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Supportive Care Needs Survey: A reliability generalization meta-analysis

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Review Article

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Abstract

Objectives. The purpose of this study is to investigate the reliability generalization of 2 forms of the Supportive Care Needs Survey (SCNS), the questionnaires commonly used to assess the unmet needs of cancer patients.

Methods. Reviewed articles were retrieved through databases including PubMed, Ovid, Embase, CINAHL (Cumulative Index to Nursing and Allied Health Literature), Web of Science, Scopus, and ProQuest. The inclusion criteria were quantitative studies that assessed the unmet needs of cancer patients using the SCNS and presented reliability coefficients with sample size. Two independent reviewers examined the studies according to inclusion criteria and quality. The final studies included in the meta-analysis were determined by consensus. A random effects model was adopted for the analysis. To estimate reliability coefficients, the alpha coefficients for each study were transformed into the Z statistic for normalization and back to alpha. The values were weighted by the inverse of the studies' variance. The Higgins I^2 statistic was used to test for heterogeneity, and the Egger's test and funnel plot were performed to evaluate publication bias.

Results. Out of 12,522 studies, 26 studies were included in the meta-analysis. The overall mean weighted effect size of the SCNS long-form (LF) was 0.90 and the subdomains ranged from 0.90 to 0.97. The overall alpha for the SCNS short-form (SF) was 0.92, and the alphas for the subdomains were between 0.81 and 0.92. The estimated reliability coefficients in both LF and SF were highest in psychological and health information needs and lowest in sexuality. No publication bias was indicated in this study.

Significance of results. In this study, the overall reliability of SCNS was presented and the factors affecting the reliability of SCNS were identified. The results of this study may help clinicians or researchers make decisions about selecting tools to measure unmet needs of cancer patients.

Introduction

Survival rates and incidence of cancer have increased due to advances in early diagnosis and treatment (Siegel et al. 2021; Sung et al. 2021). Now, cancer is considered to be a chronic disease (Bullard et al. 2019; Phillips and Currow 2010), and the important goals of the interventions for cancer patients have extended from survival to quality of life (Lee and Jeong 2019). To improve the quality of life of cancer patients, it is necessary to identify and solve the diverse needs of the patients during the full trajectory of cancer (Harrison et al. 2009) because unmet needs affect the quality of life of cancer patients (Jang and Jeong 2021). To manage the unmet needs of cancer patients, one of the most critical steps is to assess the patients' needs accurately.

Valid and reliable tools are needed to identify unmet needs properly. There are various questionnaires for measuring unmet needs, and the Supportive Care Needs Survey (SCNS) is one of most widely used questionnaires globally. There are 2 types of the SCNS – long-form (LF) and short-form (SF). The SCNS was originally developed as a 59-item list, which was later named the long-form (SCNS-LF59). Later, a 34-item questionnaire, called SCNS-SF34 or short-form, was developed to lessen a responder's burden by reducing the number of items while maintaining the psychometric properties of the long-form (Bonevski et al. 2000; Boyes et al. 2009). Both SCNS-LF59 and SCNS-SF34 have 5 major subdomains, which are psychological, health systems and information, physical and daily living, patient care and support, and sexuality. SCNS-LF59 has 22 items in the psychological subdomain, 15 items in the health systems and information subdomain, 7 items in the physical and daily living subdomain, 8 items in the patient care and support subdomain, and 3 items in the sexuality subdomain (Bonevski et al. 2000). On the other hand, SCNS-SF34 has 10 items in the psychological subdomain, 11 items in the health systems and information subdomain, 5 items in the physical and daily living

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subdomain, 5 items in the patient care and support subdomain, and 3 items in the sexuality subdomain (Boyes et al. 2009). Both SCNS forms use a 5-point response scale for each item: no need – not applicable; no need – already satisfied; low need; moderate need; or high need. The higher the score means the higher the unmet needs.

The SCNS-LF59 and SCNS-SF34 were developed in English originally. They have been translated into many languages and utilized in many countries. Bonevski et al. (2000) developed SCNS-LF59 and reported that the Cronbach's alpha ranged from 0.87 to 0.97, and the psychological subdomain presented the highest alpha and patient care and support and the sexuality subdomains showed the lowest alpha scores. In the development of SCNS-LF59, Boyes et al. (2009) reported that the alphas ranged from 0.86 to 0.96 and the highest alpha in the health systems and information subdomain compared to the lowest alpha in the physical and daily living subdomain. Both long- and short-forms have high reliability coefficient scores, but there was a difference between the 2 as to which domains have higher reliability. The studies using SCNS-LF59 or SCNS-SF34 presented various reliability coefficient scores, which ranged from 0.64 to 0.97. It is worth estimating the average reliability of SCNS-LF59 and SCNS-SF34 to give an insight to clinicians and researchers who plan to assess the unmet needs of cancer patients.

Cronbach's alpha does not give the reliability of the tool itself but of sample-specific information. However, if reliability is reported consistently high or low over time, it informs empirical evidence for future research. Reliability generalization is an extension of the meta-analysis proposed by Vacha-Haase (1998) and has been used to understand what factors affect the variability of reliability scores across the results by administrating the instruments (Vacha-Haase and Thompson 2011). The purpose of this study was to examine the overall and subdomain reliability of SCNS-LF59 and SCNS-SF34 and identify moderators in reliability variability using reliability generalization meta-analysis. Study questions are as follows.

RQ1: What are the reliability scores of the SCNS long- and short-forms?

RQ2: Is there any variation in the reliability scores among studies depending on languages or study locations?

Methods

This systematic review with meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 guideline (Page et al. 2021). The preestablished review protocol was registered to the International Prospective Register of Systematic Reviews database (CRD42021238584).

Search strategy

Reviewed studies for this study were searched through several databases, including PubMed, Ovid, Embase, CINAHL (Cumulative Index to Nursing and Allied Health Literature), Web of Science, Scopus, and ProQuest Dissertations & Theses. The search terms used for database query were ("Cancer"[Title/Abstract] OR ("Cancer"[Title/Abstract] AND "Patient"[Title/Abstract]) OR "Neoplasms"[MeSH Terms]) AND ("unmet need"[Title/Abstract] OR ("unmet"[Title/Abstract] AND "need"[Title/Abstract])) AND ("questionnaire"[Title/Abstract] OR "Assessment"[Title/Abstract] OR "Tool"[Title/Abstract] OR "measurement"[Title/Abstract] OR "measur*"[Title/Abstract] OR "Scale"[Title/Abstract] OR "survey"[Title/Abstract] OR "instrument"[Title/Abstract] OR "checklist"[Title/Abstract] OR "evaluation"[Title/Abstract] OR "Needs Assessment Tool"[Title/Abstract] OR "Assessment Tool"[Title/Abstract] OR "Needs Assessment"[Title/Abstract] OR ("Needs Assessment"[MeSH Terms] OR "Surveys and Questionnaires"[MeSH Terms])) in PubMed, for example. We chose the ProQuest Dissertations & Theses to search gray literature such as unpublished thesis or dissertation papers. All studies satisfied the inclusion criteria, and studies published up to December 2020 were searched. There were no language restrictions on the search.

