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The Association between the Use of Biomedical Services and the Holistic Use of Traditional East Asian Medicine among Outpatients in Korea

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Abstract

Objectives: The holistic use of a system of complementary and alternative medicine (CAM) is potentially linked to its treatment outcomes. This paper examines how the use of biomedicine is associated with the holistic use of CAM, focusing on traditional East Asian medicine (EM) that is uniquely integrated in the medical system in Korea.

Design/Settings: A representative national sample of EM outpatients in Korea.

Participants: 3,861 respondents to a national survey.

Methods: By using the 2011 Korean National Survey of EM Patients, ordered logistic regression models specify the relationship between EM outpatients' use of biomedicine and their holistic use of EM modalities.

Results: Among EM outpatients who used at least one EM modality in the past three months, people who used two (33.3%) or three (29.4%) modalities together are the two greatest in number, followed by users of four (18.1%), five (7.2%), six (2.1%), and seven (0.6%) modalities. Among these EM outpatients, 42.5% used biomedical services as well during the same period. The odds for EM users to use EM holistically are 17% greater among EM users who used biomedicine as well, compared to EM users who did not use biomedicine.

Conclusions: Health care community should recognize that CAM use likely becomes holistic as people use biomedicine concomitantly, when the practice rights over a CAM system are comprehensively and exclusively entitled to a group of CAM professionals who are independent from practitioners of biomedicine.

[Strengths and limitations of this study]

- It uses a national sample of EM users who visited EM facilities across Korea.
- It specifies several multivariate ordered logistic regression models to support the findings.
- All the measures are based upon self-reports of survey participants.

Introduction

The presence of complementary and alternative medicine (CAM) is substantial in contemporary health care systems around the world.[1,2] Accordingly, the health care community is concerned with the ways in which CAM is integrated in the mainstream biomedicine[3,4] and health care outcomes that CAM produces. Over 40 systematic reviews of CAM trials are currently registered in the Cochrane Library and debate the safety and efficacy of CAM. In addition, studies suggest that CAM services be provided holistically in medical trials as well as real-world practices so that CAM users can utilize all the related treatment modalities within a whole system of CAM.[5,6] It is argued that the holistic utilization of various treatment modalities within a CAM system can maximize the treatment effects of CAM, compared to the selective and fragmented use of only some modalities of the whole system.[7] In these studies, the holistic use of a CAM system refers to the utilization behavior of CAM users who use two or more treatment modalities that constitute the CAM system.[8] In contrast, the selective and fragmented use refers to the utilization behavior of CAM users who use a certain modality of the CAM system and not others.

While the therapeutic effectiveness of the holistic use of CAM still needs to be adjudicated by more research, this paper attends to the possibility that CAM is institutionalized in some countries in a way that prevents the users from its holistic use. For example, the treatment modalities that together form a whole system of traditional East Asian medicine (EM), such as acupuncture, moxibustion, cupping, herbal remedies, and acupressure, are disconnected from one another in the Japanese medical system so that only herbal remedies are selectively incorporated into the practices of biomedical doctors;[9-13] acupuncture and acupressure are

each relegated as pseudo-medicine to medical technicians, such as acupuncturists and massage therapists who are permitted to practice only acupuncture and massage therapies. These technicians are not allowed to practice herbal remedies or other EM modalities. Similar observations are made that the otherwise rich practices of acupuncture are truncated and simplified in the dominant biomedical health care systems in the U.S.[14-16] and the U.K.[17] In the contemporary French biomedical system, a variety of CAM systems are reported to become "balkanized" and their constituent treatment modalities are torn apart from one another in practice.[18] These studies together demonstrate that the intersection of a CAM system with biomedicine can result in the fragmented and partial use of the CAM system.

In other countries, on the other hand, treatment modalities within a CAM system are held together and institutionalized comprehensively into the national medical systems. For example, several treatment modalities within EM are recognized as legitimate medicine in China, Taiwan, and Korea, equivalent to biomedicine.[3,19-25] These countries feature distinctive systems of education and licensure for EM doctors who are legally permitted to practice the whole range of modalities of EM, independent from medical doctors of biomedicine. The EM doctors in Taiwan and Korea even hold the right to practice all the EM modalities in such an exclusive way that doctors of biomedicine do not hold the right to practice any of the EM modalities. Reciprocally, these EM doctors are not allowed to practice biomedicine. In China, however, biomedical doctors are allowed to practice any EM modalities as the doctors deem necessary for medical treatments. In return, EM doctors are entitled to practice biomedicine as well. These countries show that a whole system of CAM is institutionalized within the dominant biomedical system in several different ways.

Drawing on the literature of medical systems, this paper posits that these institution-level variations are consequential for the extent to which CAM users utilize various treatment modalities of a CAM system. The paper then examines users' utilization behavior by looking at the extent to which CAM users utilize multiple treatment modalities within a CAM system holistically. In accordance with previous studies,[5-8] the holistic use is defined as CAM users' utilization behavior in which two or more treatment modalities of a CAM system are used together rather than a single modality being used in isolation from the other modalities. When a user resorts to more modalities, its behavior is interpreted to be more holistic. The paper pursues this investigation by examining the case of EM that is one of the popular CAM practices in the world. In particular, it develops a specific hypothesis that elaborates the unique institutional condition of EM in Korea and relates it to the utilization behavior of EM users who may also use biomedical services concomitantly in the Korean health care system. Therefore, the hypothesis focuses on how the use of biomedical services is associated with the holistic use of EM in the Korean context.

