

Occupational stress (KOSS®19): scale development and validation in the Korean context

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ABSTRACT

Background: The Korean Occupational Stress Scale (KOSS) was developed in 2004. During this time, industrial structures have evolved, and societal awareness of occupational stress has changed. This study aims to develop and validate a revised version of the Korean Occupational Stress Scale (KOSS®19), tailored for workers, reflecting these changes.

Methods: The KOSS®19 was developed based on the 26-item KOSS–short form (SF) through a review by eight experts. A survey was conducted including 359 service industry workers, comprising the KOSS®19, Burnout, and Depression scales. The KOSS®19 subscales were restructured, and their reliability and validity were evaluated.

Results: The KOSS®19 composed of eight subscales: hazardous physical environment (2 items), high job demand (3 items), insufficient job control (2 items), low social support (2 items), job insecurity (2 items), organizational injustice (4 items), lack of reward (2 items), and work-life imbalance (2 items). The reliability and validity of the KOSS®19 were found to be satisfactory.

Conclusions: The KOSS®19 is a suitable tool for assessing occupational stress, effectively replacing the original KOSS and KOSS-SF.

Keywords: Occupational stress; Surveys and questionnaires; Burnout; Depression; Validity; Reliability

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BACKGROUND

Approximately 970 million individuals globally were living with mental disorders as of 2019, making these disorders the seventh leading cause of disability-adjusted life years. Mental health disparities are significant across regions, sexes, and age groups.¹ In South Korea, the 2021 National Mental Health Survey reported a lifetime prevalence of mental disorders at 27.8%, yet the treatment rate for depression and anxiety disorders remained alarmingly low at 9.1%.²

This study focused on workplace mental health, as approximately 15% of working-age adults experience mental disorders at some point, representing a substantial proportion of the population. Mental health issues often hinder workforce participation and lead to exclusion from employment.³ In South Korea, approximately 21% of workers are exposed to high levels of occupational stress, which contributes to 13.6% of major depressive disorders, 4% of suicides, and 6.7% and 6.9% of ischemic heart disease and stroke, respectively.⁴ Occupational stress adversely affects workers' health and organization's productivity.⁵ The connection between occupational stress and productivity loss aligns with studies demonstrating its association with presenteeism, a critical indicator of pre-emptive productivity decline.⁶

A clustering analysis of workplace suicide cases reported under Korea's industrial accident insurance identified five categories that link occupational stress to the most severe mental health outcomes: suicide, responsibility burden, role transition, hazard exposure, job insecurity, and workplace violence.⁷ To address health problems caused by occupational stress, it is essential to use reliable and valid measurement tools. However, occupational stress is a complex and multi-dimensional concept influenced by factors such as era, nation, culture, age, sex, and occupation. These variations make it challenging to develop standardized tools comparable across contexts.

Internationally, several tools have been adopted to measure occupational stress, including Japan's Brief Job Stress Questionnaire,⁸ the United States' Quality of Work Life Questionnaire,^{9,10} the United Kingdom's Work-Related Quality of Life Scale,¹¹ and the Copenhagen Psychosocial Questionnaire, which is widely used

across Europe, although it was initially developed in Denmark.¹²

In South Korea, the Korean Occupational Stress Scale (KOSS), developed by Chang et al. in 2005,¹³ has been widely used as a standardized tool. According to Crossref, this article has been cited 344 times, reflecting the high level of interest in occupational stress research. However, nearly two decades have passed since the development of this tool. During this time, industrial structures have evolved, and factors such as emotional labor and high-intensity work associated with platform-mediated employment have emerged as significant social challenges.^{14,15}

The concept of lifelong employment as a means of self-realization and job engagement has diminished, and workplace cultures have shifted from competitive, performance-driven environments to those emphasizing fair evaluation, particularly with the emergence of younger generations in the workforce.^{16,17} Additionally, societal and cultural trends focusing on work-life balance have gained prominence as strategies to address occupational stress.¹⁸

This study aimed to revise existing occupational stress measurement tools to reflect these societal changes. Over time, the authors gathered diverse feedback regarding improvements to KOSS. The revision seeks to enhance usability by reducing the number of items and redefining concepts in areas such as workplace culture, organizational injustice, insufficient rewards. The study aims to account for factors that have changed significantly over the years.