Study selection

A librarian extracted data through electronic database search based on the inclusion criteria. Two authors (Y. Jang and H. Lee) independently screened the electronic search results. Duplicate papers were excluded by a reference management software at first and then by comparing the records screened based on title, publication year, author name, and abstract. After excluding duplicates, full-text articles were assessed for eligibility by 2 authors (Y. Jeong and H. Lee) independently. The studies published in peer-reviewed journals or theses/dissertations from a university that reported reliability from the authors' own data were included in the analysis. Inclusion and exclusion criteria in detail are as follows:

Inclusion criteria

- A quantitative study assessing the unmet needs of cancer patients using the SCNS
- The reliability of the current study was reported
- A sample size was reported

Exclusion criteria

- The reliability of current study was not reported
- Cronbach's alpha value was not provided
- Participants were not cancer patients
- The questionnaire was substantially modified in terms of domains and items.
- A sample size was not reported
- Only partial subdomains were used

Disagreements between the authors were resolved by discussion. When study selection was completed, the following data were extracted: author, year of publication, countries in which the study was conducted, sample size, type of sample, reliability data, the number of SCNS items used in the study, and study design.

Quality assessment of included studies

Quality assessment for systematic review was independently conducted by 2 authors (Y. Jeong and H. Lee) using the quality rating scale based on Zangaro and Soeken (2005). The scale is a total score of 10 and consists of 7 items, including research question, subjects in sample, setting, method of data collection, response rate, measurement instrument, and reliability. The range of the scores was classified as low (0–4), moderate (5–7), or high (8–10) quality as suggested by Zangaro and Soeken (2005). Two independent review authors (Y. Jeong and H. Lee) decided the final studies to be included in meta-analysis.

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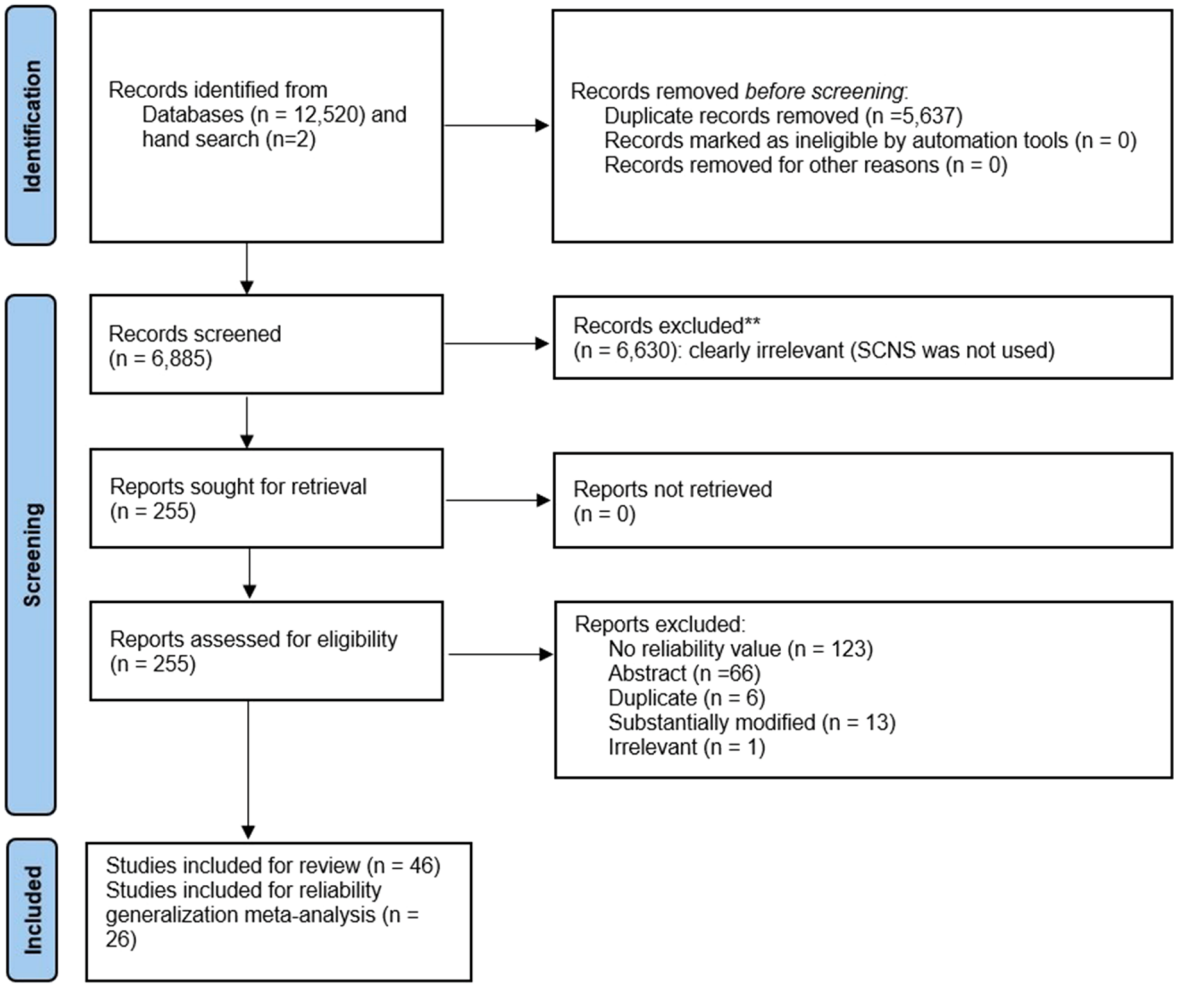

Fig. 1. Flow diagram.

