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A qualitative approach to identify clinical uncertainty in practicing physicians and clinical residents

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Abstract:

BACKGROUND: Clinical decision-making is not only stressful to physicians, but also to patients and even their companions. Thus, managing uncertainty in clinical decision-making is essential which requires knowing its origins. Therefore, this study aimed to understand determinants of uncertainty in clinical decision-making from the perspective of clinical physicians.

MATERIALS AND METHODS: This is a qualitative study which is done during October to November 2020. An in-depth interview is performed with 24 specialists of clinical groups including obstetrics, surgery, internal medicine, and pediatrics, working in teaching hospitals affiliated to Iran University of Medical Sciences. All the interviews were recorded, transcribed and analyzed according to the steps suggested by Graneheim and Lundman. The interviews were analyzed through comparative method. Then, the interviewer created initial codes, categories, and key concepts and sent them to fourteen physicians for member check.

RESULTS: According to the participants' view, determinants of uncertainty in clinical decision-making consisted of three themes: individual determinants, dynamics of medical sciences, and diagnostic and instrumental constraint. Individual determinants can be related to the physician or patient. The dynamics of medical sciences could be explained in two categories: variation of medical science and complexity. Diagnostic and instrumental constraint category could be also explained in subcategories such as lack of efficient diagnostic tests and unknown etiology.

CONCLUSION: To curb uncertainty, the more accessible way is considering interventional programs with a focus on individual determinants related to physicians, such as strengthening doctor–patient relationships, and considering related mandatory retraining courses to reduce insufficient knowledge of physicians.

Keywords:

Clinical decision-making, determinant, physicians, qualitative research, uncertainty

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Introduction

Medical uncertainty has been considered Man innate feature of medicine and medical practice.^[1] The encounter between a physician and a patient to make the best rational and ethical decision creates a complex enterprise where there are more questions than answers.^[2] As a physician should have the best action in consistent with individual preferences or societal

values, it gradually leads the therapist to uncertainty.^[2,3] In a situation that clinicians have insufficient knowledge and do not know exactly what the signs and symptoms indicate, or what the best treatment is, they experience uncertainty.^[1,4,5] Unsorted array of information, different diagnostic and therapeutic tools, as well as limited definitive knowledge are just some of the factors which lead to uncertain decision-making environment.^[3,6,7] Moreover, some individual characteristics such as low age,

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less experience, and low self-esteem are associated with uncertainty and such physicians reported more medical error and poorly tolerated uncertainty.^[8-10]

Personal decisions are the leading cause of death, and diagnostic failure is a major source of morbidity and mortality.^[11,12] Besides, more than one-third of healthcare costs are wasted due to inappropriate care and the majority of healthcare expenditures are due to improper physician decisions.^[12] Moreover, clinical decision-making is not only stressful to physicians, but also to patients and even their companions. Thus, managing uncertainty in clinical decision-making is essential which requires knowing its dimensions to provide the best care and treatment to the patient.^[13] Therefore, this study aimed to understand determinants of uncertainty in the clinical decision-making process from the perspective of clinical physicians (surgery, internal medicine, obstetrics and pediatrics).

Materials and Methods

Study design and setting

This study was conducted through a qualitative content analysis. The study setting was all hospitals affiliated with Iran University of Medical Sciences (IUMS) in Tehran city, Iran.

Study participants and sampling

24 specialists of four main clinical groups, including obstetrics, surgery, pediatrics and internal medicine working at hospitals affiliated to (IUMS) were selected using purposive sampling method and were studied. Eligible participants were experienced clinical physicians of four surgery, internal medicine, gynecology and pediatrics groups who were keen to share their experience.

Data collection tool and technique

A semi-structured, in-depth interview was applied with clinical physicians to get a more comprehensive view of uncertainty determinants. Before the interview, a summary of the research plan along with the objectives of the study and initial preparation for the interviewees was sent via email and was briefly explained at the beginning of the interview session. Data gathering was conducted after fulfilling the written consent from participants. The informed consent let the participants be aware of all options and they could withdraw from the study at any time.

