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Validity and Reliability of the Persian Version of the Council on Nutrition Appetite Questionnaire and Its Simplified Version in Iranian Community-Dwelling Older Adults

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ABSTRACT

Background: It is important to use a valid and reliable tool to measure appetite in practice and clinical research. This study aims to evaluate the characteristics, reliability, and validity of the Persian version of the Council on Nutrition Appetite Questionnaire (CNAQ) and Simplified Nutritional Appetite Questionnaire (SNAQ). **Methods:** After assessing the content validity of CNAQ and SNAQ questionnaires by both a group of experts and participants, the reliability and validity of the Persian version of these questionnaires among 250 community-dwelling elderlies (≥ 65 years, non-hospitalized in nursing homes or hospitals) were assessed. Pearson's correlation coefficient between the appetite questionnaires and Mini Nutritional Assessment (MNA), weight, and body mass index (BMI) were evaluated. In addition, the internal reliability of the SNAQ and CNAQ was evaluated by Cronbach's alpha coefficient. Factor analysis was also performed. **Results:** According to CNAQ, 142 (56.8%) participants and according to SNAQ, 124 (49.6%) participants had poor appetite ($P = 0.0001$). Both CNAQ and SNAQ were significantly associated with the MNA score ($r = 0.57$ and 0.64 , respectively, $P = 0.001$). Appetite also had a significant, but moderate correlation with weight ($r = 0.38$ and 0.31 for CNAQ and SNAQ, respectively) and BMI ($r = 0.39$ and 0.36 for CNAQ and SNAQ, respectively), and Cronbach's alpha coefficient was 0.74 for CNAQ and 0.70 for SNAQ. The confirmatory factor analysis (CFA) demonstrated that the CNAQ and SNAQ were both constructed of one factor (appetite). **Conclusions:** The Iranian version of CNAQ and SNAQ are both simple and applicable tools to assess the appetite of Iranian community-dwelling older adults.

Keywords: Elderly; CNAQ; SNAQ; Appetite; Reliability; Validity

Introduction

Malnutrition is a universal public health concern. Malnutrition (undernutrition) is caused by poor nutrient intake, and metabolic dysregulation stemming from acute or chronic inflammation. Although undernutrition is present in all age groups, its prevalence appears to increase

with age (Ferreira *et al.*, 2011, Schilp *et al.*, 2012). The prevalence of undernutrition in older community-dwelling people ranges between 1.3% and 47.8%, which has been reported to be much higher in studies performed in low-and middle-income countries (Margetts *et al.*, 2003, Vedantam

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et al., 2010). One of the important factors leading to malnutrition among the elderly, is loss of appetite, caused by both age-related health status (impaired sense of smell and taste, mental/psychological disorders, etc.) and socioeconomic factors, including living alone and sparse or loss of family relationships and social/community communication (Hughes *et al.*, 2004, Mann *et al.*, 2013, Okamoto *et al.*, 2007, Roque *et al.*, 2013). Poor appetite of geriatrics, which is also called the anorexia of aging, is as prevalent as 15-30% among community-dwelling elderlies, and is associated with malnutrition, low physical performance, sarcopenia, depression, and deterioration of cognitive function (Engel *et al.*, 2011, Landi *et al.*, 2010, Okamoto *et al.*, 2007). Screening of poor appetite, and its early detection and treatment may prevent weight loss and malnutrition, ensure adequate energy intake, improve health outcomes, and reduce mortality in the elderly.

In 2005, Wilson *et al.* (Wilson *et al.*, 2005) developed the Council on Nutrition Appetite Questionnaire (CNAQ) using the Delphi method for assessment of the appetite loss in adult and elderly patients in Long-Term Care (Table 1). They assessed the reliability and validity of this 8-itemed questionnaire using an external assessment tool (the Appetite, Hunger and Sensory Perception Questionnaire (de Jong *et al.*, 1999)) as the reference standard. After a while, The Simplified Nutritional Appetite Questionnaire (SNAQ), which retains items #1, #2, #4, and #6 from the CNAQ, was developed and routinely used for appetite assessment in young and older adults (including patients) worldwide (İlhan *et al.*, 2018, Oh *et al.*, 2019, Shimizu *et al.*, 2021, Tokudome *et al.*, 2017).

SNAQ was translated into Persian in 2019 and was confirmed to be a reliable and valid tool to assess appetite among middle aged women seeking weight-reduction (Mohammadi *et al.*, 2019). In the present study, we aimed to check the reliability and validity of both CNAQ and SNAQ among the Iranian community-dwelling older adults, the population for whom these questionnaires were first developed. In this study after translation and back translation of SNAQ and CNAQ, their reliability

and validity were investigated in regards to the well-known malnutrition screening test that is mini nutrition assessment (MNA).

Table 1. CNAQ and its short version.