METHODS

Procedure

This study is part of a project titled "Improvement and Utilization of Stress Evaluation Tools for Emotional Labor Workers," commissioned by the Korea Occupational Safety and Health Agency. The purpose of this research was to develop a revised version of the Korean Occupational Stress Scale (KOSS®19) that could be universally applied to service workers. The initial versions of KOSS-43 and KOSS-short form (SF) were developed through focus group interview and in-depth interviews targeting various occupations in the previous study.¹³ Starting

with the KOSS-SF consisting of 26 items, we organized expert meetings to draft an initial version and subsequently assess its reliability and validity.

To develop a draft of the revised KOSS, the authors refined and finalized the survey items through research team workshops, Delphi surveys, and advisory committee meetings. In the Delphi survey, experts evaluated whether to preserve, modify, or exclude each item. Positive responses regarding preserved or modified items were used to calculate the content validity ratio (CVR). Applying Lawshe's formula,¹⁹ we determined that a CVR of 0.75 or higher indicated a high level of consensus among experts. Through this process, we finalized a revised draft, officially designated as KOSS®19.

Statistical analysis

To validate KOSS®19, a survey targeting service workers was conducted ($n = 370$). The survey included demographic information (sex, age, and occupation), the KOSS®19, and measures for depression (Patient Health Questionnaire-9 [PHQ-9]),²⁰ and burnout (the emotional exhaustion subscale of the Maslach Burnout Inventory [MBI]).²¹ We selected service industry workers engaged in various levels of emotional labor across different sectors and administered face-to-face surveys to collect data for analysis.

We performed an exploratory factor analysis (EFA) to examine the factor structure of the survey items and determine whether the data aligned with the hypothesized factors. The number of factors was determined using eigenvalues of one or higher from the correlation matrix of the observed variables (survey items). Orthogonal rotation via Varimax was applied to calculate the factor loadings and assess whether each survey item aligned with its initially hypothesized factor.

To evaluate model fitness in the factor analysis, we calculated the Kaiser-Meyer-Olkin value, considering values above 0.90 as an excellent fit.²² We also performed Bartlett's test of sphericity, deeming a p -value greater than 0.05 as an indication of insufficient sample size relative to the number of items.²³

Criterion validity was assessed using depression and burnout as outcome variables, with eight subscales as independent variables. Pearson's correlation analysis was used to calculate correlation coefficients. Conver-

gent and discriminant validity were evaluated using a multitrait-multimethod matrix to derive correlation coefficients.²⁴

To assess internal consistency (reliability), Cronbach's alpha was calculated, with a value of 0.7 or higher considered indicative of high reliability among the measured items.²³ Data were analyzed using IBM SPSS Statistics version 23.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Proposed KOSS®19

The draft of KOSS®19, as determined through expert consensus, is shown in Table 1. For the "hazardous physical environment," two items were retained. For "high job demand," the items "time pressure" and "increased workload" were retained, while "sufficient rest" and "multi-tasking" were excluded. The reasons for exclusion are as follows: "insufficient rest" and "time pressure" were considered redundant, and "multi-tasking" was judged to be either an inherent characteristic of the job or a result of higher job positions.

In the "insufficient job control," "decision authority" and "workload and schedule control" were retained, while "requires creativity" and "skill discretion" were excluded. The reasons for exclusion are as follows: "creativity" was originally a question about authority in job control but was considered relevant only for certain jobs, with subjective interpretations of creativity varying greatly. "Skill discretion" was likely applicable only to professionals; therefore, it was excluded.