Data synthesis and analysis

This study was designed to generalize the reliability of the SCNS using a meta-analysis. All analyses were performed using R Statistical Software using R version 4.0.2 (R Core Team 2021) and RStudio version 1.4.1 (RStudio Team 2020) with "meta" (Balduzzi et al. 2019) and "metafor" (Viechtbauer 2010) packages. To estimate the overall alpha of all the selected studies, the alpha coefficient in each study was transformed into the Fisher's Z for normalization. After obtaining the average transformed score, it was transformed back to alpha. A random effects model was used, and the values were weighted by the inverse of the studies' variance. To measure heterogeneity, Higgins I^2 statistics were performed. I^2 values $\geq$75% means high heterogeneity (Higgins et al. 2003). To explore categorial moderator, subgroup analyses were performed using the meta-analysis of variance (meta-ANOVA), which are the same with meta-regression with a categorical predictor (Harrer et al. 2021, 198). According to the model selection flowchart suggested by Borenstein et al. (2009, 163), we used random effect model with a pooled estimate of τ^2 for meta-ANAOVA. The pooled estimate methods is "pooling Q values and degree of freedom within subgroups, estimating τ^2 from pooled values and utilizing the pool estimates of τ^2 for all subgroups" (Borenstein et al. 2009, 162). When meta-ANOVA results were statistically significant and more than 2 subgroups existed in the moderator, post hoc tests were done by pair-wise meta-ANOVA analyses. Publication bias was evaluated by checking the level of visualized symmetricity in the funnel plot and Egger's test.

Results

We identified a total of 12,522 records and finally selected 46 studies for a systematic review and 26 studies for meta-analysis (Figure 1). The characteristics and quality of the studies included in this systematic review and meta-analysis are listed in Table 1.

Study characteristics

The 46 studies analyzed in this study were published between 2000 and 2020. Five studies used SCNS-LF59, and 41 studies utilized SCNS-SF34. The locations of studies were Amman, Australia, Canada, China, Germany, Hong Kong, Indonesia, Iran, Italy, Jordan, Korea, Malaysia, Mexico, the Netherlands, Singapore, Switzerland, Taiwan, Turkey, UAE, and the UK. The sample sizes vary between 25 and 1,106 (mean 329.13 and median 236). The reliability coefficients for SCNS of all 46 studies reported was Cronbach's alpha. Twenty of the 46 studies did not present each reliability coefficients of subdomains but showed ranges only. Thirteen studies reported overall alpha only, while 11 studies reported each subdomain alphas. Two studies reported alphas of overall and each subdomain of SNCS-SF34. Based on the 46 studies, the lowest

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Table 1. Characteristics, quality rating, and reliability scores of individual studies ($k = 26$)

Author	Year	SCNS	Sample size	Location	Language	Cancer characteristics	Quality rating	Reliability scores					
								Overall	P	I	D	C	S
Bonevski	2000	LF59	888	Australia	English	Nonspecific	9 (H)	–	0.96	0.97	0.90	0.87	0.87
Fazeli	2017	LF59	360	Iran	Persian	GICA	7 (M)	0.73	–	–	–	–	–
Hwang	2006	LF59	487	Korea	Korean	BRCA	8 (H)	0.97	–	–	–	–	–
Park	2012	LF59	1084	Korea	Korean	BRCA	9 (H)	–	0.95	0.97	0.90	0.93	0.91
Park	2012	LF59	52	Korea	Korean	BRCA	8 (H)	–	0.96	0.95	0.91	0.92	0.93
Afiyanti	2018	SF34	153	Indonesia	Indonesian	Cervical/ovarian	8 (H)	0.93	–	–	–	–	–
Ahern	2016	SF34	839	Australia	English	BRCA	8 (H)	0.89	–	–	–	–	–
Alananzeh	2019	SF34	143	Australia/Jordan	Arabic	Nonspecific	9 (H)	0.96	–	–	–	–	–
Boyes	2009	SF34	444	Australia	English	Nonspecific	9 (H)	–	0.96	0.95	0.86	0.90	0.90
Chambers	2012	SF34	354	Australia	English	Nonspecific	7 (M)	0.91	–	–	–	–	–
Chen	2009	SF34	112	Taiwan	Chinese	Oral cavity	8 (H)	0.91	–	–	–	–	–
Choi	2020	SF34	1106	Hong Kong	Chinese	Nonspecific	8 (H)	–	0.85	0.87	0.74	0.76	0.64
Fong	2019	SF34	30	Malaysia	Malaysian	BRCA	8 (H)	–	0.83	0.80	0.75	0.56	0.83
Han	2017	SF34	861	China	Chinese	Nonspecific	10 (H)	0.95	0.94	0.94	0.86	0.89	0.85
Lehmann	2012	SF34	1047	Germany	German	Nonspecific	9 (H)	–	0.95	0.94	0.85	0.89	0.82
Li	2013	SF34	360	Hong Kong	Chinese	CRC	8 (H)	–	0.89	0.89	0.77	0.73	0.53
			263	Taiwan				–	0.97	0.90	0.76	0.86	0.89
Nair	2018	SF34	210	UAE	Arabic	Nonspecific	10 (H)	0.79	0.80	0.81	0.78	0.84	0.73
Ren	2020	SF34	167	China	Chinese	ECA	8 (H)	0.93	–	–	–	–	–
Renovanz	2017	SF34	173	Germany	German	Glioma	9 (H)	–	0.94	0.93	0.79	0.82	0.82
Schofield	2012	SF34	332	Australia	English	PCA	9 (H)	–	0.96	0.91	0.89	0.84	0.82
Shun	2014	SF34	277	Taiwan	Chinese	CRC	8 (H)	0.92	–	–	–	–	–
Swash	2017	SF34	91	UK	English	HCA	8 (H)	–	0.93	0.96	0.93	0.88	0.88
Temiz	2020	SF34	450	Turkey	Turkish	Nonspecific	7 (M)	0.74	–	–	–	–	–
Williams	2018	SF34	343	Australia	English	Gynecologic	8 (H)	0.96	–	–	–	–	–
Zeneli	2016	SF34	40	Italy	Italian	Nonspecific	7 (M)	0.92	–	–	–	–	–
Zhu	2018	SF34	25	China	Chinese	Nonspecific	8 (H)	0.95	–	–	–	–	–

Subdomains: C, patient care and support; D, physical and daily living; H, high; M, moderate; I, health system and information; S, sexuality; and P, psychological.
Cancer characteristics: BRCA, breast cancer; CRC, colorectal cancer; ECA, esophageal cancer; GC, gastric cancer; GICA, gastrointestinal cancer; Gyn, gynecological; HCA, hematological cancer; HNC, head and neck cancer; LCA, lung cancer; and NMSC, non-melanoma skin cancer.

