdert DM, Mello MM, Sage WM, DesRoches CM, Peugh J, Zapert K, et al. Defensive medicine among high-risk specialist physicians in a volatile malpractice environment. JAMA. 2005;293(21):2609-17.

10. Panella M, Rinaldi C, Leigheb F, Knesse S, Donnarumma C, Kul S, et al. Prevalence and costs of defensive medicine: a national survey of Italian physicians. Journal of health services research & policy. 2017;22(4):211-7.

11. Reuveni I, Pelov I, Reuveni H, Bonne O, Canetti L. Cross-sectional survey on defensive practices and defensive behaviours among Israeli psychiatrists. BMJ open. 2017;7(3):e014153.

12. Ali AA, Hummeida ME, Elhassan YA, Nabag WO, Ahmed MAA, Adam GK. Concept of defensive medicine and litigation among Sudanese doctors working in obstetrics and gynecology. BMC medical ethics. 2016;17:12.

13. Solaroglu I, Izci Y, Yeter HG, Metin MM, Keles GE. Health transformation project and defensive medicine practice among neurosurgeons in Turkey. PloS one. 2014;9(10):e111446.

14. Osti M, Steyrer J. A national survey of defensive medicine among orthopaedic surgeons, trauma surgeons and radiologists in Austria: evaluation of prevalence and context. Journal of evaluation in clinical practice. 2015;21(2):278-84.

15. Moosazadeh M, Movahednia M, Movahednia N, Amiresmaili M, Aghaei I. Determining the frequency of defensive medicine among general practitioners in Southeast Iran. International journal of health policy and management. 2014;2(3):119-23.

16. Rezayi A, Vafaee Najar A, Houshmand E, Esmaeli H, Kouhestani S. Experience and Etiology of Defensive Medicine in View of Residents in Mashhad University of Medical Sciences in 2016. Journal of Paramedical Sciences & Rehabilitation. 2017;6(2):60-8.

17. Rothberg MB, Class J, Bishop TF, Friderici J, Kleppel R, Lindenauer PK. The cost of defensive medicine on 3 hospital medicine services. JAMA internal medicine. 2014;174(11):1867-8.

18. Pellino IM, Pellino G. Consequences of defensive medicine, second victims, and clinical-judicial syndrome on surgeons’ medical practice and on health service. Updates in surgery. 2015;67(4):331-7.

19. Ogunbanjo GA, van Bogaert DK. Ethics in health care: the practice of defensive medicine. South African Family Practice. 2014;56(1):S6-S8.

20. Kessler DP. Evaluating the medical malpractice system and options for reform. Journal of Economic Perspectives. 2011;25(2):93-110.

21. Bilimoria KY, Chung JW, Minami CA, Sohn M-W, Pavey ES, Holl JL, et al. Relationship Between State Malpractice Environment and Quality of Health Care in the United States. The Joint Commission Journal on Quality and Patient Safety. 2017;43(5):241-50.

22. Dolz-Güerri F, Gómez-Durán E, Martínez-Palmer A, Céspedes MC, Arimany-Manso J. Clinical safety and professional liability claims in Ophthalmology. Archivos de la Sociedad Española de Oftalmología (English Edition). 2017;92(11):528-34.

23. Panella M, Rinaldi C, Leigheb F, Donnarumma C, Kul S, Vanhaecht K, et al. The determinants of defensive medicine in Italian hospitals: the impact of being a second victim. Revista de Calidad Asistencial. 2016;31:20-5.

24. Ramella S, Mandoliti G, Trodella L, D’Angelillo RM. The first survey on defensive medicine in radiation oncology. La radiologia medica. 2015;120(5):421-9.

25. Garattini L, Padula A, Mannucci PM. Defensive medicine: Everything and its opposite. European journal of internal medicine. 2020:in press.