In the "low social support," "supervisor support," and "coworker support" were retained, while "empathic support" was excluded. This question was deemed useful only in stressful situations, and similar to "coworker support," it was considered lower priority. Although the CVR for "supervisor support" was 0.5, which did not meet the selection criteria—it was retained as a core element of support.

The "job insecurity" retained the two items, "job insecurity" and "expecting downsizing," without modification.

The "organizational injustice" was restructured as the "workplace culture" and "organizational structure" from the original KOSS. "Equitable human resource (HR) sys-

Table 1. Delphi survey results: selection and refinement of revised items in KOSS R-26

Subscale	Question	Delphi				Conclusions (#Order of selected questions)
		P	M	E	CVR	
EN	Dangerous work	6	2	0	1	#1
	Physical burden	6	1	1	0.75	#2
DE	Time pressure	8	0	0	1	#3
	Increased workload	6	1	1	0.75	#4
	Sufficient rest	1	0	7	−0.75	Exclude
	Multi-tasking	2	0	6	−0.5	Exclude
CO	Requires creativity	0	0	8	−1	Exclude
	Skill Discretion	2	1	5	−0.25	Exclude
	Decision authority	7	1	0	1	#5
	Workload and schedule control	7	0	1	0.75	#6
SU	Supervisor support	0	6	2	0.5	#7
	Coworker support	0	7	1	0.75	#8
	Empathetic support	3	0	5	−0.25	Exclude
SE	Job insecurity	8	0	0	1	#9
	Expected downsizing	7	0	1	0.75	#10
JU	Equitable human resource system	7	1	0	1	#11
	Adequate resources available	8	0	0	1	#12
	Interdepartmental cooperation	0	0	8	−1	Exclude
	Communication channels	8	0	0	1	#13
RE	Socioemotional reward	7	1	0	1	#15
	Driven by future prospects	0	0	8	−1	Exclude
	Opportunities for growth	2	1	5	−0.25	Exclude
CU	Uncomfortable team dinner	0	0	8	−1	Exclude
	Ambiguous job instructions	0	0	8	−1	Exclude
	Authoritarian workplace culture	0	1	7	−1	Exclude
RE	Financial rewards					#14
OC	Organizational overcommitment					#16
CU	Gender-based disadvantages	0	0	8	−1	Exclude
BA	Work-life imbalance					#17
	Life-enhancing work					#18
CL	Safety climate					#19

No. of panelists = 8, minimum value of construct validity ratio = 0.75.

KOSS: Korean Occupational Stress Scale; P: preserved; M: modified; E: excluded; CVR: construct validity ratio; EN: hazardous physical environment; DE: high job demand; CO: insufficient control; SU: low social support; SE: job insecurity; JU: organizational injustice; RE: lack of reward; CU: negative workplace culture; OC: overcommitment; BA: work-life imbalance; CL: unsafety climate.

tem,” “adequate resources available,” and “communication channels” were retained, while “interdepartmental cooperation” was excluded. The reason for exclusion was that, depending on the occupation and size of the company, some workplaces may not have interactions between departments, making the generalization of this item difficult.

In the “lack of rewards,” “socioemotional reward” was retained, while “driven by future prospects” and “opportunities for growth” were excluded. These two items were based on the assumptions of future opportunities

and growth and were considered difficult to generalize across occupations. Additionally, a new item was added to reflect “financial reward”—one of the key components of the effort-reward imbalance model.

The three culture-related items in the KOSS reflect South Korea’s unique workplace culture. Since the development of KOSS, the more universally accepted concept of organizational justice has absorbed these elements. Therefore, “uncomfortable team dinner,” “ambiguous job instructions,” “authoritarian workplace culture,” and “sex-based disadvantages” were excluded

from KOSS®19.

We reviewed the retention, revision, and deletion of existing items through the Delphi study. The introduction of new items was finalized during the researcher team meeting, after deriving the subscales and items through the literature review. The new items included in this revision are work-life balance, organizational overcommitment, and psychosocial safety climate. The two-items of work-life balance was constructed into new subscale of “work-life imbalance.” Additionally, organizational overcommitment was included as “high job demand,” and psychosocial safety culture was included as “organizational injustice,” respectively.

