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## Research

## The Distraction Perceptions of Health Care Professionals in the Operating Room: The Disruptions in Surgery Index (DiSI)

Özlem Soyer Er, PhD, RN<sup>a,\*</sup>, Meryem Yavuz van Giersbergen PhD, RN<sup>b</sup><sup>a</sup> Afyonkarahisar Health Sciences University, Faculty of Health Sciences, Surgical Nursing Department, Afyonkarahisar, Turkey<sup>b</sup> Ege University, Faculty of Nursing, Surgical Nursing Department, Izmir, Turkey

## A B S T R A C T

## Keywords:

operating room  
distractions  
validity  
reliability  
Disruptions in Surgery Index

**Purpose:** The purpose of the study was to evaluate the psychometric properties of the Disruptions in Surgery Index (DiSI) in operating room health care professionals and to determine the frequency of distractions

**Design:** Methodological study.

**Methods:** The sample consisted of 152 health care professionals. Data were collected online using the DiSI scale. The language validity was ensured, and the data were analyzed with the content validity index, Cronbach  $\alpha$  coefficient, and item-total score correlation. Data on distractions of health care workers were given as percentages and averages.

**Findings:** The mean age of health care professionals was  $27.3 \pm 6.0$  years, and 77.0% of them were operating room nurses. The content validity index of the scale was found to be 0.95. The Cronbach  $\alpha$  coefficient of the scale was 0.953 for frequency, 0.967 for contribution to error, and 0.971 for obstruction of goals. The correlation between the item and the total item was positive and significant ( $p < .001$ ). Tiredness was determined as the most common distraction factor, causing errors and making it difficult to achieve goals.

**Conclusions:** The DiSI was found to be a valid and reliable tool. The most common distractions, contributing to errors and obstructing to goals, were related to individuals' skills, performance, and personality. Health care professionals perceived the distractions related to the surgical processes and the situations of the team members in the coordination and situational awareness subdimension as the least distracting factor.

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Distraction is defined as “attention being drawn or being directed to a different object or in different directions at the same time”<sup>1</sup> while attention deficit is defined as “any distracting or diverting event or stimulus that causes a distraction from achieving a goal”.<sup>2</sup> In general, distracting factors are events that potentially distract a person from the primary task, and interruptions occur when distractions are responded to, when they rapidly interrupt and distract one from the primary task.<sup>3</sup> Distraction is considered a threat to patient safety in the operating room (OR).<sup>1</sup> The OR is a setting where health care team members undertake difficult, high-risk procedures that call for situational awareness, focus, knowledge sharing, and communication among team members.<sup>4</sup> Distractions by any member of the surgical team can affect patient care.<sup>5</sup> Distractions in

the OR environment increase stress,<sup>6–12</sup> cause errors or omissions,<sup>13–15</sup> and may adversely affect the health and safety of patients and OR health care professionals.<sup>6,16</sup> Authority's Pennsylvania Patient Safety Reporting System reported that events threatening patient safety that occurred between 2010 and 2013 often occurred during the surgical procedure. Wrong side, site surgery, incorrect blood transfusion, reoperation, contamination, loss of sensation, and neurovascular changes have been reported to be associated with distraction in the OR.<sup>1</sup>

Distraction occurs frequently in ORs and is caused by both internal and external sources.<sup>1</sup> Distractions in the OR are equipment, pager or phone, radio, and case-unrelated communication.<sup>3,4,17</sup> Other distracting factors include personnel entering and exiting the OR, incorrect positioning and related mobility,<sup>3,17</sup> personnel change, waiting for the personnel, over sedation, delays due to pathology,<sup>17</sup> door movement, procedure,<sup>18</sup> messages on the OR door, and incorrect filling of the emergency preoperative checklist.<sup>9</sup> Noise is a distraction that interrupts patient care and potentially increases the risk of error. Ringtones and alarms from personal electronic devices add to the distractions. Human factors contribute to potential errors

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\* Address correspondence to: Özlem Soyer Er, Afyonkarahisar Sağlık Bilimleri Üniversitesi, Sağlık Bilimleri Fakültesi, Hemşirelik Bölümü, 03000 Afyonkarahisar, Turkey.

E-mail address: [ozlem.er@afsu.edu.tr](mailto:ozlem.er@afsu.edu.tr) (Ö. Soyer Er).