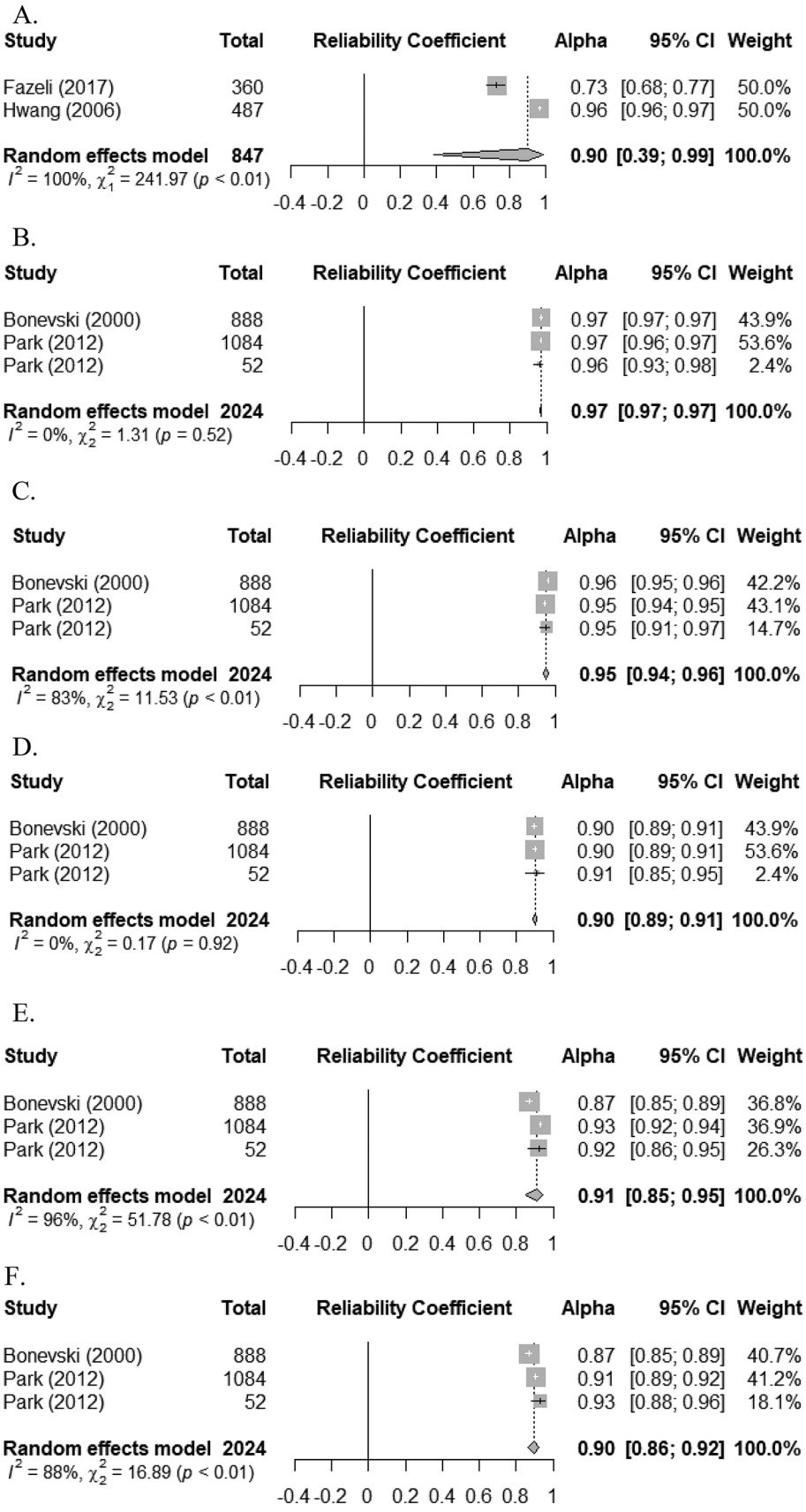

Fig. 2. Forest plots (SCNS-LF). A, Overall; B, Psychological; C, Health systems and information; D, Physical and daily living; E, Patient care and support; F, Sexuality; and F, Sexuality.

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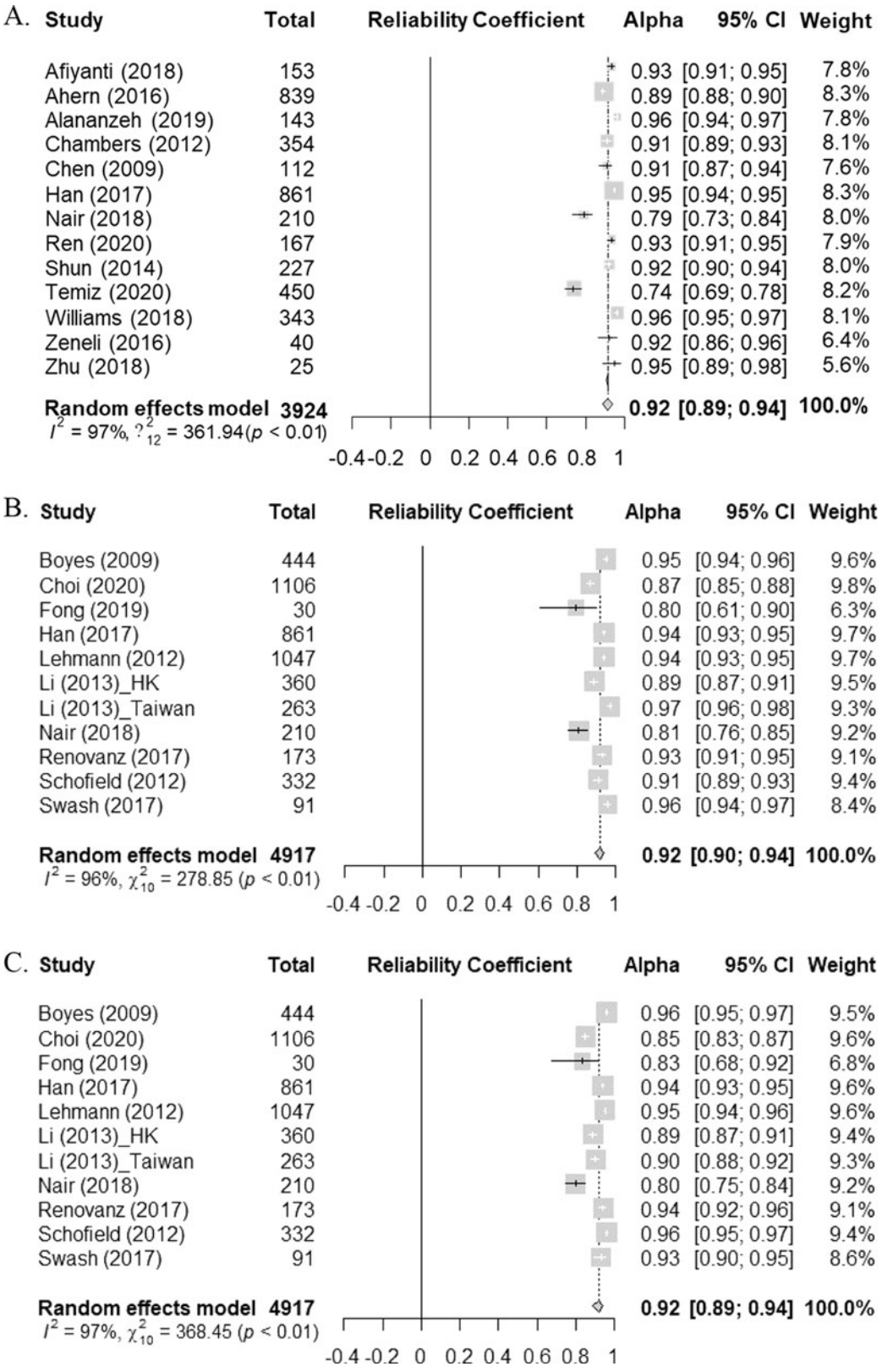

Fig. 3. Forest plots (SCNS-SF). A, Overall; B, Psychological; C, Health information; D, Daily living; E, Patient care; and F, Sexuality.