Validity

To confirm validity and reliability, a self-administered survey ($n = 359$) was performed. Regarding the sex distribution of the participants, 114 were male (31.8%) and 245 were female (68.2%). The average age of the respondents was 36.9 years. Regarding occupational status, the largest group consisted of healthcare workers (29.4%), followed by administrative/public service workers (20.9%), call center agents (20.6%), retail and food ser-

vice workers (10.3%), and police/firefighters (7.0%).

Factorial validity

EFA was conducted on the results of the survey administered using the draft version of KOSS®19. Five factors were identified based on eigenvalues >1 . The total variance explained by these five factors is 61.5%. After performing an orthogonal rotation to distinguish the factors, item 19 (safety climate) was grouped with justice, reward, and balance, while the single item for organizational overcommitment was grouped with working conditions and demand (Table 2). The remaining items were grouped according to the initial hypotheses. The authors discussed these results and finalized the KOSS®19 as described below.

Factor 1 included eight items (11–19) that were grouped together under the same component. However, the originally proposed domains were maintained, and the items were re-categorized as “organizational injustice” (items 11, 12, 13, and 19), “lack of reward” (items 14 and 15), and “work-life imbalance” (items 17 and 18). Factor 2 included items 1, 2, 3, and 4, as well as the newly proposed item 16 (organizational overcommitment). The

Table 2. Rotated component matrix

Order	Items	Component				
		1	2	3	4	5
18	Life-enhancing work	0.767	0.103	−0.068	0.049	0.017
19	Safety climate	0.706	0.192	0.191	0.055	0.110
14	Appropriate financial rewards	0.703	0.209	−0.032	−0.099	0.081
15	Socioemotional reward	0.634	0.069	0.360	−0.001	0.242
12	Adequate resource available	0.626	0.316	0.258	0.106	0.046
17	Work-life imbalance	0.612	0.333	−0.043	0.218	0.065
11	Equitable human resource system	0.543	0.255	0.371	−0.120	0.120
13	Communication	0.464	0.108	0.454	0.147	0.392
3	Time pressure	0.187	0.841	0.034	0.083	0.063
4	Increased overload	0.249	0.778	0.033	0.063	−0.042
1	Dangerous work	0.216	0.642	−0.038	0.021	−0.042
2	Physical burden	0.180	0.633	−0.036	0.221	0.255
16	Organizational overcommitment	0.141	0.532	0.176	0.057	0.162
7	Supervisor support	0.071	0.138	0.811	−0.100	0.147
8	Coworker support	0.110	−0.131	0.758	0.163	−0.030
9	Job insecurity	0.109	0.091	0.025	0.876	0.037
10	Expecting downsizing	−0.051	0.290	0.049	0.809	0.035
5	Decision authority	0.090	−0.049	0.102	−0.031	0.833
6	Workload and schedule control	0.169	0.230	0.051	0.097	0.756

The bold font is the factor loading value of each item attributed to the subscales.

initial subdomains were preserved, with “hazardous physical environment” (items 1 and 2) retained, and item 16 (organizational overcommitment) included in the “high job demand” domain (items 3, 4, and 16). Factor 3 included “low social support” (items 7 and 8), and this grouping was maintained. Factor 4, grouped under “job insecurity” (items 9 and 10), was retained. Factor 5 was grouped under “insufficient control” (items 5 and 6), and this categorization remained unchanged. Ultimately, the 19 items in the KOSS®19 were re-categorized into eight subscales.

Criterion validity

A correlation analysis was conducted between the subscales of the final KOSS®19 and burnout and depression. The results showed significant positive correlations between burnout, depression, and all subscales, except for

“low social support.” Among the subscales, “low social support” had the weakest correlations, with burnout showing a statistically significant correlation and depression not showing a significant correlation (Table 3).