Interviews were conducted during October to November 2020 in a private room and lasted on average for 45 minutes. All interviews were recorded using a digital recorder after obtaining permission from all participants. Data collection continued until reaching theoretical

saturation, during which collected data provided no more categories.^[14]

To ensure the trustworthiness of the data, four criteria, namely, credibility, conformability, dependency, and transferability were considered. Triangulation strategy was used to obtain the credibility. The peer and member check were also used to assess the dependency of the data.^[15]

Ethical consideration

Informed consent was obtained from the participants and they were assured that their information would remain confidential. This study was approved by the ethics committee of Iran University of Medical Sciences (IR. IUMS.FMD.REC. 1399.418).

Data analysis

The recorded interviews were transcribed verbatim and analyzed through comparative method. The analysis was done in several stages: 1) The transcript of each interview was read several times to get a sense of everyone's story; 2) related meaning units to the study aim were identified; 3) each condensed meaning unit was given a code, which was a summary of its content; 4) the codes with similar concepts were formed into subcategories; 5) similar subcategories were grouped as categories; and 6) based on interpretations of meanings in the categories, main themes were formed.

The created initial codes, categories, and key concepts were sent to physicians who participated in the study. They were asked to check the correctness of the extracted results. 14 professors participated in the member check stage for necessary changes. Finally, the authors agreed on extracted themes, categories, and subcategories to describe determinants of clinical uncertainty.

Results

In total, 24 specialists participated in the study, of which 17 were male (70.83%). The informants were 30 to 57 years of age. The mean of their job experience was 12.67 ± 9.28 . Amongst them, 9 were internal medicine specialists, 4 were gynecologists, 5 were pediatricians, and 6 were surgeons [Table 1].

Determinants of uncertainty

According to the participants' view, three main themes emerged during data collection as determinants of uncertainty in clinical decision-making. The themes were individual determinants, dynamics of medical sciences, and diagnostic and instrumental constraint [Table 2].

Individual determinants

Individual determinants were one of the themes in explaining clinical uncertainty. It can be related to the physician or patient.

Table 1: Characteristics of the participants (n=24)

Characteristics	n (%)
Gender	
Male	17 (70.83)
Female	7 (29.17)
Specialty	
Internal Medicine	9 (37.50)
Gynecology	4 (16.67)
Pediatrics	5 (20.83)
Surgery	6 (25.00)
Scientific rank	
Assistant	9 (37.50)
Assistant Professor	5 (20.83)
Associate Professor	7 (29.17)
Full Professor	3 (12.50)

Table 2: Themes, categories, and subcategories of uncertainty in clinical decision-making

Themes	Categories	Subcategories
Individual determinants	Physician-related determinants	Physician-related history writing problems
		Poor information
		Over-diagnosis
		Lack of self-confidence
		Lack of comprehensive vision
		Conflicting diagnostic views
	Patient-related determinants	Difficulties in expressing disease history
		Socio-economic barriers of the patient
		Emergence of new diseases
		Resource inadequacy and ambiguity
Dynamics of medical sciences	Relativity of medical science	Uncertain nature of medical science
		Complexity
		Concurrent diseases and complications
	Lack of efficient diagnostic methods	Wide range of diseases in the clinical field
		Unpredictability
		Weakness of diagnostic tests
Diagnostic and instrumental constraint	Unknown etiology	Paraclinical limitations
		Similarity of clinical manifestations
	Lack of efficient diagnostic methods	Lack of clinical evidence
		Individual differences in the occurrence of clinical signs
		Presence of latent symptoms

Physician-related determinants

The "physician-related determinants" play an important role in the individual determinant category. This category includes aspects such as 1) physician-related history writing problems, 2) poor information, 3) over-diagnosis, 4) lack of self-confidence, 5) lack of comprehensive vision, and 6) conflicting diagnostic views.