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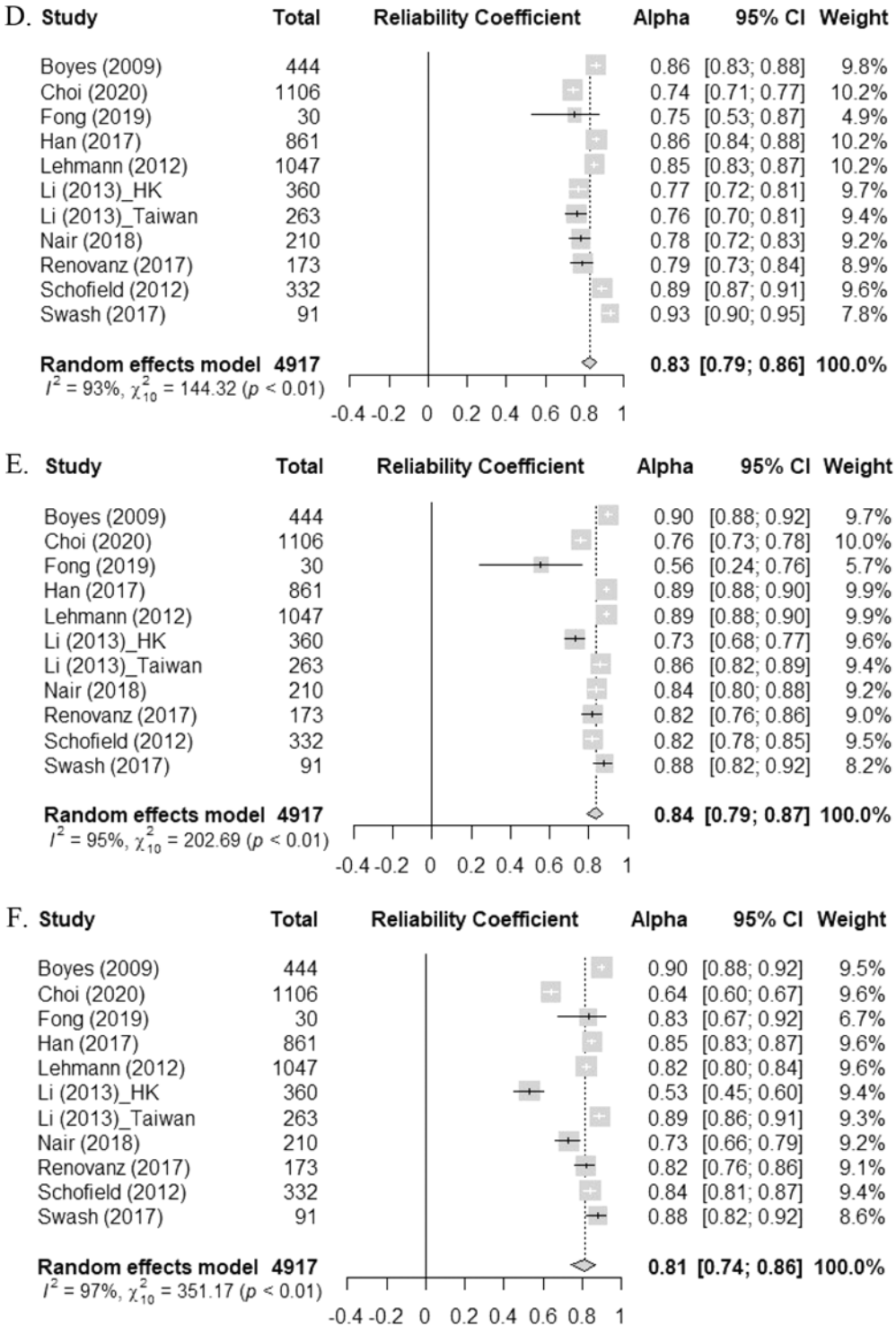

Fig. 3. (Continued.)

reliability scores reported for SCNS-LF59 and SCNS-SF34 was 0.73 and 0.56, respectively. Quality rating of 46 studies was mostly over 8 points, which was classified as high quality except for 4 studies with 7 points. Twenty-six studies reported that alpha scores of overall or each subdomain were included in final reliability generalization meta-analysis (Table 1).

Pooled results of reliability

Reliability of SCNS-LF59

Out of 5 selected studies, 2 studies presented the overall reliability of SCNS-LF59. The pooled reliability was 0.90 (95% confidence interval [CI]: 0.39, 0.99). However, high heterogeneity was observed ($I^2 = 100$ %, $p < 0.001$; see Figure 2A).

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Table 2. Results of the moderator analyses