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that could compromise patient safety.<sup>5</sup> Factors affecting distractions can be examined as surgical methods, timing, capacity to manage, and expectations.<sup>18</sup>

The characteristics and frequency of distractions in the OR environment in Turkey have not been documented, according to literature scanning on the topic. Studies have emphasized that it is very important to recognize and reduce the risks of distractions in the OR.<sup>6,8,11,19-22</sup> The majority of research into OR distractions is based on observational studies.<sup>18,23-25</sup> The Disruptions in Surgery Index (DiSI) is a measure of the frequency and impact of disruptions experienced by OR staff during surgical procedures. This index assesses various types of disruptions, including equipment malfunctions, communication breakdowns, staffing issues, and unexpected events, among others. DiSI is a tool developed to determine the self-perceptions of OR health care professionals regarding distractions in the OR.<sup>26</sup> No measurement tool has been found in Turkey that assesses the perceptions of health care professionals regarding distractions that disrupt surgeries. The purpose of the study was to evaluate the psychometric properties of the DiSI in OR health care professionals and to determine the frequency of distractions.

## Methods

### Design and Participants

The research was a methodological study conducted for adapting the DiSI to Turkish. The sample of the study consisted of health care workers working in ORs between May 15 and August 31, 2021. DiSI, which was adapted into Turkish in the research, consists of 29 items. When conducting validity and reliability studies, 5 to 10 times the number of items should be sampled.<sup>27</sup> Based on this information, we planned to sample 145 health care professionals, five times the item number of 29, which is the number of the items in the DiSI from where the sample was formed. A total of 152 health care professionals over the age of 18, working in the OR and volunteering to participate were included. 67.1% of the participants were female, and 32.9% were male. 77.0% of the participants were nurses, 11.8% were surgeons, 6.0% were anesthesia technicians, 3.2% were OR technicians, and 2.0% were anesthesiologists. The majority (75%) of the participants were undergraduates; 58.6% of the participants worked in day and night shifts; 65.1% of the participants had been working for 0 to 5 years (Table 1).

### Data Collection

The data collection process of the research is presented in Figure 1. (1) Preparation was made in the language adaptation of the scale. At this stage, the languages in which the scale was adapted before were examined in the national and international literature. We found no adaptation study to the Turkish language. (2) The forward translation was done. The original language of the scale was translated from English to Turkish by two linguists. The linguists were informed about terminology. The researchers synthesized these translations. (3) The back translation was done. The synthesized Turkish translations into English were made by two linguists. These translations were synthesized by the researchers. The translation was evaluated by back-translating linguists and researchers, and (4) A committee review was requested. A committee evaluation form including both English and Turkish versions of the scale items was created. A committee of 10 experts in the field of surgery evaluated the scale title, evaluation criteria, subdimensions, and items in terms of language appropriateness. (5) Field testing was applied. Ten health care professionals working in the OR evaluated the scale in terms of language. (6) Field testing results were evaluated and the scale was finalized.

**Table 1**  
Sociodemographic and Professional Characteristics of the Participants (N = 152)

	n	%
Age (x ± SD) 27.3 ± 6.0		
Gender		
Female	102	67.1
Male	50	32.9
Profession		
Nurse	117	77.0
Surgeon	18	11.8
Anesthesia technician	9	6.0
Operating room technician	5	3.2
Anesthesiologist	3	2.0
Education		
High school	17	11.2
Associate degree	13	8.5
Undergraduate	114	75.0
Postgraduate	8	5.3
Shift time		
Day	63	41.4
Day and night	89	58.6
Working duration in the profession		
0-5 years	99	65.1
6-10 years	29	19.1
11-15 years	14	9.2
More than 15 years	10	6.6
Working duration in the operating room		
0-5 years	99	65.1
6-10 years	27	17.8
11-15 years	15	9.9
More than 15 years	11	7.2