Discriminant validity

To evaluate the appropriateness of convergence and discriminant validity between the pre-conceptualized factors and the subscales in the final KOSS®19, a multi-trait-multimethod matrix analysis was conducted (Table 4). Convergent validity was established when the correlation between each item and its corresponding factor was at least 0.40, whereas discriminant validity was established when the correlation between each item and its corresponding factor was greater than the correlation between the item and the subscales to which it did not belong. The success rate of item discriminant validity

Table 3. Correlations between KOSS®19 subscales and burnout/depression

Subscale	Burnout		Depression	
	Correlation coefficient	p-value	Correlation coefficient	p-value
EN	0.434	<0.001	0.345	<0.001
DE	0.658	<0.001	0.437	<0.001
CO	0.278	<0.001	0.150	0.004
SU	0.077	<0.001	0.014	0.793
SE	0.264	<0.001	0.236	<0.001
JU	0.432	<0.001	0.358	<0.001
RE	0.341	<0.001	0.352	<0.001
BA	0.459	<0.001	0.462	<0.001

KOSS: Korean Occupational Stress Scale; EN: hazardous physical environment; DE: high job demand; CO: insufficient control; SU: low social support; SE: job insecurity; JU: organizational injustice; RE: lack of reward; BA: work-life imbalance.

Table 4. Multitrait-multimethod matrix for assessing item convergence and discrimination

Subscale	No. of items	Correlation coefficient interval		Scaling success, rate (%) ^a	
		Convergent validity ^b	Discriminant validity ^c	Convergent validity	Discriminant validity
EN	2	0.831–0.857	0.036–0.508	2/2 (100)	16/16 (100)
DE	3	0.743–0.865	0.068–0.586	3/3 (100)	24/24 (100)
CO	2	0.813–0.851	0.022–0.350	2/2 (100)	16/16 (100)
SU	2	0.810–0.891	0.009–0.366	2/2 (100)	16/16 (100)
SE	2	0.884–0.887	0.053–0.353	2/2 (100)	16/16 (100)
JU	4	0.751–0.805	0.062–0.558	4/4 (100)	32/32 (100)
RE	2	0.809–0.873	0.058–0.662	2/2 (100)	16/16 (100)
BA	2	0.881–0.882	0.104–0.500	2/2 (100)	16/16 (100)

KOSS: Korean Occupational Stress Scale; EN: hazardous physical environment; DE: high job demand; CO: insufficient control; SU: low social support; SE: job insecurity; JU: organizational injustice; RE: lack of reward; BA: work-life imbalance.

^aScaling success: No. of convergent correlations significantly higher than discriminant correlation/No. of correlations; ^bCorrelations with own scale;

^cCorrelations with other scales (range of correlations).

was calculated as the percentage of successful tests out of the total number. The results showed that convergent validity was strong for all eight subdomains, with correlation coefficients (r) above 0.7 and a scaling success rate of 100%. Furthermore, the success rate for discriminant validity was 100% for all the subscales (Table 5).

Reliability

The reliability analysis for the final KOSS®19 indicated satisfactory reliability, with Cronbach's alpha values ranging from 0.592 to 0.779 (Table 6).

DISCUSSION

In this study, a KOSS®19 questionnaire consisting of 19 items across eight subscales, was developed. The subscales include: "hazardous physical environment" (2 items), "high job demand" (3 items), "insufficient control" (2 items), "low social support" (2 items), "job insecurity" (2 items), "organizational injustice" (4 items), "lack of reward" (2 items), and "work-life imbalance" (2 items). The results of the reliability and validity assess-

ments of the service industry workers were satisfactory.