In Korea, the professional practice of EM is comprehensively and exclusively entitled to EM doctors in separation from the professional practice of biomedicine by medical doctors. This comprehensive sanction of all treatment modalities of EM within the medical system and, at the same time, the exclusive entitlement of the practice rights of these modalities only to EM doctors (and not biomedical doctors) likely project EM to Korean medical service users as a system of medical practices that is very different and independent from biomedicine. EM can be also viewed as a whole medical system that is composed of a variety of related treatment modalities that are readily available for the needs of medical service users. In this institutional condition, EM users who co-utilize biomedical services as well are likely those

who search for diverse medical resources of different kinds that the national medical system provides for them. These EM users, when compared to EM users who do not use biomedical services and thus do not seek for diverse medical resources, are likely to seek even more diverse modalities that are available within EM itself. Therefore, this paper hypothesizes that the EM users who also use biomedical services are likely to use EM more holistically.

Hypothesis: Among EM users in Korea where certified EM professionals hold the comprehensive and exclusive practice rights over EM, medical service users' use of biomedical services is positively associated with their likelihood of using EM holistically.

Methods

Data come from the 2011 Korean National Survey of EM Patients (NSEMP) that was administered to a nationally representative sample of patients who visited (i.e. outpatients) or were hospitalized (i.e. inpatients) in an EM facility as of September 2011. This survey used the national sampling frame of 12,250 EM facilities that were registered in the national health insurance system. This sampling frame was duly regarded as the national population of EM facilities in Korea, since all medical service providers should be registered in the national insurance system for reimbursement from the national government in the universal Korean health care system. The survey then drew a stratified systematic sample of 471 EM facilities (4% of the sampling frame). At each selected facility, the outpatient questionnaire of the survey was administered to a random sample of 9 outpatients drawn from people in the waiting area. When the facility was equipped with hospital beds, an additional random sample of 8 inpatients was drawn from the list of inpatients and these inpatients participated

in the inpatient questionnaire. As a result, 3,926 outpatients and 1,581 inpatients participated in the survey.

This paper analyzes only the responses from the outpatient EM users and not those from the inpatient users, since only the outpatient questionnaire investigated the uses of EM in each of the seven different EM modalities in detail; the inpatient questionnaire investigated whether a respondent ever used any of the EM modalities without differentiating which modality was used. These inpatient responses are ignorant of which and how many EM modalities were used and, thus, how holistic the EM use was. As a result, the following analysis includes responses from the final sample of 3,861 outpatient EM users. Its difference from the total outpatient participants (65 = 3,926 – 3,861) is due to a further exclusion of 65 inpatient respondents that are missing values in one or more of the variables that are included in the following analysis.

The dependent variable, *the holistic use of EM*, is an ordinal variable that measures the number of different EM modalities that were used together by a respondent in the past three months. It is a composite measure that summarizes responses to seven distinct questions. Each of the seven questions asked whether a respondent used one of the seven EM modalities respectively ("have you used [a specific EM modality] for medical problems in the past three months?"), such as 1) herbal extracts, 2) herbal pills/powders, 3) acupuncture, 4) moxibustion, 5) cupping, 6) chuna, and 7) manual treatments. The response to each question is coded 1 if yes (0 if not). Thus, the values of the dependent variable range from 1 to 7. The focal independent variable is *the use of biomedical services* which measures whether a respondent visited a biomedical clinic or hospital where biomedical doctors provide medical services for

the medical conditions for which the respondent used EM modalities. It is coded 1 if a respondent visited a biomedical clinic or hospital in the past (0 if not).

[Table 1]

A set of potential covariates, which may intervene in the relationship between holistic EM use and the use of biomedical services, are incorporated in the analysis as control variables. These control variables are the frequency of EM use, self-rated health status, gender, age, marital status, the highest level of education, and monthly household income (Table 1 for descriptive statistics). This paper uses ordered logistic regression models to test the hypothesis about the relationship between holistic EM use and the use of biomedical services, since it interprets different values in the dependent variable as ordered categories that refer to the extent of holistic EM use. Results from negative binomial regression models, which treat the dependent variable as a count measure, agree with the results reported here. For comparison, results from negative binomial regression models are reported in Table A1 in the Appendix.

Results

Among all current outpatient EM users who used at least one EM modality in the past three months, EM users who used two or three modalities are the two greatest in number, followed by those who used four, five, six, and seven modalities. The proportion of EM users who used only one modality is only 9.4%. It turns out that more than 90% of current EM outpatients in Korea used multiple EM modalities together when they ever resorted to EM.

Close to a half of these EM users (42.5%) also used biomedical services by visiting a biomedical clinic or hospital. In addition, the bivariate tabulation on the relationship between the extent of holistic EM use and the use of biomedical services shows that there is a positive relationship between the two; EM users who utilized various EM modalities more holistically were more likely to use biomedical services as well (Table 2). Put differently, EM users who also used biomedical services were more likely to utilize EM modalities holistically than EM users who did not use biomedical services.

[Table 2]

[Table 3]

Model 1 in Table 3 puts this bivariate association in odds ratio and finds it to be statistically significant. The odds for EM users who also used biomedical services to utilize EM holistically are greater than those for EM users who did not use biomedical services (OR=1.27; 95% CI=1.13–1.42). The following two models show that this association remains the same when respondents' frequency of EM use is controlled (Model 2) or when respondents' health status is controlled (Model 3). The final Model 4 incorporates these two confounders together and other possible confounders as control variables; the positive association between holistic EM use and the use of biomedical services still persists. In this final model, the odds for EM users who also used biomedicine to use EM holistically are 17% greater than those for EM users who did not use biomedicine (OR=1.17; 95% CI=1.04–1.31). These results support the hypothesis unambiguously.