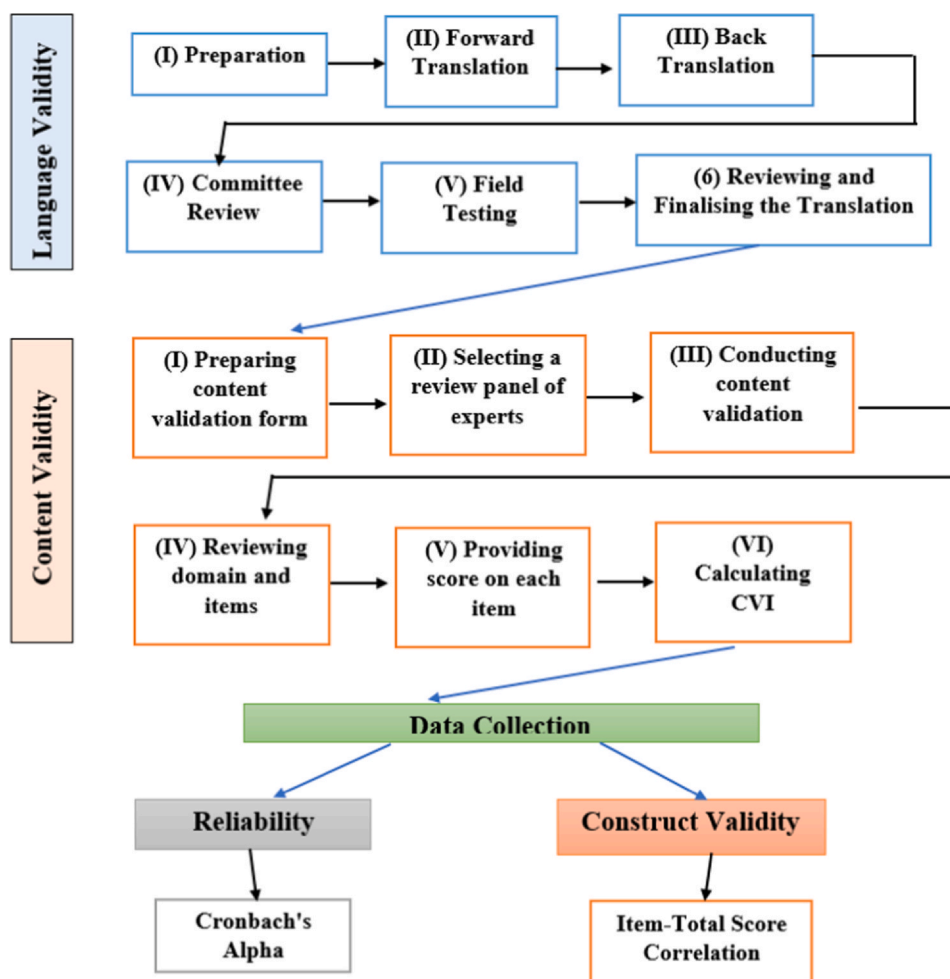
To evaluate the content validity, the following steps were taken: (1) Preparing content validation form: An expert evaluation form was created for the scale items determined after language validity. (2) Selecting a review panel of experts: 10 faculty members who are experts in the field of surgical nursing were selected for expert opinion. (3) Conducting content validation: The selected experts were informed about the form, and it was sent to them via personal e-mails. (4) Reviewing domain and items: Experts were asked to make a critical review of each item and state their recommendations. (5) Providing score on each item: Scores and recommendations from experts were combined into a single file. (6) Calculating content validity index (CVI): The CVI value of each item and scale was calculated by the researchers.

Data collection for construct validity and reliability analysis was done online due to the COVID-19 restrictions survey since some restrictions were being implemented in hospitals to prevent COVID transmission. The data were collected online from the online survey system at <http://www.survee.com/>. (1) A data collection form (<http://www.survee.com/SurveyStart.aspx?lang=1&surv=840fec3cfc44cf8a64295b9f75a7ea6>) was created. (2) A link containing the data collection form was sent to the participants selected from the researchers' personal WhatsApp, Instagram, Telegram, and Facebook accounts. (3) A reminder message was sent 2 weeks later.

### Data Collection Tools

Sociodemographic and Occupational Characteristics Form has nine questions regarding the sociodemographic and professional characteristics of the participants. The sociodemographic and occupational characteristics of the participants included their age, gender, educational status, marital status, occupation, working style, working time in the institution, and profession.

The Sociodemographic and Occupational Characteristics Form and the DiSI were used to collect the data.



**Figure 1.** Flowchart of Adaptation the Disruptions in Surgery Index (DiSI) Scale into Turkish. This figure is available in color online at [www.jopan.org](http://www.jopan.org).