The EFA revealed five factors. Among the eight subscales, "insufficient control," "low social support," and "job insecurity" were clearly distinguished, while "organizational injustice," "lack of reward," and "work-life imbalance" were grouped into one subscale and "risky physical environment" and "high job demand" were grouped together. Possible explanations for this issue include items failing to differentiate between different concepts, when there are high correlations between concepts, when the sample size is small, or when the items lack commonality based on the latent variables that they aim to measure. According to the theoretically hypothesis-driven original KOSS study model, we divided it into six existing factors (hazardous physical environment, high job demand, insufficient control, low social support, job insecurity, lack of reward), one modified factor (organizational injustice), and one additional factor (work-life imbalance). Additionally, we performed confirmatory factor analysis (not shown in Table), and found that they are reclassified into eight subscales. In this study, since the factor loadings and

Table 5. Results of item-scaling tests ($n = 359$)

Subscale	Item	Item-scale correlation							
		EN	DE	CO	SU	SE	JU	RE	BA
EN	1	0.847	0.453	0.123	0.036	0.184	0.315	0.284	0.292
	2	0.831	0.508	0.253	0.058	0.330	0.330	0.282	0.368
DE	3	0.586	0.865	0.203	0.068	0.274	-0.401	0.278	0.428
	4	0.507	0.855	0.157	0.075	0.251	0.386	0.319	0.424
	5	0.297	0.742	0.210	0.104	0.298	0.365	0.297	0.244
CO	6	0.082	0.067	0.813	0.206	0.022	-0.234	0.206	0.108
	7	0.281	0.313	0.851	0.157	0.170	0.350	0.275	0.259
SU	8	0.097	0.154	0.225	0.891	0.020	0.366	0.248	0.148
	9	-0.017	0.009	0.127	0.810	0.104	0.265	0.149	0.137
SE	10	0.256	0.237	0.096	0.056	0.887	0.210	0.104	0.194
	11	0.279	0.353	0.103	0.063	0.884	0.144	0.053	0.152
JU	12	0.246	0.361	0.228	0.299	0.062	0.781	0.543	0.337
	13	0.404	0.405	0.205	0.258	0.218	0.805	0.519	0.492
	14	0.238	0.299	0.402	0.358	0.192	0.751	0.501	0.326
	15	0.304	0.393	0.270	0.263	0.146	0.774	0.558	0.526
RE	16	0.304	0.339	0.198	0.089	0.058	0.532	0.873	0.440
	17	0.255	0.271	0.303	0.337	0.097	0.622	0.809	0.418
BA	18	0.399	0.466	0.226	0.167	0.238	0.472	0.401	0.881
	19	0.295	0.327	0.164	0.133	0.104	0.468	0.500	0.882

The bold font is the correlation coefficient between the total of the subscales and each item.

EN: hazardous physical environment; DE: high job demand; CO: insufficient control; SU: low social support; SE: job insecurity; JU: organizational injustice; RE: lack of reward; BA: work-life imbalance.

Table 6. Final KOSS®19 questionnaire and reliability estimates (n = 359)

Initial no.	Final no.	Subscale	Question	Cronbach's alpha
1	1	EN	Dangerous work	0.568
2	2		Physical burden	
3	3	DE	Time pressure	0.757
4	4		Increased overload	
16	5	CO	Organizational overcommitment	0.559
5	6		Decision authority	
6	7		Workload and schedule control	
7	8	SU	Supervisor support	0.609
8	9		Coworker support	
9	10	SE	Job insecurity	0.727
10	11		Expecting downsizing	
11	12	JU	Equitable human resource system	0.779
12	13		Adequate resource available	
13	14		Communication channels	
19	15	RE	Safety climate	0.592
14	16		Appropriate financial rewards	
15	17		Socioemotional reward	
17	18	BA	Work-life imbalance	0.712
18	19		Life-enhancing work	

KOSS: Korean Occupational Stress Scale; EN: hazardous physical environment; DE: high job demand; CO: insufficient control; SU: low social support; SE: job insecurity; JU: organizational injustice; RE: lack of reward; BA: work-life imbalance.

discriminant validity were relatively good, the close correlation between factors may have caused this issue. The sample size in this study was insufficient to analyze by occupation, suggesting that a larger-scale study that includes various job types is necessary. The study was conducted only on service sector workers and on a specific dataset of 370 participants. Further research is needed in other datasets targeting various occupations to ensure the generalizability.