One of the individual underlying factors associated with physicians was difficulty of writing patient history. This refers to a set of underlying factors that interfere with patient-history writing. The physician's inability to communicate with the patient and the patient's biography, incorrect description, and clinical examination along with the physician's inadequate literacy are among the problems that have been repeatedly mentioned in interviews as factors influencing difficulty of writing patient history. Biography problems are much more noticeable in pediatric groups. One of the doctors declared:

When the doctor does not yet have enough experience in how to communicate with the patient, he can certainly not write a correct history of the person's physical condition and consequently the disease, and this is the first important line that if not done correctly may affect the doctor's diagnosis of the disease and the doctor practically has uncertainty in the decision. (ID: 4, a Pediatrician)

Another physician said:

We must have a correct history and a proper examination of the patient, otherwise the possibility of uncertainty increases. (ID: 3, a Pediatric Subspecialty)

Poor physician information was another subcategory that explains the determinants of physician-related uncertainty. Deprived information can be due to insufficient physician literacy, lack of up-to-date information or lack of sufficient experience and professionalism of the physician. One of the internal specialists says:

Lack of physician knowledge and information can lead to a kind of uncertainty called cognitive or epistemological uncertainty. (ID: 14, an Internal Medicine Specialist)

Another doctor, regarding the importance of keeping the doctor's information up to date, stated that:

As a doctor I have to be up to date, when a new illness comes I have to read the update 777 and if I have any doubts I should check all the related guidelines and articles. (ID: 17, Male, a Pediatrician)

Over-diagnosis or Excessive diagnosis was another factor associated with uncertainty in the physician's decision-making, sometimes due to a physician's over-information and over-attention to symptoms. In such cases, the doctor will diagnose many of the patient's symptoms and problems, but his attention to these symptoms will distract him from the main disease and problem, and the principle that the patient suffers from is neglected. One of the internal specialists said:

One of the causes of uncertainty is over diagnosis, this causes us to go and find a correct but irrelevant diagnosis in the patient and we are still in that uncertainty of the first symptom. Although we are treating another condition, another symptom and sign may never cause a deficiency. (ID: 24, Male, an Internal Specialist)

Lack of self-confidence in dealing with patients was one of the subgroups that refers to the determinants of physician-related uncertainty, especially among less experienced doctors. A physician with 14 years of experience declared:

Low self-esteem is more prevalent among inexperienced and younger physicians. Sometimes, even though the doctor has enough knowledge for the patient's diagnostic and treatment measures, he doubts his decision due to low self-confidence and postpones the decision to consult with others again. Sometimes even this person, despite consulting, still can't make a definite decision, and this is especially very destructive in cases where the patient is not in a favorable position and the decision must be made as soon as possible. (ID: 13, Male, a Surgeon)

Another individual factor that leads to uncertainty is lack of comprehensive physician vision. The specialization of the disciplines and the limitation of physicians' vision to their specialty cause physicians to not have a comprehensive vision in dealing with the patient. Sometimes a doctor tries to treat only by focusing on what he has learned without consulting others. An internal specialist stated:

Sometimes we encounter a person whose diagnosis is outside our area of expertise, and in these cases, if we want to diagnose the problem based on our area of expertise and seek treatment, we become uncertain. Unfortunately, in some cases, the doctor insists on solving the patient's problem based on his/her field, while we have to get help from the doctor or the relevant medical team or refer the patient to the relevant ward. (ID: 21, Male, an Internal Specialist)

Another subcategory of determinants of physician-related uncertainty was the conflict of diagnostic views between physicians. This conflict and sometimes disagreement occur in specific cases and rare diseases, as well as when several organs of the patient are involved. These cases require further consultation with the expert team. A gynecologist with about 30 of experience stated:

In some cases, there is a controversy about patient management between colleagues. Especially, when several organs are involved and there is a disagreement over which diagnostic method to use and which treatment is the best for the patient in this situation. Such cases need further

investigation, which we usually try to raise in Morning reports. (ID: 2, Female, a Gynecologist)

Patient-related determinants

The category of patient-related determinants also plays an important role in the theme of individual determinants. This category includes dimensions such as 1) difficulties in expressing disease history, and 2) socio-economic barriers of the patient.