The DiSI is a self-report questionnaire developed by Sevdalis et al<sup>26</sup> in 2008 to determine the perceptions of health care professionals working in the OR toward distractions that interrupt surgeries. The scale consists of six subdimensions as "Individuals' skills, performance, and personality", "OR environment", "Communication", "Coordination and situational awareness", "Patient-related disruptions", "Team and organizational disruptions", and has 29 items. Respondents are asked to give a percentage of incidence for each item and score from 1 to 10 (0 = none; 9 = excessive) as to its contribution to potential error and obstruction of goals.

#### Ethical Considerations

The approval of the Non-Clinical Interventional Research Ethics Committee of a university (dated April 16, 2021, and numbered 2021/295) was obtained. Before the application, the health care professionals were informed about the purpose of the study and how it would be conducted, and their written consent was obtained.

#### Data Analysis

Number and percentage were used in the analysis of the participant's gender, profession, education, shift time, work duration at the profession, and OR. Mean and standard deviation were used in the analysis of the participants' age.

Language, content, and construct validity were applied in the analysis of validity tests. Cronbach's alpha test was used for the reliability test. Understandability (readability) refers to the degree to which an item can be easily understood by most people. Language validity was carried out under an application guide developed by Hall et al.<sup>28</sup> (1) Preparation, (2, 3) Translation steps, (4) Committee Review, (5) Field testing, and (6) Reviewing and finalizing the translation processes were followed,<sup>28</sup> and its final shape was given by the researchers.

Content validity is important for health care professionals because they need to understand whether the measurement tools to be used in research are socioculturally appropriate for the participants and for the field in which they are conducted, or whether new regulations are needed. The CVI was calculated with the Davis technique in content validity. According to the Davis technique, experts are asked to rate each item in the scale separately using a rating scale. Experts are asked to evaluate each item as "4-Very appropriate, 3-Suitable, 2-Few changes are required (as I suggest), 1-A lot of changes are required (as I suggest)". After the evaluation, the CVI value of the items and the scale is calculated. Calculated CVI values are required to be greater than 0.80.<sup>29</sup>

Cronbach's alpha test was used to test the internal consistency of data collected online. All subdimensions in the three areas of the scale (frequency, contribution to error, obstruction of goals) and the total were calculated for the scale. Acceptable Cronbach's alpha value should be above 0.70.<sup>30</sup> The item-total score correlation was calculated for construct validity. An acceptable value for item-total correlation should be higher than 0.50.<sup>31</sup>

**Table 2**  
Reliability Analyses of Scale Subdimensions and Scale

Distraction Type	Item Focus		
	Frequency	Contribution to Error	Obstruction of Goals
	$\alpha$	$\alpha$	$\alpha$
A. Individuals' skill, performance, and personality	0.773	0.839	0.876
B. Operating room environment	0.820	0.887	0.907
C. Communication	0.324	0.605	0.692
D. Coordination and situational awareness	0.890	0.924	0.929
E. Patient-related disruptions	0.921	0.928	0.927
F. Team and organizational disruptions	0.876	0.908	0.912
Total scale	0.953	0.967	0.971

## Results

In terms of language validity, the items on the scale were translated from English to Turkish by two independent linguists. Again, two independent linguists translated the scale items from Turkish into English. The compatibility between them was determined by the researchers.

For content validity, expert opinion was obtained from 10 faculty members who are experts in the field of surgical nursing. After the expert opinions, the CVI of items 2, 3, 22, and 23 were below 0.8. The CVI of the items, which were reviewed in line with the recommendations of the experts, was between 0.8 and 1. The CVI of the scale was found to be 0.94.

Cronbach's alpha values for frequency, contribution to error, and obstruction of goals of the DiSI were given in Table 2. Cronbach's alpha values were found to be 0.953 for frequency, 0.967 for contribution to error, and 0.971 for obstruction of goals.

The item-total score correlation in the construct validity of the scale was presented in Table 3. Item-total score correlations were found to be between 0.530 and 0.811 for frequency, between 0.655 and 0.836 for contribution to error, and between 0.599 and 0.848 for obstruction of goals.

The incidence of distractions, their contribution to the error, and their perceptions of the obstruction of goals according to the health care professionals were given in Figure 2. The three most frequently perceived distractions were fatigue 63.6%, temperature 52.8%, and multi-tasking 52.0%. The highest average of the three distractions contributing to the error was 7.2 for fatigue, 6.6 for lapses in attention, and 6.1 for unavailable or not working equipment/multi-tasking. The highest average of the three distractions assumed to cause obstruction of goals was 6.9 for fatigue, 6.7 for lapses in attention, and 6.3 for unavailable or not working equipment (Figure 2).