Discussion

To our knowledge, this is the first study in the global medical community that examines how the use of biomedical services is associated with the extent to which the users of CAM, involving EM, utilize various modalities of a CAM system holistically. It is surprising that this line of inquiry has been neglected in the literature, in spite of a potential link between the holistic-vs-selective utilization of a CAM system and its varying health care outcomes. While awaiting more empirical evidence on this link, this paper contributes to developing a much-needed analytical perspective that elaborates CAM utilization behavior beyond existent studies of the simple utilization rate and popularity of CAM among various populations.[25-31]

As such, this perspective has grown out of a group of studies that investigate the complementary-versus-substitutive relationship between CAM use and biomedicine use.[23,32-35] Whereas these existing studies have investigated whether the utilization of fragmented CAM modalities increases or decreases the utilization of biomedical services by comparing the behavior of CAM users to the behavior of non-users, this paper originally focuses on CAM users only and investigates how their CAM utilization behavior is shaped by their use (vs. non-use) of biomedical services. In this sense, this paper provides CAM-centered evidence to the complementarity-versus-substitution debate; its finding suggests that CAM use can be complementary to biomedicine to the extent that users rely on a variety of treatment modalities within a CAM system even when they use biomedical services (i.e. the holistic co-utilization of CAM).

Conclusions

This finding is based upon the experiences of EM users in Korea where the professional practice of EM is comprehensively and exclusively entitled to EM doctors. It will take more research to generalize this finding in other institutional contexts and, at the same time, to discern any cross-national differences. The qualifications and characterizations that this paper has developed regarding the Korean medical system will certainly serve future research interest in this direction. A comparative study between the East Asian countries, such as China, Korea, and Japan where EM originated and is institutionalized differently, will shed more light.

The authors recommend that the CAM-centered perspective, asking how CAM use is reconstructed by biomedicine use, is especially relevant to studying CAM utilization behavior in societies where a system of CAM treatment modalities has existed for quite some time (e.g. traditional Indian medicine in the U.S., traditional African medicine in Africa, Ayurveda and Indian medical traditions in India, etc.). The international medical community will gain a lot from these future studies on their own accord. It will gain even more from these studies when the link between the holistic-versus-selective use of CAM and its varying health care outcomes is examined further.

Appendix

[Table A1]

Contributorship Statement

JMS conceived the study, analyzed the data, and wrote the manuscript. YSL conceived the study and helped modify the data analysis and revise the manuscript.

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Competing Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Data Sharing Statement

The data will be available from the corresponding author upon request.

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Table 1. Descriptive Statistics[1)] of Variables Used (N=3,861)

Variable	N	%	Variable	N	%
The Holistic Use of EM			Age		
1	363	9.4	less than 20	143	3.7
2	1,284	33.3	20s or 30s	894	23.2
3	1,135	29.4	40s	762	19.7
4	699	18.1	50s	833	21.6
5	276	7.2	60s	575	14.9
6	82	2.1	70s	522	13.5
7	22	0.6	80s or more	132	3.4
The Use of Biomedical Services			Marital Status		
Yes	1,641	42.5	Single	613	15.9
No	2,220	57.5	Married	2,783	72.1
EM Use Frequency[2)]			Widowed/Divorced/Separated	440	11.4
1 to 3 times	1,389	36.0	Others	25	0.6
4 to 10 times	1,289	33.4	Education		
11 to 30 times	885	22.9	No formal education	279	7.2
30 times or more	298	7.7	Elementary school	557	14.4
Self-Rated Health Status			Middle school	467	12.1
Very bad	103	2.7	High school	1,215	31.5
Bad	1,010	26.2	College or graduate school	1,343	34.8
Fair	1,651	42.8	Household Income		
Good	983	25.5	less than 1 million wons	733	19.0
Very good	114	3.0	1 to 1.9 million wons	789	20.4
Gender			2 to 2.9 million wons	831	21.5
Male	1,161	30.1	3 to 3.9 million wons	615	15.9
Female	2,700	69.9	4 to 4.9 million wons	446	11.6
			5 million wons or more	447	11.6

Note: [1)] The socio-demographic characteristics of EM users show that EM is being used very widely across different social groups in age, education, and income. [2)] This refers to how many times a respondent has used EM services in the past three months. It is certain that, when a respondent uses EM less often, the respondent is less likely to use different treatment modalities of EM. However, a respondent who uses EM very often does not necessarily utilize different treatment modalities (e.g. a respondent who uses only acupuncture many times).

Table 2. The Bivariate Association between the Use of Biomedical Services and the Holistic Use of Traditional East Asian Medicine (EM)

		The Use of Biomedical Services		
		No	Yes	Total
The Holistic Use of EM (# of EM Modalities Used)	1	227 (62.5)	136 (37.5)	363 (100.0)
	2	766 (59.7)	518 (40.3)	1284 (100.0)
	3	654 (57.6)	481 (42.4)	1135 (100.0)
	4	389 (55.6)	310 (44.4)	699 (100.0)
	5	138 (50.0)	138 (50.0)	276 (100.0)
	6	39 (47.6)	43 (52.4)	82 (100.0)
	7	7 (31.8)	15 (68.2)	22 (100.0)
	Total	2,220 (57.5)	1641 (42.5)	3,861 (100.0)

Note: Percentages in parentheses. Pearson's χ^2 (6) = 22.8001; p-value = 0.001.