This study did not aim to choose the best theoretical model among many but rather focused on identifying how individuals exposed to occupational stressors can be categorized while maintaining existing theoretical models. This approach can be an effective way to measure actual occupational stress.^{25,26} From this perspective, the following observations were made for each of the subscales:

“Hazardous physical environment” reflects an overall subjective perception of the working environment. “Dangerous work” refers to the perceived risk of accidents, and “physical burden” addresses ergonomic risk factors in a single item. Recently, hazardous work environmental factors such as accident risks, extreme temperatures, smoke, and ergonomic risks in sectors such

as delivery services and logistics have become more prominent, increasing the importance of this item.²⁷⁻²⁹

“High job demand” is a classical and core factor of occupational stress. Elements of job demand, such as long working hours and overwork, are used as evidence for cardiovascular disease compensation. However, the effects of “high job demand” are moderated by control, support, and resources; therefore, it should be considered alongside other factors.³⁰ In this tool, the concepts reflected in job demand include time pressure, increased workload, and overcommitment. Time pressure is a key component of other occupational stress assessment tools. An increased workload reflects fluctuations in work volume caused by unexpected events or spontaneous organizational demands, such as those witnessed during the coronavirus disease 2019 pandemic.^{31,32} Overcommitment, which is either required or encouraged by the organization, is related to cultural traits in Korean companies, such as work centrality, collectivism, future orientation, and strong work ethics.³³

Reduced control increases tension when combined with increased job demand. In contrast, an increase in control reportedly improves employee’s mental health.^{34,35} Task authority and skill discretion are con-

sidered elements of control. Task authority refers to personal control over work methods and decision-making processes. Skill discretion refers to how individuals can utilize and control their skills or abilities. In KOSS®19, the item regarding skill discretion was excluded. Control over skill has largely shifted to capital, with labor dependent on platforms based on creativity and technical leadership.³⁶ Questions based on skill discretion are often replaced with issues of “status.” Thus, the final tool reflects control through items regarding decision-making authority and control over workload and schedules, which can be generalized to all workers and used to improve occupational stress.

“Low social support” refers to support from supervisors and coworkers, a core concept in Karasek and Theorell’s demand-control model.³⁷ The “buffer hypotheses” have shown consistent results in studies.²⁶ Supervisor support affects attitudes toward work, whereas coworker support reflects practical and immediate assistance, explaining the two aspects of support well.³⁸

“Job insecurity” refers to the degree of job or career stability, including concerns about job insecurity and employment instability.³⁹ Downsizing during economic recessions and restructuring due to pandemics have been reported to negatively affect workers’ mental health.⁴⁰ The items proposed in KOSS®19 reflect individuals’ concerns about unemployment or job deterioration prospects. According to existing studies, perceived job insecurity independently impacts health.⁴¹ The instability resulting from role restructuring due to workforce reduction or high turnover rates and the psychological response of survivors after layoffs narrates a similar issue.⁴²

In KOSS®19, “organizational injustice” is composed of four items and is proposed in three dimensions: distributive, procedural, and interactional justice.⁴³ Multiple discussions occurred regarding the redundancy between items in different domains. For example, distributive justice is addressed in an effort-reward imbalance model. “Organizational injustice” is related to supervisor and coworker support and organizational incivility.⁴⁴ However, procedural and interactional justice, as part of organizational justice, negatively affects mental health independently from other factors.⁴⁵ Therefore, to maintain the discriminant validity of the items, organi-

zational justice in KOSS®19 was constructed only with the procedural and interactional justice dimensions, excluding overlapping items related to supervisor and coworker support. In this survey, procedural rationality in organizational decision-making was reflected through an equitable HR system and communication channels, whereas interactional justice was reflected through adequate resources and a safety climate. Organizational injustice is not a subjective perception of individuals and is not directly related to supervisor support. This evaluation item reflects an overall organizational assessment and addresses a dimension distinct from other factors.