## Discussion

Psychometric properties for DiSI were evaluated, and the frequency of distraction perception in the OR health care professionals was determined. After the analysis, it was determined to be a valid and reliable measurement tool for Turkish society. Developed in English in the United Kingdom in 2008, this measurement tool<sup>26</sup> was then adapted into Portuguese for Brazilian society.<sup>32</sup>

Language and content validity was carried out in the version adapted to Portuguese. Within the scope of content validity, expert opinion was taken, and 89.6% of the experts approved the content validity of the scale and found it to be superior to that recommended in the international literature (80%). In addition, the

average of general clarity and verbal comprehension by the participants reached  $4.48 \pm 0.16$  from a maximum value of 5.<sup>32</sup>

In the study in which the scale was developed, Cronbach's alpha values were evaluated in three different ways as frequency, contribution to error, and obstruction of goals. The Cronbach alpha values found were observed to be the highest in the Team Cohesion subdimension for frequency, in the OR environment subdimension for contributing to error, and in the individuals' skill, performance, and personality subdimension for obstruction of goals. In three different evaluations, the lowest Cronbach alpha values were found in the communication subdimension.<sup>26</sup> In their study examining the perceptions of distractions by cardiovascular surgery team members, Nina et al<sup>33</sup> conducted reliability analyses of the DiSI. Cronbach's  $\alpha$  values were above 0.83 for all subdimensions. However, in this study different Cronbach  $\alpha$  values were given, since frequency, contribution to error, and obstruction of goals were separate evaluations. In three different analyses of the frequency of distractions, contribution to error, and obstruction of goals, the Cronbach's  $\alpha$  value obtained for all items indicates the overall reliability of that questionnaire. The general acceptance is that this value should be 0.7 or greater. On the other hand, the low-calculated  $\alpha$  value may also be due to the small number of items in the scale.<sup>34</sup> Cronbach's alpha values obtained low in the communication subdimension are similar to the literature.<sup>33</sup> The low Cronbach  $\alpha$  value in the communication subdimension may be due to the fact that the number of questions in this subdimension was two. Other subdimensions were above the value of 0.70 and at the desired level as stated in the literature.

Health care professionals perceived the team and the organizational disruptions subdimension, which includes morale and feeling like part of the team, related to the functioning of the institution as the most frequent distractions. The individuals' skill, performance, and personality subdimension, which includes distractions related to their own state and emotions; the items in the subdimension of patient-related disruptions, such as lack of patient information and test results, were perceived as the least distracting.<sup>26</sup> The most distracting factors for health care professionals were coordination and situational awareness, and the least distracting ones were team-based.<sup>33</sup> Health care professionals stated that the most distracting factors were the distractions in the subdimension of individuals' skills, performance, and personality, and the least were the factors arising from coordination and situational awareness. There appears to be a difference in the frequency of distractions in all studies.

The contribution to error score was determined to be highest in the patient-related disruptions subdimension (in terms of one's self=4.77; in terms of others=4.62) and the lowest in the communication subdimension (in terms of one's self=2.41; in terms

**Table 3**  
Item-total Item Correlation for Construct Validity

Distraction Type		Item Focus		
		Frequency	Contribution to Error	Obstruction of Goals
		r	r	r
A. Individuals' skill, performance, and personality	Tiredness	0.574**	0.582**	0.599**
	Lapses in attention	0.614**	0.575**	0.649**
	Short-temperedness	0.585**	0.679**	0.734**
	Overconfidence	0.530**	0.584**	0.715**
	Lack of feedback on performance	0.593**	0.726**	0.779**
B. Operating room environment	Bleeps	0.614**	0.677**	0.732**
	External noise	0.711**	0.698**	0.727**
	Loud music	0.597**	0.705**	0.757**
	People walking in and out of the operating room	0.628**	0.673**	0.720**
	Temperature	0.584**	0.655**	0.704**
	Unavailable or not working equipment	0.635**	0.710**	0.692**
C. Communication	Irrelevant chatting	0.418**	0.599**	0.704**
	Language issues	0.643**	0.734**	0.682**
D. Coordination and situational awareness	Late changes to the operating list	0.705**	0.776**	0.766**
	Management of the next case(s)	0.705**	0.789**	0.817**
	Team members being late	0.708**	0.754**	0.813**
	Team members being absent during the procedure	0.763**	0.801**	0.839**
	Lack of awareness of team process(es)	0.811**	0.836**	0.848**
	Multi-tasking	0.719**	0.789**	0.772**
E. Patient-related disruptions	Lack of necessary patient information	0.720**	0.762**	0.774**
	Inaccurate patient information	0.656**	0.729**	0.712**
	Unavailable preoperative notes	0.728**	0.759**	0.719**
	Unavailable test results	0.725**	0.772**	0.759**
F. Team and organizational disruptions	Not feeling part of the team	0.699**	0.786**	0.767**
	Low morale	0.715**	0.732**	0.720**
	Teaching	0.678**	0.733**	0.777**
	Time pressure	0.629**	0.777**	0.767**
	Hospital rationing policies	0.712**	0.743**	0.734**
	Unrealistic operating lists	0.642**	0.721**	0.725**