Domain	Moderator	$Q_{Between}$	*p*	Number of studies	Alpha estimates	95% CI		Post hoc analysis of moderator (*p*)
Overall	Language	0.13	0.713	13				
	Original			3	0.926	0.866	0.960	
	Translated			10	0.915	0.875	0.943	
	Location	1.11	0.575	13				
	Asia			8	0.906	0.854	0.940	
	Europe			1	0.924	0.860	0.959	
	Oceania			4	0.936	0.893	0.962	
Psychologic	Language	1.14	0.286	11				
	Original			3	0.943	0.888	0.971	
	Translated			8	0.912	0.868	0.942	
	Location	1.87	0.393	11				
	Asia			6	0.909	0.902	0.915	
	Europe			3	0.940	0.934	0.946	
	Oceania			2	0.936	0.926	0.944	
Health systems and information	Language	4.68	0.030*					
	Original			3	0.953	0.9170	0.973	
	Translated			8	0.903	0.864	0.931	
	Location	15.73	<0.001*					
	Asia (A)			6	0.882	0.843	0.913	A vs O (0.001)*
	Europe (E)			3	0.941	0.910	0.962	A vs E (0.014)*
	Oceania (O)			2	0.960	0.934	0.976	O vs E (0.005)*
Physical and daily living	Language	11.60	<0.001*					
	Original			3	0.893	0.852	0.922	
	Translated			8	0.796	0.755	0.831	
	Location	6.68	0.035*					
	Asia (A)			6	0.784	0.722	0.833	A vs O (0.006)*
	Europe (E)			3	0.864	0.803	0.907	A vs E (0.055)
	Oceania (O)			2	0.876	0.808	0.921	O vs E (0.847)
Patient care and support	Language							
	Original	1.30	0.255	3	0.870	0.794	0.919	
	Translated			8	0.822	0.765	0.866	
	Location	2.24	0.326					
	Asia			6	0.806	0.732	0.861	
	Europe			3	0.867	0.788	0.918	
	Oceania			2	0.866	0.767	0.924	
Sexuality	Language	3.02	0.082					
	Original			3	0.876	0.787	0.929	
	Translated			8	0.782	0.701	0.843	
	Location	2.72	0.256					
	Asia			6	0.768	0.660	0.844	
	Europe			3	0.841	0.723	0.911	
	Oceania			2	0.873	0.751	0.938	

Note: $^{*}p < 0.05$.

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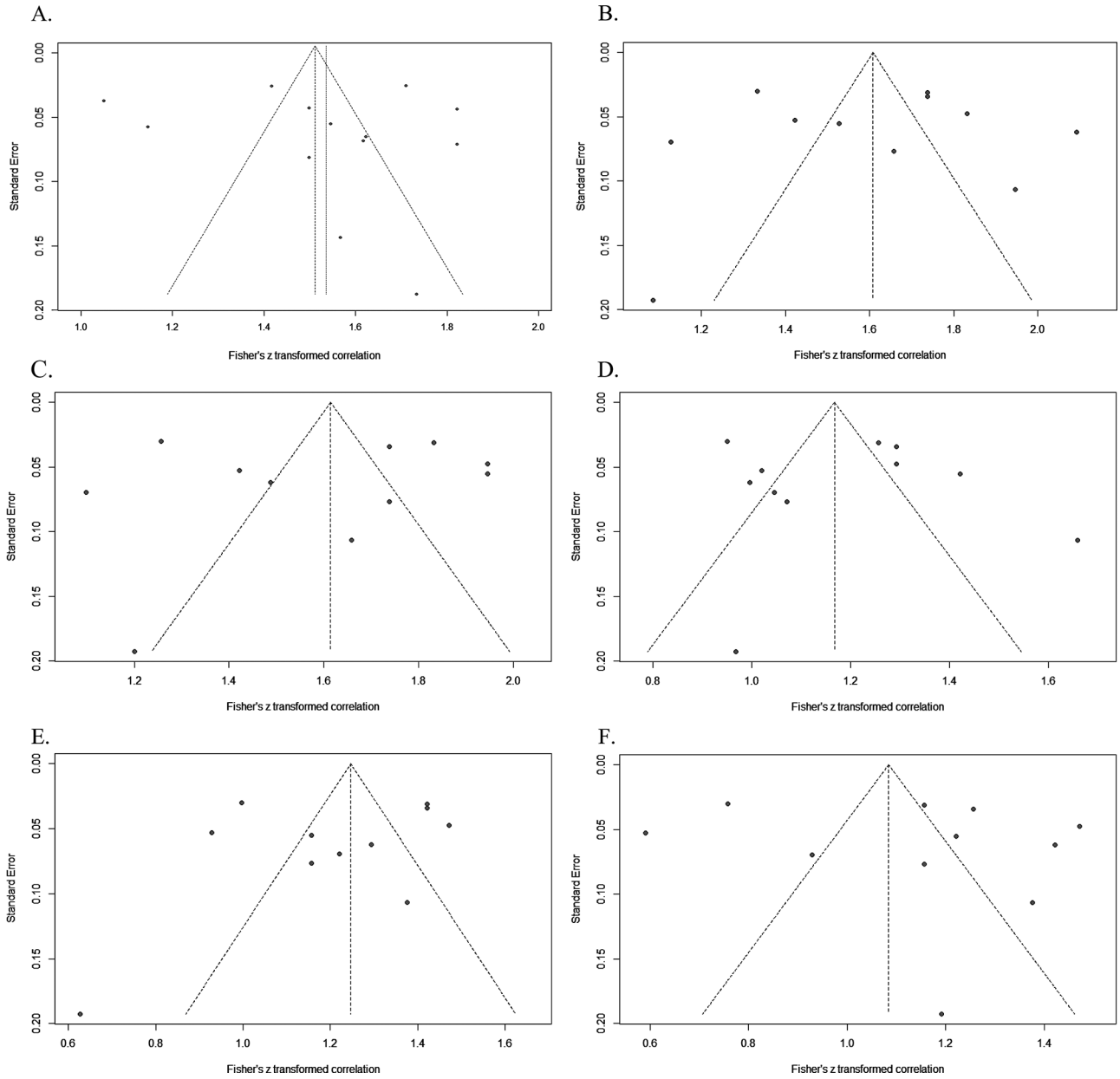

Fig. 4. Funnel plots (SCNS-SF). A, Overall; B, Psychological; C, Health information; D, Daily living; E, Patient care; and F, Sexuality.

Reliability of SCNS-LF59 subdomains

Out of the 5 selected studies, 3 studies presented the reliability values of SCNS-LF59 subdomains. The pooled reliability of the subdomains ranged from 0.90 in the physical and daily living and sexuality (95% CI: 0.89, 0.91 and 0.86, 0.92, respectively) domains to 0.97 in the psychological domain (95% CI: 0.97, 0.97), as shown in Figure 2. The psychological and physical and daily living domains showed homogeneity, while the other subdomains showed high heterogeneity ($I^2 = 83–98\%$, $p < 0.001$; see Figure 2B–F).

Forest plots (SCNS-LF)

Reliability of SCNS-SF34

Thirteen studies among 21 studies presented overall reliability of SCNS-SF34. The pooled reliability was 0.92 (95% CI: 0.89, 0.94). However, high heterogeneity was observed ($I^2 = 97\%$, $p < 0.001$; see Figure 3A).

Reliability of SCNS-SF34 subdomains

Ten studies presented the reliability values of the SCNS-SF34 subdomains. Li et al. (2013) reported the results separately for each region, so the analysis was conducted separately. The pooled reliability of the subdomains ranged from 0.81 (sexuality, 95% CI: 0.74, 0.86) to 0.92 (psychological and health information), as shown in Figure 3. However, high heterogeneity was observed in all subdomains ($I^2 = 93–97\%$, $p < 0.001$; see Figure 3B–F).