Table 3. Ordered Logistic Regression Models of Holistic EM Use upon the Use of Biomedical Services and Other Covariates

	Model 1		Model 2		Model 3		Model 4	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Biomedical Service Use	1.27***	(1.13-1.42)	1.18**	(1.05-1.33)	1.23***	(1.09-1.38)	1.17**	(1.04-1.31)
EM Use Frequency (Ref = 1 to 3 times)								
4 to 10 times			2.29***	(2.00-2.64)			2.30***	(2.00-2.65)
11 to 30 times			3.38***	(2.90-3.96)			3.45***	(2.93-4.06)
31 or more times			3.40***	(2.71-4.27)			3.53***	(2.78-4.47)
Self-Rated Health Status (Ref = Very good)								
Very bad					0.88	(0.54-1.43)	0.58*	(0.35-0.95)
Bad					1.32	(0.93-1.88)	0.92	(0.64-1.32)
Fair					1.10	(0.78-1.55)	0.84	(0.59-1.19)
Good					0.91	(0.64-1.29)	0.78	(0.55-1.11)
Female							1.09	(0.96-1.24)
Age (Ref = less than 20)								
20s or 30s							2.96***	(1.98-4.44)
40s							3.28***	(2.13-5.05)
50s							3.06***	(2.00-4.70)
60s							2.45***	(1.58-3.79)
70s							2.29***	(1.46-3.58)
80s or more							2.33**	(1.37-3.97)
Marital Status (Ref = Single)								
Married							1.12	(0.91-1.39)
Widowed/Divorced/Separated							1.13	(0.83-1.52)
Others							1.08	(0.50-2.34)
Education (Ref = No formal education)								
Elementary school							1.05	(0.80-1.38)
Middle school							0.92	(0.68-1.25)
High school							0.97	(0.72-1.31)
College or graduate school							0.90	(0.66-1.24)
Household Income (Ref = less than 1 million wons)								
1 to 1.9 million wons							1.00	(0.82-1.22)
2 to 2.9 million wons							0.95	(0.77-1.17)
3 to 3.9 million wons							1.02	(0.81-1.28)
4 to 4.9 million wons							1.05	(0.82-1.35)
5 million wons or more							1.19	(0.92-1.54)
Observations		3,861		3,861		3,861		3,861

Note: significant at 0.05 (*), 0.01 (**), 0.001 (***).

Table A1. The Replication of Table 3 in Negative Binomial Regression Models

	Model 1		Model 2		Model 3		Model 4	
	coeff.	(95% CI)	coeff.	(95% CI)	coeff.	(95% CI)	coeff.	(95% CI)
Biomedical Service Use	0.06**	(0.02-0.10)	0.04*	(0.01-0.08)	0.05**	(0.02-0.09)	0.04*	(0.01-0.08)
EM Use Frequency (Ref = 1 to 3 times)								
4 to 10 times			0.19***	(0.14-0.23)			0.18***	(0.14-0.23)
11 to 30 times			0.27***	(0.22-0.32)			0.28***	(0.22-0.33)
31 or more times			0.27***	(0.20-0.35)			0.28***	(0.21-0.36)
Self-Rated Health Status (Ref = Very good)								
Very bad					-0.02	(-0.18-0.14)	-0.11	(-0.27-0.06)
Bad					0.06	(-0.06-0.17)	-0.02	(-0.14-0.10)
Fair					0.02	(-0.09-0.13)	-0.04	(-0.15-0.08)
Good					-0.02	(-0.13-0.10)	-0.05	(-0.17-0.07)
Female							0.02	(-0.02-0.06)
Age (Ref = less than 20)								
20s or 30s							0.24***	(0.10-0.38)
40s							0.26***	(0.11-0.41)
50s							0.25***	(0.10-0.39)
60s							0.21**	(0.05-0.36)
70s							0.18*	(0.03-0.33)
80s or more							0.17	(-0.01-0.35)
Marital Status (Ref = Single)								
Married							0.03	(-0.04-0.10)
Widowed/Divorced/Separated							0.03	(-0.06-0.13)
Others							-0.02	(-0.32-0.28)
Education (Ref = No formal education)								
Elementary school							0.00	(-0.09-0.09)
Middle school							-0.02	(-0.12-0.08)
High school							-0.01	(-0.11-0.09)
College or graduate school							-0.02	(-0.12-0.09)
Household Income (Ref = less than 1 million wons)								
1 to 1.9 million wons							0.01	(-0.06-0.07)
2 to 2.9 million wons							-0.00	(-0.07-0.06)
3 to 3.9 million wons							0.00	(-0.07-0.08)
4 to 4.9 million wons							0.02	(-0.06-0.10)
5 million wons or more							0.04	(-0.05-0.12)
Constant	1.04***	(1.01-1.06)	0.89***	(0.85-0.93)	1.02***	(0.91-1.13)	0.67***	(0.49-0.85)
Observations		3,861		3,861		3,861		3,861

Note: significant at 0.05 (*), 0.01 (**), 0.001 (***).

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2 to 4
Objectives	3	State specific objectives, including any prespecified hypotheses	4 to 5
Methods			
Study design	4	Present key elements of study design early in the paper	5 to 6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5 to 6
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	n.a.
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	n.a.
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	5 to 6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed	n.a.
		Case-control study—For matched studies, give matching criteria and the number of controls per case	n.a.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6 to 7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6 to 7
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6 to 7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	n.a.
		(*c*) Explain how missing data were addressed	6
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	n.a.
		Case-control study—If applicable, explain how matching of cases and controls was addressed	n.a.
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	n.a.
		(*e*) Describe any sensitivity analyses	7

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	n.a.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	6
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	n.a.
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	n.a.
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	n.a.
		Cross-sectional study—Report numbers of outcome events or summary measures	7
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8
		(*b*) Report category boundaries when continuous variables were categorized	7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n.a.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10
Discussion			
Key results	18	Summarise key results with reference to study objectives	9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9 to 10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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The Association between the Use of Biomedical Services and the Holistic Use of Traditional East Asian Medicine: a National Survey of Outpatients in South Korea

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The Association between the Use of Biomedical Services and the Holistic Use of Traditional East Asian Medicine: a National Survey of Outpatients in South Korea

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Abstract

Objectives: The holistic use of a system of complementary and alternative medicine (CAM) is potentially linked to its treatment outcomes. This paper examines how the use of biomedicine is associated with the holistic use of CAM, focusing on traditional East Asian medicine (EM) that is uniquely integrated in the medical system in South Korea.