\*\*Correlation is significant at the 0.01 level (2-tailed).

of others=2.69). In the obstruction of goals, the error score was the most for the patient-related disruptions subdimension (in terms of one's self=4.30; in terms of others=4.05), the least for the communication subdimension (in terms of one's self = 2.51; in terms of others=2.75). Although the health care professionals' self-perceptions and perceptions of distractions for others are similar in contribution to error and obstruction of goals, the average score for others was high.<sup>26</sup> Nina et al<sup>33</sup> used the DiSI to assess participants' perceptions of their own distractions as well as their perceptions of the health care professionals with whom they work. In the area of contributing to error and obstruction of goals, the mean scores of participants' perceptions of distractions toward themselves were higher than the mean scores of perceptions of other health care professionals. Participants were more positive toward themselves and tended to blame their coworkers. These results show that participants think that other health care professionals are more influential than themselves in the contribution of distractions to the inhibition of goals and errors.<sup>33</sup> However, in this study, in which only the participants' own perceptions were evaluated, the contribution to error scores of distractions was found to be higher than the areas of obstruction of goals. The fact that the participants stated the items in the subdimension of individuals' skills, performance, and personality as the most distracting factors and that these scores were high showed that they clearly made their self-evaluations and expressed their deficiencies. In this sense, self-awareness suggests that self-control can be achieved and used effectively in interventions to prevent distractions. In addition, distractions that are low in coordination and situational awareness may suggest the existence of a good organizational structure in the OR. However, to obtain clear