Moderator analysis

Moderator analysis was done for SCNS-SF34 using meta-ANOVA. Mediators for subgroup analysis were language and location. We

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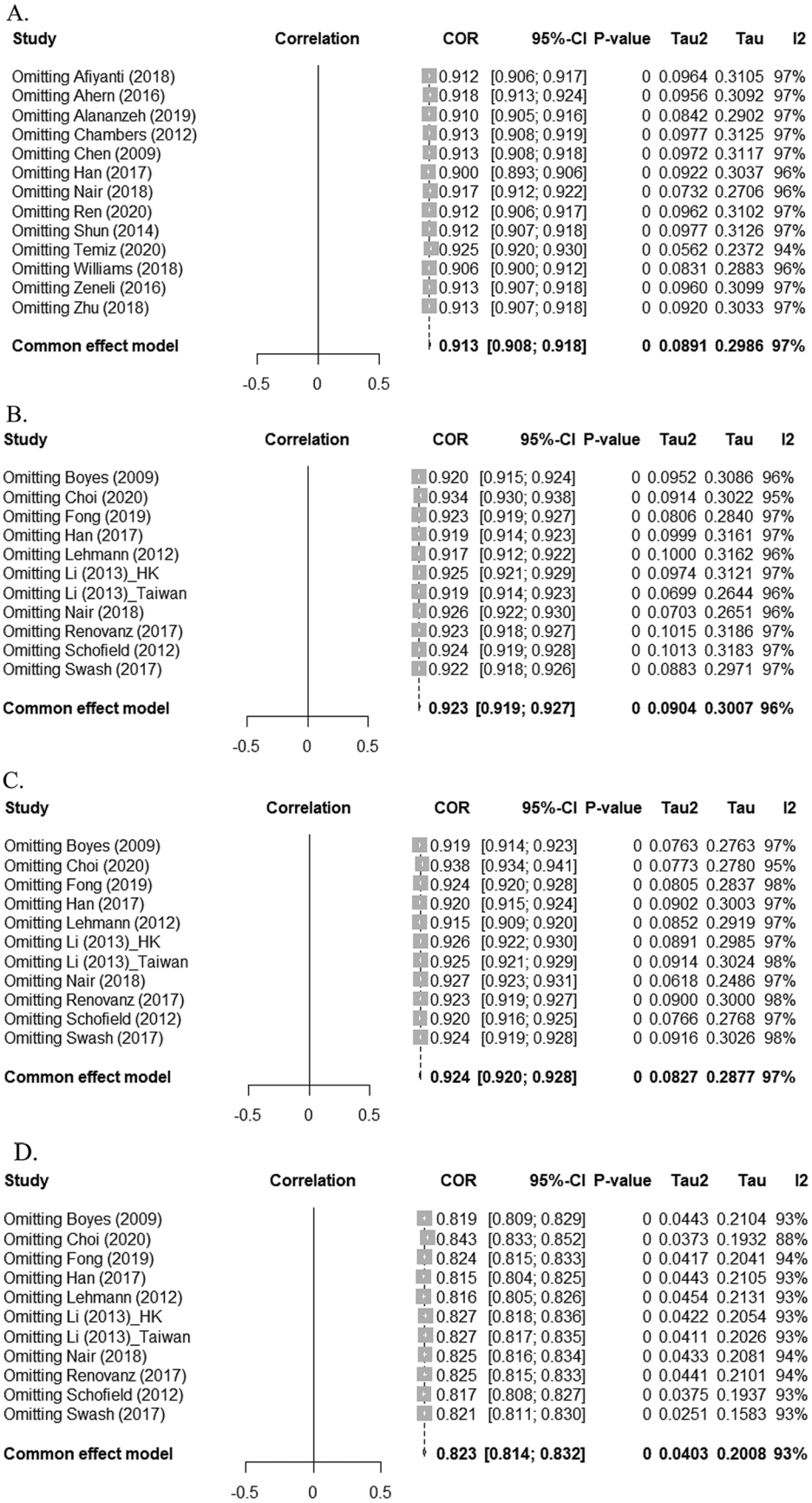

Fig. 5. Sensitivity tests (SCNS-SF). A, Overall; B, Psychological; C, Health information; D, Daily living; E, Patient care; and F, Sexuality.

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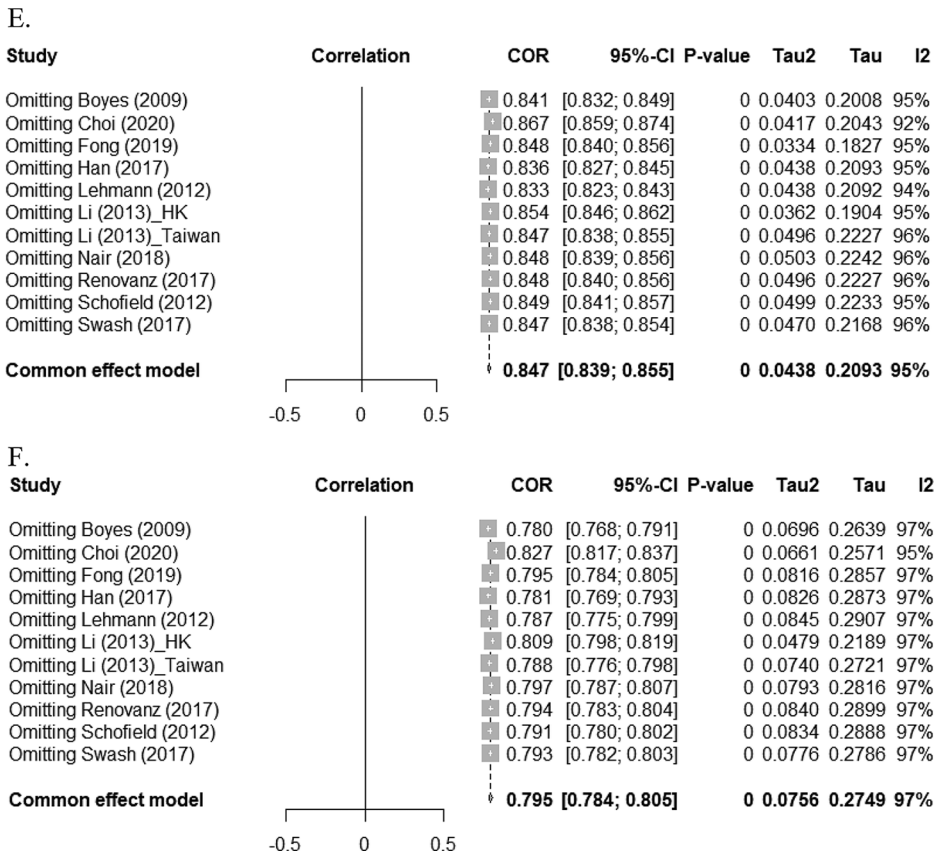

Fig. 5. (Continued.)

compared the differences in alpha coefficients between original language (English) of the SCNS and the translated version (non-English) to explore the effect of translation invariance on heterogeneity. We also compared the differences between study locations. We originally speculated culture or country as a moderator, and it was not possible to test in this study due to the small sample size. We eventually analyzed subgroup difference by continent. The results are presented in Table 2. Language and location were significantly different between subgroups in the health systems and information as well as the physical and daily living subdomains. In the physical and daily living subdomain, there was a subgroup difference only between Asia and Oceania.