Design/Settings: A representative national sample of EM outpatients in South Korea.

Participants: 3,861 survey respondents.

Methods: By using the 2011 Korean National Survey of EM Patients, ordered logistic regression models specify the relationship between EM outpatients' use of biomedicine and their holistic use of EM modalities.

Results: Among EM outpatients who used at least one EM modality in the past three months, people who used two (33.3%) or three (29.4%) modalities together are the two greatest in number, followed by users of four (18.1%), five (7.2%), six (2.1%), and seven (0.6%) modalities. The odds for EM users to use EM holistically are 17% greater among EM users who used biomedicine as well, compared to EM users who did not use biomedicine.

Conclusions: Health care community should recognize that CAM use likely becomes holistic as people use biomedicine concomitantly, when the practice rights over a CAM system are comprehensively and exclusively entitled to a group of CAM professionals who are independent from practitioners of biomedicine.

[Strengths and limitations of this study]

- It uses a national sample of EM users who visited EM facilities across South Korea.
- It specifies several multivariate ordered logistic regression models to support the findings.
- All the measures are based upon self-reports of survey participants.

Introduction

The presence of complementary and alternative medicine (CAM) is substantial in contemporary health care systems around the world.[1,2] The health care community is concerned with the ways in which CAM is integrated in the mainstream biomedicine[3,4] and subsequent health care outcomes that CAM produces. Studies suggest that CAM services be provided holistically so that CAM users can utilize all the related treatment modalities within a whole system of CAM.[5,6] In the literature, the holistic use of a CAM system refers to the utilization behavior of CAM users who use two or more treatment modalities together that constitute the CAM system.[7,8] In the selective and fragmented use, on the contrary, people use only a certain modality of the CAM system and not the other modalities. It is argued that the holistic use can maximize the treatment effects of CAM, compared to the selective and fragmented use of only one modality out of multiple interrelated modalities in the whole system.[8]

This paper aims to investigate what generates this difference in the behavior of CAM users. Drawing on the literature of medical systems, the paper posits that the ways in which CAM is institutionalized in medical systems are consequential for the extent to which CAM users utilize various treatment modalities of a CAM system holistically. In accordance with previous studies,[5-8] the paper defines the holistic use of CAM as CAM users' utilization behavior in which two or more treatment modalities of a CAM system are used together rather than a single modality being used in isolation from the other modalities of the CAM system. When a user resorts to more modalities, its behavior is interpreted to be more holistic.

The paper pursues this investigation by examining the case of a whole system of traditional East Asian medicine (EM) that is composed of multiple treatment modalities, such as acupuncture, moxibustion, cupping, herbal remedies, and acupressure. In particular, the paper develops a specific hypothesis that elaborates the unique institutional condition of EM in South Korea and relates it to the utilization behavior of EM users who may also use biomedical services concomitantly that are readily available in the national health care system of the country. The hypothesis focuses on how the use of biomedical services is associated with the holistic use of EM in the Korean context.

In Korea, the professional practice of EM is comprehensively and exclusively entitled to EM doctors in separation from the professional practice of biomedicine by medical doctors.[9-12] Korea features distinctive systems of education and licensure for EM doctors who are legally permitted to practice the whole range of modalities of EM, independent from medical doctors of biomedicine. The EM doctors even hold the right to practice all the EM modalities in such an exclusive way that doctors of biomedicine do not hold the right to practice any of the EM modalities. Reciprocally, these EM doctors are not allowed to practice biomedicine. This comprehensive sanction of all treatment modalities of EM within the medical system and, at the same time, the exclusive entitlement of the practice rights of these modalities only to EM doctors (and not biomedical doctors) likely project EM to medical service users as a system of medical practices that is distinct and independent from biomedicine. EM is also viewed as a whole medical system that is composed of a variety of interrelated treatment modalities that are readily available for the needs of medical service users.

In this institutional condition in Korea, EM users who co-utilize biomedical services as well are likely those who search for diverse medical resources of different kinds that the national medical system provides for them. These EM users, when compared to EM users who do not use biomedical services and thus do not seek for diverse medical resources, are likely to seek even more diverse modalities that are available within EM itself. Therefore, this paper hypothesizes that the EM users who also use biomedical services are likely to use EM more holistically.

Hypothesis: Among EM users in Korea where certified EM professionals hold the comprehensive and exclusive practice rights over EM, medical service users' use of biomedical services is positively associated with their likelihood of using EM holistically.

Methods

Data come from the 2011 Korean National Survey of EM Patients (NSEMP) that was administered to a nationally representative sample of patients who visited (i.e. outpatients) or were hospitalized (i.e. inpatients) in an EM facility as of September 2011. This survey used the national sampling frame of 12,250 EM facilities that were registered in the national health insurance system. This sampling frame was duly regarded as the national population of EM facilities in Korea, since all medical service providers should be registered in the national insurance system for reimbursement from the national government in the universal Korean health care system. The survey then drew a stratified systematic sample of 471 EM facilities (4% of the sampling frame). At each selected facility, the outpatient questionnaire of the survey was administered to a random sample of 9 outpatients drawn from people in the

waiting area. When the facility was equipped with hospital beds, an additional random sample of 8 inpatients was drawn from the list of inpatients and these inpatients participated in the inpatient questionnaire. As a result, 3,926 outpatients and 1,581 inpatients participated in the survey.