One of the subcategories that create uncertainty in physicians on the part of the patient is the inability of the patient or error in expressing history of the disease and current condition. This problem is more common in child patients who cannot speak or the elderly who suffer from many diseases such as forgetfulness. When the patient is an infant and does not have the ability to speak, his biography by parents who may not be sure of their child's condition might lead to uncertainty in the physician's decision. A physician said:

Misinformation of the patient can lead to problems in processing information. That is, what is learned from the patient is different from what is ultimately diagnosed. (ID: 18, Male, an Internal Specialist)

Another colleague with 10 years of experience in the field of children stated:

In children, as the parents have a biography of a child, the uncertainty can be more because the child can't speak or fully express". (ID: 3, Female, a Pediatric Subspecialist)

Another subcategory that determines the uncertainty in a physician's decisions related to the patient's socio-economic problems. Some diseases require long-term follow-up, and even in spite of discharge, the patient has to see a doctor several times. Poor economic conditions of some patients and high cost of referrals will lead to their non-follow-up, which will face a doctor with some restrictions and sometimes uncertainty in terms of treatment choice and duration of treatment. A pediatrician declared:

In some situations when the patient needs a follow-up, it is important to see how correct and effective the treatment decision I made is. But sometimes the patient's financial situation is such that he does not cooperate with us in this follow-up". (ID: 17, Pediatric Attending)

Also, the patient's social and cultural level might be such that for all procedures, the physician will have to explain the details to the patient's companions or the patient himself, and this will sometimes limit the physician and his treatment options. A pediatrician with five years of experience stated:

Sometimes the socio-economic status of the patient can affect the treatment process. That is, a family with a disease sends a child for a diagnosis and treatment approach, and another family sends another child with the same disease, but due to the difference in their culture and level, we have to use another approach for treatment. (ID: 5, Male, a Pediatrician)

Dynamics of medical sciences

Another theme in explaining clinical decision uncertainty is the dynamics of medical science. This theme could be explained in two categories, which include: a) variation of medical sciences and b) complexity.

Variation of medical science

The variation of medical science also plays an important role in the central category of medical science dynamics as a determinant of clinical uncertainty. This category includes dimensions such as 1) the emergence of new diseases, 2) resource inadequacy and ambiguity, and 3) the uncertain nature of medical science.

One of the factors that plays a very important role in explaining the dynamics of medical science is the emergence of new diseases. Changing medicine and dealing with patients with new symptoms, unknown or rare diseases that a physician rarely encounters are factors that make the physician hesitant to make certain clinical decisions. The recent coronavirus (Covid-19) is a prime example of not only an emerging disease but also changing clinical symptoms.

In new diseases with no recommendations in the sources and guidelines, where the symptoms of the disease are not completely listed, the doctor will face more uncertainty. (ID: 21, Male, an Internal Specialist)

One gynecologist explained:

"There are some new cases. For example, we did not have EP Scars until years ago. For several years now, the EP scars have been created because cesarean sections have become common. That is, there are a series of things that have become more common in our work. Not only in our country, but all over the world, with the prevalence of cesarean section, a series of events are happening." (ID: 2, Female)

Another determinant of variation is resource inadequacy and ambiguity. In some cases, different diagnoses and reports are seen in studies, and there are few solid recommendations in the guidelines. In addition, there are cases of ambiguity and blind spots in medicine that remain unresolved. Given that referring to the sources and references in cases of uncertainty, is one of the solutions that the doctor seeks help, the existence of defects and ambiguity in the sources will increase the

uncertainty of physicians in their decisions. One of the internal specialist stated:

In cases with no solid evidence according to the guidelines for doing or not doing treatment for that disease, the uncertainty in our decision exacerbates. (ID: 21, Male)

Confirming the importance of this subcategory, another doctor said:

In cases with paraclinical similarities, despite referring to the references, we can't have a good conclusion, for example, about abdomen's problems. It only works well in children, but in adults it gives you two different diagnoses from this reference to that reference". (ID: 24, Male, an Internal Specialist)

Another subcategory is the relativity of medical science. This item was repeatedly mentioned by the interviewees. The fact that there is no one-hundred-percent diagnosis in medicine points to the absolute impossibility of medical science, which can be one of the main causes of uncertainty in the doctor's decision. In affirming relativity as a feature of medical science, a doctor says:

In medicine, nothing is one hundred percent sure. There is this principle for everyone". (ID: 11, Female, a gynecologist)

Another gynecologist said:

Not everything is sure. For example, we had a case. Some time ago, the child had a tachycardia. NST again had tachycardia and sinus rhythm. Perinatal counseling Perrynatal told us to take a decolonization test, but all the tests were normal, it was still a baby with tachycardia and sinus rhythm. Completely with Apgar 7, and did not intubate at all, but checking that his hemoglobin was five or six, the child had a blood problem at all. Basically, the problem of uterus, placenta or, for example, the problem of women who are deficient because of these side things that may be present in the child itself, creates this uncertainty for us.