Publication bias

Because the number of studies using SCNS-LF59 is too small, it is not appropriate to test publication bias. Figure 4 visualizes the level of publication bias for the analyzed studies for SCNS-SF34 through the funnel plot. According to the Egger's regression test, the funnel plot remained symmetrical in the overall (bias = 0.9228, $t = 0.24$, $df = 11$, $p = 0.812$), psychological (bias = 0.310, $t = 0.08$, $df = 9$, $p = 0.941$), health systems and information (bias = −0.759, $t = -0.16$, $df = 9$, $p = 0.874$), physical and daily living (bias = 0.870, $t = 0.30$, $df = 9$, $p = 0.771$), patient care and support (bias = −1.698, $t = -0.50$, $df = 9$, $p = 0.630$), and sexuality (bias = 2.808, $t = 0.63$, $df = 9$, $p = 0.544$) subdomains.

Sensitivity test

We performed sensitivity test to explore studies contributing to influence on effect sizes. A post hoc influential analysis was done by omitting studies one by one. Sensitivity analysis showed stable results (Figure 5).

Discussion

In this study, we performed reliability generalization of SCNS-LF and SCNS-SF and tested whether there were any differences in reliability depending on language and location. In this study, we examined pooled reliability coefficients of overall and subdomains. It seems that the overall alpha value or the alpha value of the subdomain has been presented depending on whether the whole is viewed as a single structure or whether each of the multidimensional subdomains has its own focus. The authors who developed SCNS-LS and SCNS-SF did not report overall alpha scores but reported the alpha scores for each subdomain. Therefore, the authors may weigh internal consistency reliability within each subdomain more than overall reliability. However, many studies using SCNS reported overall reliability with or without subdomain reliabilities. There is an opinion that alpha should be applied when a scale is unidimensional (Dunn et al. 2014), while another opinion exists that reliabilities of overall and subdomains may need to be reported (Cho and Kim 2015). Which reliability to report or not is beyond the scope of this study. Therefore, we analyzed reliability coefficients of both overall and subdomains as they were reported in selected studies.

The results showed that the average Cronbach's alpha values of overall and each subdomain of SCNS-LF were greater than 0.9. For SCNS-SF, overall Cronbach's alpha was greater than 0.9, and the alpha values of subdomains were greater than 0.81. Although there is no definite cutoff values of alpha (Taber 2018), reports showed

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that alpha values 0.7 or above are satisfactory, while a higher value over 0.90 is needed for clinical application (Bland and Altman 1997) or the values of 0.8 or higher were reasonable (Gliem and Gliem 2003). Therefore, it suggests that the average alpha coefficients of both SCNS-LF and SCNS-SF are acceptable levels. More studies have used SCNS-SF rather than SCNS-LF. One of the reasons is that the number of SCNS-SF items is small, which ultimately reduces the burden and fatigue of research participants. In general, alpha decreases as the number of items is reduced (Schrepp 2020). However, the alpha values of SCNS-SF did not decrease dramatically even though the number of items decreased by 25 compared to the SCNS-LF. This might be another reason for researchers to choose SCNS-SF over SCNS-LF.

The results of this meta-analysis presented that the reliability of a specific subdomain was lower than other subdomains. Although the alpha coefficients of all subdomains in SCNS-LF and SCNS-SF were acceptable levels, the sexuality subdomain in both types of SCNS showed the lowest alpha values. Possible causes of a low Cronbach's alpha value are small number of items, or low correlation between items, or mixed construct (Tavakol and Dennick 2011). The reason of low alpha values of sexuality may be the number of items because this domain has the smallest number of questions.

To identify whether there are any differences in reliability coefficients by language and location, we performed moderator analysis on SCNS-SF. There were no statistical differences in reliability values between original language and translated languages in version except health systems and information as well as physical and daily living subdomains. Based on this result, language may be a cause for heterogeneity in the reliability values. However, the differences were also found in the same 2 subdomains, health systems and information and physical and daily living, based on location. It is not clear that the differences are based on translation, locations, or both. Further analyses are needed in the future.

One of the limitations of this paper is that reliability generalization was performed based solely on Cronbach's alpha. The reason we analyzed reliability based on Cronbach's alpha was because it was the only reliability reported in selected papers. Cronbach's alpha, also called Cronbach's coefficient alpha or coefficient alpha, is one type of reliability. Types of reliability are classified into internal consistency, test–retest, and inter-rater reliability (Charter 2003). Cronbach's alpha is the most widely used measurement statistics of internal consistency reliability but is not the one and only reliability coefficient. However, most papers have reported Cronbach's alpha without explanation of the reason to choose the alpha despite there being alternatives to alpha (Sijtsma 2009). There are controversial views of use of Cronbach's alpha. Some researchers criticize that Cronbach's alpha is problematic, while others support the merits of Cronbach's alpha (Raykov and Marcoulides 2019). In addition, there are opinions to report whether the assumption of tau-equivalence was met or not to estimate Cronbach's alpha accurately (Graham 2006). However, it has not been commonly reported in published papers whether the assumptions were met. It suggests that various reliability coefficients may be considered based on what to measure, and the assumptions to estimate reliability should be reported if it is required. Another limitation is that we could not analyze other moderators, such as gender, age, and disease-related characteristics of study population, due to small number of studies.

We recommend that researchers report the reliability coefficients of their own study. Surprisingly, we found some researchers did not report the alpha of their own study but described the alpha values that the original authors of the SCNS reported in their study. We also found some researchers did not report reliability coefficients at all. In addition, some papers presented the range of alpha instead of the alphas of each subdomain. When reporting alphas of subdomains, we suggest researchers to report reliability thoroughly. We also recommend in future studies to compare generalized reliability coefficients with other tools measuring unmet needs.

Conclusion

Through the reliability generalization, the pooled Cronbach's alpha coefficients of both SCNS-LF and SCNS-SF presented acceptable reliability estimates. Language and location may be factors that affect reliability in the health systems and information and physical and daily living subdomains.

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