This paper analyzes only the responses from the outpatient EM users, since only the outpatient questionnaire investigated the uses of EM in each of the seven different EM modalities in detail; the inpatient questionnaire investigated whether a respondent ever used any of the EM modalities without differentiating which modality was used. These inpatient responses give no information of which and how many EM modalities were used and, thus, how holistic the EM use was. As a result, the following analysis includes responses from the final sample of 3,861 outpatient EM users. Its difference from the total outpatient participants (65 = 3,926 – 3,861) is due to a further exclusion of 65 inpatient respondents that are missing values in one or more of the variables that are included in the following analysis. This study, which uses publically available survey data, is granted an exemption from requiring ethics approval by the Institutional Review Board of Korea University.

The dependent variable, *the holistic use of EM*, is an ordinal variable that measures the number of different EM modalities that were used together by a respondent in the past three months. It is a composite measure that summarizes responses to seven distinct questions. Each of the seven questions asked whether a respondent used one of the seven EM modalities respectively ("have you used [a specific EM modality] for medical problems in the past three months?"), such as 1) herbal extracts, 2) herbal pills/powders, 3) acupuncture, 4) moxibustion, 5) cupping, 6) chuna, and 7) manual treatments. The response to each question is coded 1 if

yes (0 if not). Thus, the values of the dependent variable range from 1 to 7. The focal independent variable is *the use of biomedical services* which measures whether a respondent visited a biomedical clinic or hospital where biomedical doctors provide medical services for the medical conditions for which the respondent used EM modalities. It is coded 1 if a respondent visited a biomedical clinic or hospital (0 if not).

Table 1. Descriptive Statistics[1)] of Variables Used (N=3,861)

Variable	N	%	Variable	N	%
The Holistic Use of EM			Age		
1	363	9.4	less than 20	143	3.7
2	1,284	33.3	20s or 30s	894	23.2
3	1,135	29.4	40s	762	19.7
4	699	18.1	50s	833	21.6
5	276	7.2	60s	575	14.9
6	82	2.1	70s	522	13.5
7	22	0.6	80s or more	132	3.4
The Use of Biomedical Services			Marital Status		
Yes	1,641	42.5	Single	613	15.9
No	2,220	57.5	Married	2,783	72.1
EM Use Frequency[2)]			Widowed/Divorced/Separated	440	11.4
1 to 3 times	1,389	36.0	Others	25	0.6
4 to 10 times	1,289	33.4	Education		
11 to 30 times	885	22.9	No formal education	279	7.2
30 times or more	298	7.7	Elementary school	557	14.4
Self-Rated Health Status			Middle school	467	12.1
Very bad	103	2.7	High school	1,215	31.5
Bad	1,010	26.2	College or graduate school	1,343	34.8
Fair	1,651	42.8	Household Income		
Good	983	25.5	less than 1 million wons	733	19.0
Very good	114	3.0	1 to 1.9 million wons	789	20.4
Gender			2 to 2.9 million wons	831	21.5
Male	1,161	30.1	3 to 3.9 million wons	615	15.9
Female	2,700	69.9	4 to 4.9 million wons	446	11.6
			5 million wons or more	447	11.6

Note: [1)] The socio-demographic characteristics of EM users show that EM is being used very widely across different social groups in age, education, and income. [2)] This refers to how many times a respondent has used EM services in the past three months. It is certain that, when a respondent uses EM less often, the respondent is less likely to use different treatment modalities of EM. However, a respondent who uses EM very often does not necessarily utilize different treatment modalities (e.g. a respondent who uses only acupuncture many times).

A set of potential covariates, which may intervene in the relationship between holistic EM use and the use of biomedical services, are incorporated in the analysis as control variables. These control variables are the frequency of EM use, self-rated health status, gender, age, marital status, the highest level of education, and monthly household income (Table 1 for

descriptive statistics). This paper uses ordered logistic regression models to test the hypothesis about the relationship between holistic EM use and the use of biomedical services, since it interprets different values in the dependent variable as ordered categories that refer to the extent of holistic EM use. Results from negative binomial regression models, which treat the dependent variable as a count measure, agree with the results reported here. For comparison, results from negative binomial regression models are reported in Table A1 in the Appendix.

Results

Among all current outpatient EM users who used at least one EM modality in the past three months, EM users who used two or three modalities are the two greatest in number, followed by those who used four, five, six, and seven modalities. The proportion of EM users who used only one modality is only 9.4%. It turns out that more than 90% of current EM outpatients in Korea used multiple EM modalities together when they ever resorted to EM.

Close to a half of these EM users (42.5%) also used biomedical services by visiting a biomedical clinic or hospital. In addition, the bivariate tabulation on the relationship between the extent of holistic EM use and the use of biomedical services shows that there is a positive relationship between the two; EM users who utilized various EM modalities more holistically were more likely to use biomedical services as well (Table 2). Put differently, EM users who also used biomedical services were more likely to utilize EM modalities holistically than EM users who did not use biomedical services.