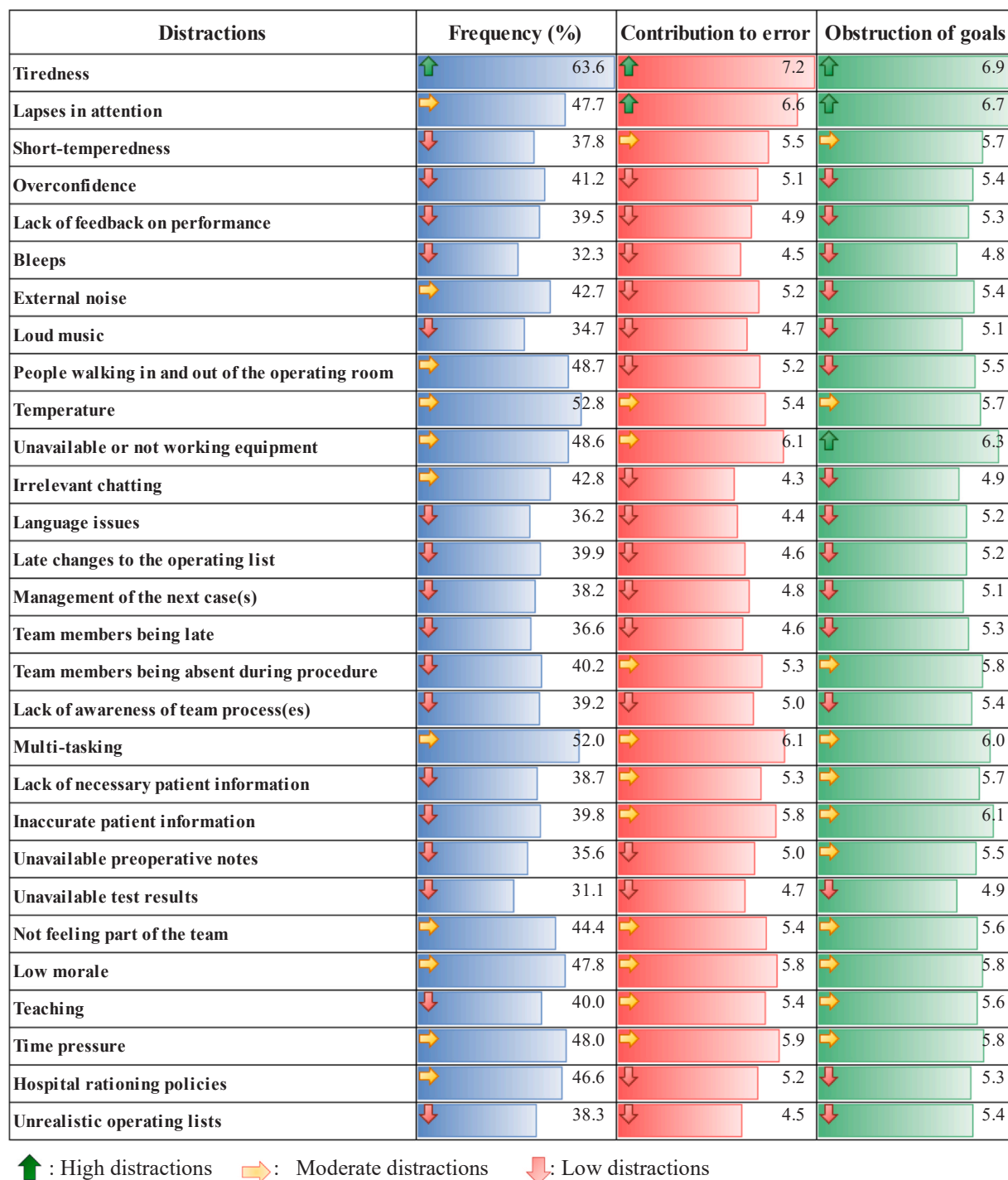
results, perceptions of distractions about other health care professionals should also be measured in studies to be conducted in Turkey.

According to health care professionals, people outside the team were the most distracting. The lack of coordination between hospital units was stated to be the most disturbing problem.<sup>19</sup> Noise, especially the one caused by music, is known to worsen performance.<sup>35</sup> Loud music was perceived by health care professionals as a low distraction factor. Perception is strongly governed by internal processes and situations that select and organize sensory input as well as external stimuli for goal-directed behavior to occur.<sup>36</sup> Different perceptions of distractions by health care professionals may be due to the difference between their knowledge and awareness.

#### Limitations

The research results include health care professionals' perceptions of distractions. This study's findings are not generalizable to a broader population. There may be personal differences regarding perceived distractions. The health care professionals' recall times can also create bias in the study. Health care professionals' most recent experience with distractions can affect the frequency of distractions. It may also be imaginary to rate distractions on a scale of 0 to 9 if there was no error and no impact on the results.

In addition, since the study was conducted during the COVID-19 period, conducting the online surveys limits the accuracy of the participants. We attempted to prevent this situation with IP address verification.



**Figure 2.** Perceptions of Health Care Professionals on Distractions. This figure is available in color online at [www.joan.org](http://www.joan.org).

## Conclusion

By using the DiSI, researchers can gain a better understanding of the challenges faced by OR health care professionals and the impact that these disruptions have on patient outcomes, staff satisfaction, and other important measures. This information can then be used to develop interventions and strategies to reduce the frequency and impact of these disruptions, ultimately improving the quality of care provided in the OR.

Overall, the DiSI provides a valuable tool for assessing the disruptions experienced by OR health care professionals and can help to inform efforts to improve the safety and efficiency of surgical procedures.

The Turkish version of the DiSI was found to be a valid and reliable tool for Turkish society in determining the distraction perceptions of health care professionals. The adapted index consists of 29 items and three sections evaluating distractions, the contribution of distractions to error, and distractions that obstruct of goals. Validity was ensured by language validity, content validity, and construct validity.

There are similar problems in terms of distractions in the ORs of different countries or cultures. Identifying these problems and conducting root cause analyses for problems, implementing improvement initiatives, and publishing the results will improve patient safety goals. It is also recommended to use prospective descriptive studies to determine the perceptions of distractions of healthcare professionals working in ORs, to test the difference between occupational groups and distractions, and to work with larger groups.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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