- 1. My appetite is**
 - a very poor
 - b poor
 - c average
 - d good
 - e very good
- 2. When I eat...**
 - a. I feel full after eating only a few mouthfuls
 - b. I feel full after eating about a third of a meal
 - c. I feel full after eating over half a meal
 - d. I feel full after eating most of the meal
 - e. I hardly ever feel full
- 3. I feel hungry...**
 - a. rarely
 - b. occasionally
 - c. some of the time
 - d. most of the time
 - e. all of the time
- 4. Food tastes...**
 - a. very bad
 - b. bad
 - c. average
 - d. good
 - e. very good
- 5. Compared to when I was younger, food tastes...**
 - a. much worse
 - b. worse
 - c. just as good
 - d. better
 - e. Much better
- 6. Normally I eat...**
 - a less than one meal a day
 - b one meal a day
 - c two meals a day
 - d three meals a day
 - e more than three meals a day
- 7. I feel sick or nauseated when I eat...**
 - a. most times
 - b. often
 - c. sometimes
 - d. rarely
 - e. never
- 8. Most of the time my mood is...**
 - a. very sad
 - b. sad
 - c. neither sad nor happy
 - d. happy
 - e. very happy

SNAQ is consisted of items #1, #2, #4, and #6 of CNAQ.

Materials and Methods

Participants: During the period from November 2020 to May 2021, 250 community-dwelling older adults living in Tehran, Iran, were recruited in this study through convenience sampling. The exclusion criteria were being less than 65 years of age, being hospitalized in nursing homes or hospitals, suffering from Alzheimer's disease, dementia or dysphagia, using appetite suppressant drugs, and dependence on wheelchair. None of the participants were receiving enteral tube feeding or parenteral nutrition.

Translation and back translation of CNAQ and SNAQ: As first, linguistic validity of the original version of the questionnaires was checked through translation from English to Persian using the standard translation-re-translation method (Del Greco *et al.*, 1987). CNAQ comprised eight items: appetite, feeling full, feeling hunger, food tastes, food tastes compared to when younger, meal frequency per day, feeling sick or nauseated when eating, and usual mood (**Table 1**). SNAQ consisted of questions regarding appetite, the amount eaten at each meal, the taste of food, and the number of meals eaten per day. Each item included five graded answers (a-e) based on a 5-point Likert scale. The total score ranged from 4 to 40 for CNAQ and 4-20 for SNAQ, with higher scores indicating a better appetite. In this study, with the permission of the original author, the original version of the questionnaires was translated from English to Persian by two certified translators, then the Persian versions were translated into English by two independent translators who were blinded to the original questionnaire. Finally, a coordinator put together the Persian and English translations and obtained the final Persian version of the questionnaires, which were revised and approved by the research committee.

Data collection: Age, sex, weight, height, education, marital status, occupation, smoking status, supplement intake, and results of the Iranian version of CNAQ and SNAQ plus MNA were collected through an online form.

Content validity: To assess the content validity of

Persian version of CNAQ and SNAQ, the questionnaires were sent to eight experts in the field of geriatrics and nutrition via email, and they were asked to evaluate the questionnaires according to their relevancy to the purpose of the questionnaire (appetite) and whether or not they were suitable to be used among the indigenous Iranian population. Also, to ensure the clarity of the questionnaires face validity was performed as well. Twenty elderly were invited to a group discussion session and were asked to give their opinion on the comprehension and cultural relevance of the questionnaire.

Construct validity: Confirmatory factor analysis (CFA) was used to probe fitting to the model for the CNAQ and SNAQ using goodness of fit index (GFI), adjusted GFI (AGFI), and a root mean square error of approximation (RMSEA). The PASW Statistics 18 and Release Version 19.0.0 were used to analyze the data. Exploratory Factor Analysis (EFA) was also used to assess the dimensionality of the Iranian version of CNAQ and SNAQ and factors were extracted through Principal Component Analysis (Chan and Idris, 2017). The Kaiser criteria (Eigenvalues >1) was used for analysis extraction of the principal axis factors (Braeken and Van Assen, 2017). The factor structure was determined by attributing any items with a factor loading of >0.4 to a specific factor (Sties *et al.*, 2012). To test for concurrent validity, Spearman's correlation was used to test the agreement between CNAQ and SNAQ and MNA. According to the correlation results, values between 0.1-0.29 were interpreted as weak, 0.3-0.49 as moderate, 0.50- 0.10 as almost perfect (Cohen, 1988).

Reliability: Cronbach's alpha coefficient was used as an index of internal consistency. The internal consistency values of 0.5 and above were considered acceptable (Brown, 2002). SPSS version 24 (IBM Corp, Released 2015, IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.) were used for statistical analysis. $P < 0.05$ was considered to be statistically significant.

Ethical considerations: All men and women were provided written informed consent prior to participation. The study protocol was approved by

the Ethics Committee of the Iran University of Medical Sciences (ethics code: IR.IUMS.REC.1398.996).