Complexity

Complexity also plays an important role in the category of medical science dynamics. The dimensions of this subcategory are: 1) concurrent diseases and complications, 2) the wide range of diseases in the clinical field and 3) unpredictability.

One of the items that explains the category of complexity is coexisting diseases. When a patient has two or more diseases at the same time, or clinical signs indicate involvement of several organs at the same time, it becomes difficult not only to diagnose and choose the appropriate diagnostic method, but also to decide on

treatment measures. In such cases, the doctor will face uncertainty. A doctor declared:

We have trouble with patients who have multiple organ involvement simultaneously. Because, performing each diagnostic and therapeutic measures may harm another organ. For example, I would like to serve you. For example, there is a patient who has been hospitalized with hypertensive pulmonary disease and has a history of COPD. We can't do CT angiography because it damages his kidney, on the one hand, to continue the patient's treatment to document whether the patient has a pulmonary embolism or we need to use a diagnostic modality; Well, our diagnostic modalities are limited, or in fact, perfusion scan or CT angiography, for example, because of a complication, we can't use X-ray or perfusion scan, and this is a clear example of a disease that we encounter in the field of practice. A very ordinary patient may be much more complicated than me. (ID: 1, Female, an Internal Specialist)

Another subcategory that refers to the category of complexity is the breadth of diseases and disciplines. The wide range of diseases and symptoms, as well as the breadth of different fields of specialization and subspecialty in the clinical field intensify the complexity of medical science. This in turn can lead to increased uncertainty in the physician's clinical decision. A physician stated:

Although we suffer from uncertainty, there is much more uncertainty inside its different branches. It has seven sub-branches. In the fields of surgery and gynecology, he finally makes a surgical decision, or if he does not, he will refresh it internally. My children have an almost definite range, but internally there is a very wide range of progress. Both the age of the patient and different organs. (ID: 11, Female, a Gynecologist)

To all these cases, unpredictability must be added. The concept of unpredictability encompasses a range of issues in medicine, including the unpredictable side effects of the treatment of choice, the patient's condition, and the progression of a disease. These lead to the complexity of the decision and consequently to its uncertainty. A gynecologist in the study said:

Our cases are unpredictable because we are on the side of both the mother and the child. And my emergency conditions are high and it is not at all predictable that, for example, a mother comes in very good conditions. Either everything is going well or there is an umbilical cord that drops the baby's heart or there is a decolon that drops the baby's heart. Or there are conditions that we do not know at all what happens in the process of childbirth. (ID: 12, Female)

Sometimes this uncertainty is due to the patient's condition and the progression of the disease is unpredictable. One physician said:

Once the patient finds an acute condition that was unpredictable before that, both the patient and the doctor have problems. (ID: 2, Female, a Gynecologist)

Instrumental constraint

Diagnostic and instrumental constraint and limitation is another theme in explaining uncertainty in clinical decision-making. This could be explained in two categories, which include a) a lack of efficient diagnostic methods and b) unknown etiology.

Lack of effective diagnostic methods

The theme of lack of efficient diagnostic tests includes two main categories: 1) weakness of diagnostic tests and 2) paraclinical limitations.

Low accuracy of measuring instruments, limited diagnostic modalities, low specificity of tests, and the effect of physiological changes on the results of diagnostic tests are among the problems that indicate the weakness of diagnostic tests and lead to uncertainty in clinical decisions. A doctor in the study explained:

We have restrictions on the use of tests. Sometimes the patient has a problem that we can not use all the diagnostic tests and we have limitations in using the test. On the other hand, not all tests give us the result we are looking for. That is, we have uncertainty about what to do with this patient. (ID: 1, an Internal Specialist)

Another doctor confirmed the lack of specific diagnostic tests and declared:

Some diseases don't have diagnostic tests such as syndromes related to rheumatic diseases. There are a series of symptoms that are put together. Criteria are put together. A series of non-specific and sometimes specific laboratory diagnostic findings are put together. A diagnosis is finally made. This diagnosis could also be possible. Given that definitive diagnosis is possible mainly with pathology specimens and in most cases either the disease isn't so serious as to cause sampling inconvenience, or the conditions for having a pathology specimen aren't provided, or perhaps in some cases the pathology is nonspecific and can't make a definitive diagnosis. Inevitably, based on the evidence, we've a possible diagnosis, based on which we treat, and this lack of specific tests makes us uncertain. (ID: 23, Male, an Internal Specialist)

In addition to the weakness of diagnostic tests, paraclinical limitations also explains the lack of effective diagnostic tests as a tool constraint. These include

paraclinical limitations, system problems and late response to imaging, limited access to some emergency images, unavailability of daily diagnostic tests such as radiology, and inactivity on holidays, poor accuracy of some diagnostic tools, including CT scans, and the similarity of the paraclinical results of several diseases. A doctor stated:

Many times you have tests that due to the situation in the system, the answer is too late or you have a certain limit for a series of emergency imaging and well, this affects the patient's diagnosis. (ID: 3, a Pediatrician)

A surgeon said:

When we use graphs and CT scans, we do not talk about soft tissue damage, and what we say can be based on our first speculation and previous experience that this type of fracture is associated with some amount of soft tissue damage. But this is not certain. But when we use more accurate MRI tools, then we can talk about it much more definitively. The criteria of certainty and uncertainty that deal with anatomy depend on the tool they use. In the medical field, this uncertainty is much greater because what we are dealing with is laboratory changes due to physiological changes that make it a little harder. And until the last moment we have some uncertainty in our diagnosis. (ID: 20, Male)

The category of unknown etiology also plays a prominent role in instrumental constraint. Dimensions of this category include: 1) similarity of clinical manifestations, 2) a lack of clinical evidence, 3) individual differences in the occurrence of clinical signs and 4) the presence of latent symptoms.

The similarity of clinical signs in several diseases is one of the factors that explains the category of unknown etiology. The overlapping of clinical signs and symptoms of some diseases and cross-reactions of diagnostic tests leaves the origin of the disease unclear, which leads to uncertainty. A doctor explained:

There is a differential diagnosis that may be present in a disease, and some diseases manifest themselves with similar clinical symptoms in the laboratory. Their tests may have a cross-reactivity with each other. It may be positive. (ID: 22, Male, an Internal Specialist)

Another subcategory that explains unknown etiology is clinical evidence deficiency. Insufficient symptoms, lack of evidence of paraclinical information, lack of solid evidence for performing or not performing specific treatments, are all cases that indicate the lack of clinical evidence and create uncertainty in the doctor's decision. In this regard, a surgeon said:

Cases with less common symptoms or no visible result through paraclinical information, make us more uncertain. To reduce it, we postpone treatment until after consulting with colleagues and Comment on them. (ID: 6, Male, a Surgeon)

Individual differences in clinical signs is another determinant of unknown etiology. The presence of different clinical signs from person to person, especially in new diseases such as coronaviruses and physician exposure to a wide range of different symptoms, makes the physician uncertain in his decision. One of the physicians said:

Especially in this situation where a new disease called corona has come with different clinical presentation, I can never say with strength whether it is a disease or not. Virtually every person develops certain symptoms that may be different from the other person, which in turn confronts us with uncertainty. (ID: 17, Male, a Pediatric Subspecialist)

The presence of latent symptoms is another determinant of the category of unknown etiology. The fact that all the symptoms are not considered during the first visit and the onset of symptoms of some diseases is time consuming and will increase uncertainty in the doctor's decision. An internal specialist stated:

A very general discussion about diagnosing diseases is that you do not see all the symptoms at the first visit. The term proderma is coming up. Suppose schizophrenia proderma can take months to years, and this in itself gives rise to initial uncertainty in diagnosis. And again, during the prodermal period, there is a lot of coherence in the different diagnoses that similar prodermals have". (ID: 24, Male, an Internal Specialist)

Discussion

This qualitative study aimed to understand determinants of uncertainty in clinical decision-making from the perspective of clinical physicians working at hospitals affiliated to Iran University of Medical Sciences in Tehran city, Iran. According to the participants' views, determinants of uncertainty in clinical decision-making included individual determinants, dynamics of medical sciences, and diagnostic and instrumental constraint.