26. Asher E, Greenberg-Dotan S, Halevy J, Glick S, Reuveni H. Defensive medicine in Israel–a nationwide survey. PLoS One. 2012;7(8):e42613.

27. Zhu L, Li L, Lang J. The attitudes towards defensive medicine among physicians of obstetrics and gynaecology in China: a questionnaire survey in a national congress. BMJ open. 2018;8(2):e019752.

28. Hiyama T, Yoshihara M, Tanaka S, Urabe Y, Ikegami Y, Fukuhara T, et al. Defensive medicine practices among gastroenterologists in Japan. World journal of gastroenterology: WJG. 2006;12(47):7671-5.

29. Al-Atram AA. Defensive practice among psychiatrists in middle East Countries: A questionnaire survey. Journal of Health Specialties. 2018;6(1):30-8.

30. Polit DF, Beck CT, Owen SV. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. Res Nurs Health. 2007;30(4):459-67.

31. DeVon HA, Block ME, Moyle‐Wright P, Ernst DM, Hayden SJ, Lazzara DJ, et al. A psychometric toolbox for testing validity and reliability. Journal of Nursing scholarship. 2007;39(2):155-64.

32. DeVellis RF. Scale development: Theory and applications. California: Sage publications; 2016.

33. Din RS, Yan SC, Cote DJ, Acosta MA, Smith TR. Defensive medicine in US spine neurosurgery. Spine. 2017;42(3):177-85.

34. Bourne T, Vanderhaegen J, Vranken R, Wynants L, De Cock B, Peters M, et al. Doctors' experiences and their perception of the most stressful aspects of complaints processes in the UK: an analysis of qualitative survey data. BMJ open. 2016;6(7):e011711.

35. Sekhar M, Vyas N. Defensive Medicine: A Bane to Healthcare. Annals of Medical and Health Science Research 2013;3(2):295-6.

36. Reisch LM, Carney PA, Oster NV, Weaver DL, Nelson HD, Frederick PD, et al. Medical malpractice concerns and defensive medicine: a nationwide survey of breast pathologists. American journal of clinical pathology. 2015;144(6):916-22.

37. Miron-Shatz T, Rapaport SR, Srebnik N, Hanoch Y, Rabinowitz J, Doniger GM, et al. Invasive Prenatal Diagnostic Testing Recommendations are Influenced by Maternal Age, Statistical Misconception and Perceived Liability. Journal of genetic counseling. 2018;27(1):59-68.

38. Hedden L, Barer ML, Cardiff K, McGrail KM, Law MR, Bourgeault IL. The implications of the feminization of the primary care physician workforce on service supply: a systematic review. Human resources for health. 2014;12:32.

39. Wallis CJ, Ravi B, Coburn N, Nam RK, Detsky AS, Satkunasivam R. Comparison of postoperative outcomes among patients treated by male and female surgeons: a population based matched cohort study. BMJ. 2017;359:j4366.

40. Lee L, Weston W. The aging physician. Canadian Family Physician. 2012;58(1):17-8.

41. Ahmadi F, Zarei E. Prescribing patterns of rural family physicians: a study in Kermanshah Province, Iran. BMC public health. 2017;17:908.

42. Tsugawa Y, Jena AB, Figueroa JF, Orav EJ, Blumenthal DM, Jha AK. Comparison of hospital mortality and readmission rates for Medicare patients treated by male vs female physicians. JAMA internal medicine. 2017;177(2):206-13.

43. Charness G, Gneezy U. Strong evidence for gender differences in risk taking. Journal of Economic Behavior & Organization. 2012;83(1):50-8.

44. Pearse RM, Harrison DA, James P, Watson D, Hinds C, Rhodes A, et al. Identification and characterisation of the high-risk surgical population in the United Kingdom. Critical care. 2006;10(3):R81.

45. Grytten J, Skau I, Sørensen R. The impact of the mass media on obstetricians’ behavior in Norway. Health Policy. 2017;121(9):986-93.