Table 2. The Bivariate Association between the Use of Biomedical Services and the Holistic Use of Traditional East Asian Medicine (EM)

		The Use of Biomedical Services		
		No	Yes	Total
The Holistic Use of EM (# of EM Modalities Used)	1	227 (62.5)	136 (37.5)	363 (100.0)
	2	766 (59.7)	518 (40.3)	1284 (100.0)
	3	654 (57.6)	481 (42.4)	1135 (100.0)
	4	389 (55.6)	310 (44.4)	699 (100.0)
	5	138 (50.0)	138 (50.0)	276 (100.0)
	6	39 (47.6)	43 (52.4)	82 (100.0)
	7	7 (31.8)	15 (68.2)	22 (100.0)
	Total	2,220 (57.5)	1641 (42.5)	3,861 (100.0)

Note: Percentages in parentheses. Pearson's χ^2 (6) = 22.8001; p-value = 0.001.

Table 3. Ordered Logistic Regression Models of Holistic EM Use upon the Use of Biomedical Services and Other Covariates

	Model 1		Model 2		Model 3		Model 4	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Biomedical Service Use	1.27***	(1.13-1.42)	1.18**	(1.05-1.33)	1.23***	(1.09-1.38)	1.17**	(1.04-1.31)
EM Use Frequency (Ref = 1 to 3 times)								
4 to 10 times			2.29***	(2.00-2.64)			2.30***	(2.00-2.65)
11 to 30 times			3.38***	(2.90-3.96)			3.45***	(2.93-4.06)
31 or more times			3.40***	(2.71-4.27)			3.53***	(2.78-4.47)
Self-Rated Health Status (Ref = Very good)								
Very bad					0.88	(0.54-1.43)	0.58*	(0.35-0.95)
Bad					1.32	(0.93-1.88)	0.92	(0.64-1.32)
Fair					1.10	(0.78-1.55)	0.84	(0.59-1.19)
Good					0.91	(0.64-1.29)	0.78	(0.55-1.11)
Female							1.09	(0.96-1.24)
Age (Ref = less than 20)								
20s or 30s							2.96***	(1.98-4.44)
40s							3.28***	(2.13-5.05)
50s							3.06***	(2.00-4.70)
60s							2.45***	(1.58-3.79)
70s							2.29***	(1.46-3.58)
80s or more							2.33**	(1.37-3.97)
Marital Status (Ref = Single)								
Married							1.12	(0.91-1.39)
Widowed/Divorced/Separated							1.13	(0.83-1.52)
Others							1.08	(0.50-2.34)
Education (Ref = No formal education)								
Elementary school							1.05	(0.80-1.38)
Middle school							0.92	(0.68-1.25)
High school							0.97	(0.72-1.31)
College or graduate school							0.90	(0.66-1.24)
Household Income (Ref = less than 1 million wons)								
1 to 1.9 million wons							1.00	(0.82-1.22)
2 to 2.9 million wons							0.95	(0.77-1.17)
3 to 3.9 million wons							1.02	(0.81-1.28)
4 to 4.9 million wons							1.05	(0.82-1.35)
5 million wons or more							1.19	(0.92-1.54)
Observations	3,861		3,861		3,861		3,861	

Note: significant at 0.05 (*), 0.01 (**), 0.001 (***).

Model 1 in Table 3 puts this bivariate association in odds ratio and finds it to be statistically significant. The odds for EM users who also used biomedical services to utilize EM holistically are greater than those for EM users who did not use biomedical services (OR=1.27; 95% CI=1.13–1.42). The two subsequent models show that this association remains the same when respondents' frequency of EM use is controlled (Model 2) or when respondents' health status is controlled (Model 3). The final Model 4 incorporates these two confounders together and other possible confounders as control variables; the positive association between holistic EM use and the use of biomedical services still persists. In this final model, the odds for EM users who also used biomedicine to use EM holistically are 17% greater than those for EM users who did not use biomedicine (OR=1.17; 95% CI=1.04–1.31). These results support the hypothesis unambiguously.

Discussion

This paper found that people who used biomedicine were more likely to use EM holistically in South Korea. Among EM outpatients who used at least one EM modality in the past three months, people who used two or three modalities together are the two greatest in number, followed by users of four, five, six, and seven modalities. The odds for EM users to use EM holistically are greater among EM users who used biomedicine as well, compared to EM users who did not use biomedicine. It is a limitation of this study that it used measures based on self-reports of survey participants. However, it is worth noting that the paper used a national sample of EM users who visited EM facilities across South Korea and specified multivariate regression models to show the robustness of these findings.

To our knowledge, this is the first study in the global medical community that examines how the use of biomedical services is associated with the extent to which the users of CAM utilize various modalities of a CAM system holistically. It is surprising that this line of inquiry has been neglected in the literature, in spite of a potential link between the holistic-vs-selective utilization of a CAM system and its health care outcomes. Furthermore, it is very probable that CAM users shape their specific ways of using CAM in relation with biomedical services that are available to them. In this sense, this paper contributes to developing a much-needed analytical perspective that elaborates CAM utilization behavior beyond existent studies of the simple utilization rate and the popularity of CAM.[13-19]

As such, this perspective has grown out of a group of studies that investigate the complementary-versus-substitutive relationship between CAM use and biomedicine use.[9,20-23] Whereas these existing studies have investigated whether the utilization of fragmented CAM modalities increases or decreases the utilization of biomedical services by comparing the behavior of CAM users to the behavior of non-users, this paper originally focuses on CAM users only and investigates how their CAM utilization behavior is shaped by their use (vs. non-use) of biomedical services. In this sense, this paper provides CAM-centered evidence to the complementarity-versus-substitution debate; its finding suggests that CAM use can be complementary to biomedicine to the extent that users rely on a variety of treatment modalities within a CAM system even when they use biomedical services (i.e. the holistic co-utilization of CAM).