Individual determinants

Individual determinants of uncertainty in clinical decision-making can be from a doctor or a patient. Previous findings also confirm the fact that both physicians and patients face uncertainty.^[6] Among the individual determinants associated with physicians, we can point to 1) physician-related history writing

problems, 2) poor information, 3) over-diagnosis, 4) lack of self-confidence, 5) lack of comprehensive vision, and 6) conflicting diagnostic views.

One of the causes of a physician's history writing problems is not only poor physician information, but also the physician's inability to communicate with the patient.^[13] Although patient–doctor interaction has changed in the past century and has focused on patient-centered care and shared decision-making,^[16] poor communication of physicians is still a problem. Ray and Lu also point to personal insecurity due to a lack of communication with the patient and a lack of knowledge related to patient care.^[17]

Weak information of the physician, which is in the category of individual determinants of uncertainty related to the physician, can be due to insufficient literacy, lack of up-to-date information, and lack of physician experience in explaining uncertainty. In line with the findings of this study, previous studies also show that medical students and less experienced physicians are more likely to encounter doubts, questions and uncertainties in decision-making.^[18] One reason for this is the greater stress of inexperienced physicians in the face of uncertainty, which reduces their ability to manage stress.^[1] The findings also indicate that physicians experience uncertainty in situations where they have insufficient knowledge and do not know exactly what the symptoms are or what the desired treatment is, based on previous evidence and experience.^[5] Therefore, clinical uncertainty in the field of medicine is due to the lack of sufficient knowledge of physicians regarding issues causing the disease and as a result, decisions are made without full knowledge of the patient's file.^[13]

The physician's low self-esteem is another individual trait in explaining individual determinants of physician uncertainty. The low self-esteem factor in previous studies is mostly attributed to female physicians. In other words, wherever a gynecologist admits that he or she is unsure about the diagnosis, this is attributed to the low self-esteem of gynecologists and their unsuitability for the job.^[9] As low self-esteem might lead to patient dissatisfaction, it should be managed.^[9]

Over-diagnosis was another individual cause associated with the physician. In fact, in some cases, the doctor's diagnosis is too much and therefore, he focuses on irrelevant symptoms that are not related to the patient's main problem. Previous studies have also shown that stress and anxiety of the clinical staff is exacerbated during a clinical encounter in conditions such as cognitive overload, and leads to over-diagnosis which is associated with greater uncertainty.^[19,20] In addition to the above, the lack of a comprehensive view by the physician

was another individual determinant of uncertainty which could be due to the mentioned determinants. Therefore, having a comprehensive view by physicians to reduce uncertainty in clinical decisions is important.

Individual determinants of uncertainty can also be related to the patient, which can play an important role in the uncertainty of physicians due to factors such as problems of patient expression, and socio-economic barriers of the patient.

Although problems with patient history can occur at any age, it is more common in children, illiterate, and elderly people, especially those with problems such as forgetfulness. Previous studies also show that in an environment where patients cannot express their current illness, the treatment team are not able to make decisive decisions to diagnose and provide the best possible treatment to the patient.^[21] In accordance with the findings, previous studies also show that it is difficult to obtain a history of children and understand what their main problem is, and also it seems difficult for them to talk about their illness which can cause several problems in diagnosis.^[22,23] An incomplete history is also inevitable for elderly patients in some cases, and the uncertainty and decision-making regarding the best way to diagnose and treat the elderly patient is much greater, especially for those with complex medical conditions.^[24]

The patient's poor socio-economic status is another individual trait that leads to uncertainty in the physician's decision. For those people who are not in a favorable financial situation and cannot use the method of diagnosis or treatment of more effective but more expensive treatment, the available options to the doctor will be limited. Therefore, the physician may face doubts and uncertainties regarding the chosen method. As Leech *et al.*^[25] noted, despite the availability of an affordable method for cancer patients compared to another method, this method is beyond the reach of many people and is unaffordable. Socio-cultural barriers of the patient is another individual determinant of uncertainty in a physician's decision. In a way, some companions ask the doctor to explain the diagnosis in detail, and this sometimes causes the doctor limitations that can even lead to the adoption of another treatment and diagnostic method by the physician.