“Lack of reward” plays a central role in the effort-reward imbalance model. Rewards are divided into monetary compensation and non-monetary rewards, such as respect, opportunities for development, and job security.⁴⁶⁻⁴⁸ This survey evaluated both appropriate financial rewards and socioemotional rewards.

“Work-life imbalance” has become widely accepted in recent years. This concept reveals differences in perspectives between older generations and newer generations regarding the value of work.⁴⁹ Previously, work-family conflict focused on how excessive workloads affected the family life of married individuals.⁵⁰ As a result, work-life imbalance was used to reflect job demands. However, since interference with personal life is emphasized as a unique stressor when work-life imbalance is appropriately managed, work enhances life. Thus, the two items in the balance domain demonstrated appropriate internal consistency and discriminant validity.

When using KOSS®19, it is not recommended to use the total score by summing all items or calculating the overall mean score. The primary purpose of assessing occupational stress is to identify vulnerability factors. The use of summed or averaged scores may hinder the identification of these critical factors. Furthermore, the total score does not necessarily represent the overall quantity of stress.

This study had several limitations. First, the participants used to validate the reliability and validity of the tool were from various service industries. Therefore, the generalizability of these findings to primary industries or the manufacturing sectors cannot be confirmed. It is required to perform the further validation study tar-

getting various occupations. Second, since the validity assessment was conducted through a cross-sectional study, the generalizability of its findings is limited. While the latent period between exposure to occupational stress and its outcomes is not long, which makes it acceptable, further evaluation through a prospective study is necessary. Although the internal consistency was good, certain items had Cronbach's alpha values below 0.6, which were not satisfactory. Additional reviews of individual survey items, item responses, difficulty of answers, and the appropriateness of meaning delivery may be required. Despite these limitations, the strength of this tool lies in its ability to reflect the characteristics of Korean's organizational culture and the evolving perceptions of occupational stress in response to social changes. Additionally, this study provides reference values based on sex, making it practical for application in workplace stress management ([Supplementary Tables 1 and 2](#)). A Korean version of KOSS®19 was provided ([Supplementary Data 1](#)).

CONCLUSIONS

KOSS®19, an occupational stress assessment tool composed of 19 items across 8 subscales, demonstrated relatively good reliability and validity. This study focused on verifying existing theoretical models and considering the actual exposure to occupational stress, reviewing the redundancy between concepts, and constructing a questionnaire with mutually independent factors. Improving the items from the original KOSS, or short version, excluding unnecessary items, and adding new ones better reflects the occupational stress experienced by current service industry workers. Therefore, this tool can replace the existing full version or short-form of KOSS.

Further research is necessary to determine whether this tool can be appropriately applied across various industries. Assessing improvements before and after occupational stress interventions will be an important task for future research.

NOTES

Abbreviations

CVR: content validity ratio; EFA: exploratory factor anal-

ysis; HR: human resource; KOSS: Korean Occupational Stress Scale; MBI: Maslach Burnout Inventory; SF: short form; PHQ-9: Patient Health Questionnaire-9.

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Competing interests

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Author contributions

Conceptualization: Chang SJ. Data curation: Hyun DS, Jeung DY. Formal analysis: Kim HR, Kim I, Yoon JH. Investigation: Kim I, Koh SB. Methodology: OH SS, Kang HT. Validation: Song H, Suh C. Writing - original draft: Song H, Chang SJ. Writing - review & editing: Song H.

SUPPLEMENTARY MATERIAL

Supplementary Table 1. ROC analysis and cut-off value of subscales based on depression by sex.

Supplementary Table 2. Proposed reference value of subscales by sex.

Supplementary Data 1. KOSS®19 Korean version.

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