The findings in this paper suggest that the knowledge of how CAM is institutionalized in a medical system can generate reasonable predictions about how CAM users behave. It is

known that the various modalities of EM are disconnected from one another in the Japanese medical system so that only herbal remedies are selectively incorporated into the practices of biomedical doctors;[24-28] acupuncture and acupressure are each relegated as pseudo-medicine to medical technicians, such as acupuncturists and massage therapists who are permitted to practice only acupuncture and massage therapies. These technicians are not allowed to practice herbal remedies or other EM modalities. Similar observations are made that the otherwise rich practices of acupuncture are truncated and simplified in the dominant biomedical health care systems in the U.S.[29-31] and the U.K.[32] In the contemporary French biomedical system, a variety of CAM systems are reported to become "balkanized" and their constituent treatment modalities are torn apart from one another in practice.[33] In these institutional contexts, this paper suggest, the intersection of a CAM system with biomedicine can result in the fragmented and partial use of the CAM system as people use biomedical services concomitantly.

Conclusions

Health care community should recognize that CAM use likely becomes holistic as people use biomedicine concomitantly, when the practice rights over a CAM system are comprehensively and exclusively entitled to a group of CAM professionals who are independent from practitioners of biomedicine. This conclusion is based upon the experiences of EM users in Korea. It will take more research to generalize this finding against other institutional contexts and, at the same time, to discern any cross-national differences. A comparative study between the East Asian countries, such as China, Korea, and Japan where EM originated and is institutionalized differently, will shed more light.

The authors recommend that the CAM-centered perspective, asking how CAM use is reconstructed by biomedicine use, is especially relevant to studying CAM utilization behavior in societies where a relatively coherent system of CAM has existed for quite some time (e.g. traditional Indian medicine in the U.S., traditional African medicine in Africa, Ayurveda and Indian medical traditions in India, etc.). The international medical community will gain a lot from these future studies. It will gain even more from the studies when the link between the holistic-versus-selective use of CAM and its varying health care outcomes is examined further.

Appendix

[Table A1]

Contributorship Statement

JMS conceived the study, analyzed the data, and wrote the manuscript. YSL helped conceive the study, modify the data analysis, and revise the manuscript.

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Competing Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Data Sharing Statement

The data are available from the corresponding author upon request.

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Table A1. The Replication of Table 3 in Negative Binomial Regression Models

	Model 1		Model 2		Model 3		Model 4	
	coeff.	(95% CI)	coeff.	(95% CI)	coeff.	(95% CI)	coeff.	(95% CI)
Biomedical Service Use	0.06**	(0.02-0.10)	0.04*	(0.01-0.08)	0.05**	(0.02-0.09)	0.04*	(0.01-0.08)
EM Use Frequency (Ref = 1 to 3 times)								
4 to 10 times			0.19***	(0.14-0.23)			0.18***	(0.14-0.23)
11 to 30 times			0.27***	(0.22-0.32)			0.28***	(0.22-0.33)
31 or more times			0.27***	(0.20-0.35)			0.28***	(0.21-0.36)
Self-Rated Health Status (Ref = Very good)								
Very bad					-0.02	(-0.18-0.14)	-0.11	(-0.27-0.06)
Bad					0.06	(-0.06-0.17)	-0.02	(-0.14-0.10)
Fair					0.02	(-0.09-0.13)	-0.04	(-0.15-0.08)
Good					-0.02	(-0.13-0.10)	-0.05	(-0.17-0.07)
Female							0.02	(-0.02-0.06)
Age (Ref = less than 20)								
20s or 30s							0.24***	(0.10-0.38)
40s							0.26***	(0.11-0.41)
50s							0.25***	(0.10-0.39)
60s							0.21**	(0.05-0.36)
70s							0.18*	(0.03-0.33)
80s or more							0.17	(-0.01-0.35)
Marital Status (Ref = Single)								
Married							0.03	(-0.04-0.10)
Widowed/Divorced/Separated							0.03	(-0.06-0.13)
Others							-0.02	(-0.32-0.28)
Education (Ref = No formal education)								
Elementary school							0.00	(-0.09-0.09)
Middle school							-0.02	(-0.12-0.08)
High school							-0.01	(-0.11-0.09)
College or graduate school							-0.02	(-0.12-0.09)
Household Income (Ref = less than 1 million wons)								
1 to 1.9 million wons							0.01	(-0.06-0.07)
2 to 2.9 million wons							-0.00	(-0.07-0.06)
3 to 3.9 million wons							0.00	(-0.07-0.08)
4 to 4.9 million wons							0.02	(-0.06-0.10)
5 million wons or more							0.04	(-0.05-0.12)
Constant	1.04***	(1.01-1.06)	0.89***	(0.85-0.93)	1.02***	(0.91-1.13)	0.67***	(0.49-0.85)
Observations		3,861		3,861		3,861		3,861

Note: significant at 0.05 (*), 0.01 (**), 0.001 (***).

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2 to 3
Objectives	3	State specific objectives, including any prespecified hypotheses	3 to 4
Methods			
Study design	4	Present key elements of study design early in the paper	4 to 6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4 to 6
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	n.a.
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	n.a.
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	4 to 6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed	n.a.
		Case-control study—For matched studies, give matching criteria and the number of controls per case	n.a.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5 to 6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5 to 6
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5 to 6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6
		(*b*) Describe any methods used to examine subgroups and interactions	n.a.
		(*c*) Explain how missing data were addressed	5
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	n.a.
		Case-control study—If applicable, explain how matching of cases and controls was addressed	n.a.
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	n.a.
		(*e*) Describe any sensitivity analyses	6

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	n.a.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	5
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	n.a.
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	n.a.
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	n.a.
		Cross-sectional study—Report numbers of outcome events or summary measures	6
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7
		(*b*) Report category boundaries when continuous variables were categorized	6
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n.a.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	8
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8 to 9
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.