Dynamics of medical sciences

Findings in our study showed that the variability of medical sciences due to the emergence of new diseases, along with some other factors like the both shortcomings and ambiguity of sources could be considered as another determinant of uncertainty in clinical medicine. The unpredictability of some cases, the wide range of clinical diseases, and the presence of concomitant diseases and

complications also indicate the complexity of clinical medicine and lead to uncertainty in physician decisions.

In this regard, previous findings in justifying the uncertainty have pointed to the complexity and ambiguity of medical science and the rapid development of new methods of diagnosis and treatment, which lead to the multiplicity of available diagnostic and treatment options. In addition, they point to the patient's unpredictable response to treatment.^[6] Moreover, the diversity of sources and the existence of different evidences of the disease in different sources contribute to this uncertainty.^[26] The wide range of information and medical knowledge, as well as its dynamics, makes it impossible to master medical science. This issue is often observed especially among medical students; therefore, the major problems that medical students and learners face are related to how to manage their limitations and cognitive capabilities in organizing a large part of medical resources and texts.^[1] Also, medical residents experienced a higher level of anxiety due to less tolerance to uncertainty and also less ability to use the knowledge contained in the texts, and inability to communicate between them with clinical situations and psychological dimensions of patient care.^[10,27]

Similarly, Tirota and Durante pointed to the extensive literatures as a cause of diagnostic uncertainty.^[28] Therefore, the need for reliable studies, and accurate and calculated information is essential to increase medical knowledge and improve the provision of health services. However, there are limitations to the information available in terms of quality, reliability, and usability that lead to uncertainty. In addition, in the rich volume of information collected, a degree of uncertainty is inevitable at the point of clinical decision-making because the nature of medicine is associated with the diversity of patients and their clinical symptoms.^[13,17]

The development of new methods also exacerbates the complexity of clinical decision-making. Modern medicine has developed an unlimited range of diagnostic and therapeutic tools which are expanding rapidly. However, these developments make it difficult and questionable to decide on the optimal treatment strategy for physicians due to the multiplicity of treatment options.^[6] New diagnostic methods, at least as long as there is no mastery of the methods, can themselves be a factor of uncertainty. All these cases are evidence of the dynamics of medical science and consequently, the inherent relativity of medical science, which has been repeatedly mentioned in various sources.^[16,17]

Diagnostic and instrumental constraint

Instrumental limitations in medical science were another determinant of uncertainty in clinical decision-making. These limitations include the lack of efficient diagnostic

tests and an unclear etiology. In other words, due to the lack of clinical evidence, the presence of hidden symptoms, the difference between individuals in clinical signs and the similarity of clinical manifestations in several diseases, the etiology becomes difficult and leads to uncertainty. Consistent with our findings, previous findings showed that the diversity of patients and their clinical manifestations, and the presence of unexplained symptoms lead to differences in disease and inability to make definitive diagnoses for patients, which in turn leads to uncertainty in medical science.^[17,26,29]

Limitations and strengths

To the best of our knowledge, this is the first qualitative study to examine the determinants of uncertainty among clinical physicians. Therefore, its results can be helpful in identifying these determinants and used to control and reduce uncertainty in clinical groups, and even for policy-makers and health planners to implement more efficient plans in the future. However, due to the nature of qualitative studies, our findings are applicable to implement interventional programs in Iran University of Medical Sciences, but cannot be generalized.

Conclusion

To curb uncertainty, individual determinants related to both physicians and patients, the dynamics of medical science, and diagnostic and instrumental constraints should be considered. However, the more accessible way is applying interventional programs with a focus on individual determinants. One of these can be strengthening doctor-patient relationships. Moreover, insufficient knowledge of the physician should also be reduced to a minimum by considering related mandatory retraining courses in order to share new experiences and findings. As low self-esteem might lead to patient dissatisfaction and indecisive decisions, such physicians should be identified through psychological tests, and courses should be considered to increase their self-confidence. These in turn lead to the comprehensive view of physicians which can also be influential in reducing uncertainty in their clinical decisions.

Availability of data and materials

Upon reasonable request and Iran University of Medical Sciences agreement, data will be available.

Ethics registration code

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Conflicts of interest

There are no conflicts of interest.

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