Results

Participants' characteristics: There were 110 men (44%) and 140 women (56%) (**Table 2**). The mean age was 69.60 ± 6.36 years and men (68.38 ± 5.42 years) were younger than women (70.57 ± 6.89 years). Mean heights and body weights were higher in men ($P = 0.014$ and $P = 0.002$, respectively), but body mass index (BMI) did not significantly differ between the sexes ($P = 0.89$). Most men (55%) and most women (36%) were characterized as overweight. Based on the score of the MNA questionnaire, women had a more vulnerable nutritional status than men, such that 61.8% of women and 18.9% of men were at risk of malnutrition, and 2.7% of men and 8.8% of women were malnourished ($P = 0.0001$). The results of CNAQ and SNAQ were almost similar in women, in which 67.6% and 65.5% of women had poor appetite, respectively. Regarding men, 43.2% based on CNAQ, and 29.7% based on SNAQ were anorexic. **Table 3** shows that the mean scores of CNAQ and SNAQ were higher in men than women (CNAQ: 29.05 ± 2.78 and 25.94 ± 4.15 ; SNAQ: 15.39 ± 1.84 and 13.38 ± 2.33 for men and women, respectively), indicating that men had a better appetite than women.

Validity: In terms of concurrent validity, the CNAQ and SNAQ were significantly associated with weight, BMI, and the MNA score. **Table 4** shows that the Pearson's correlation coefficients between the CNAQ and nutritional status is

moderate in men ($r = 0.46$), and perfect in women ($r = 0.62$). The correlation between CNAQ and BMI was also weak among men ($r = 0.29$), while it was moderate among women ($r = 0.36$). Weight was moderately correlated with CNAQ in men and women ($r = 0.38$ and $r = 0.36$, respectively, $P = 0.001$). The same results were observed for SNAQ ($P = 0.001$). Overall, CNAQ and SNAQ were perfectly correlated with MNA, but moderately correlated with weight and BMI. CFA is represented in **Table 5**. The GFI and AGFI values for the CNAQ and SNAQ were >0.9 , indicating a good fit model. The RMSEAs of the CNAQ and SNAQ were 0.064 and 0.080, respectively. **Table 6** showed EFA that the Iranian versions of CNAQ and SNAQ were unifactorial. A single factor was identified for both CNAQ and SNAQ with an Eigenvalue greater than 1.0, explaining 50.0% of the total variance in the questionnaires. All items presented a factorial load above 0.4. The explained variances for the respective factor 1 were 26.21 and 32.64 for CNAQ and SNAQ, respectively.

Reliability: The reliability of CNAQ measured by Cronbach's alpha coefficient was 0.7 for men, women, and total sample, which is well acceptable. Cronbach's alpha coefficient was 0.7 for SNAQ, which is also acceptable. Overall, the results showed an acceptable level of internal consistency for all items of CNAQ and SNAQ (**Table 7**), and they were homogenous. Furthermore, no items needed to be removed to increase the internal consistency.

Table 2. Characteristics of the participants.

Variables		Men (n=110)	Women (n= 140)	Total (n=250)	P-value ^b
Quantitative variables					
Age (year)		68.38 ± 5.42 ^a	70.57 ± 6.89	69.60 ± 6.36	0.007
Weight (kg)		79.49 ± 11.72	69.10 ± 14.42	73.71 ± 14.24	0.002
Height (cm)		171.14 ± 7.29	159.17 ± 6.48	164.48 ± 9.08	0.01
Body mass index (kg/m ²)		27.20 ± 3.94	27.28 ± 5.13	27.25 ± 4.63	0.89
Qualitative variables					
		N (%)	N (%)	N (%)	
Weight status	Underweight	3 (2.7)	7 (5.0)	10 (4.0)	0.01
	Normal	20 (18.0)	46 (33.1)	66 (26.4)	
	Overweight	61 (55.0)	50 (36.0)	111 (44.4)	
	Obese	27 (24.3)	36 (25.9)	63 (25.2)	
Education	Under diploma	43 (38.7)	97 (69.8)	140 (56.0)	0.0001
	Diploma	34 (30.6)	33 (23.7)	67 (26.8)	
	BSc	13 (11.7)	9 (6.5)	22 (8.8)	
	MSc & higher	21 (18.9)	0 (0.0)	21 (8.4)	
Marital status	Married	91 (82.0)	59 (42.4)	150 (60.0)	0.0001
	Single	14 (12.6)	5 (3.6)	19 (7.6)	
	Widowed	3 (2.7)	71 (51.1)	74 (29.6)	
	Divorced	3 (2.7)	4 (2.9)	7 (2.8)	
Job	Housewife	3 (2.7)	101 (72.7)	104 (41.6)	0.0001
	Clerk	16 (14.4)	13 (9.4)	29 (11.6)	
	Free	67 (60.4)	10 (7.2)	77 (30.8)	
	Others	25 (22.5)	15 (10.8)	40 (16.0)	
Smoking	Yes	23 (20.7)	10 (7.2)	33 (13.2)	0.002
	No	88 (79.3)	129 (92.8)	217 (86.8)	
Supplement intake	Yes	35 (31.5)	79 (56.8)	114 (45.6)	0.0001
	No	76 (68.5)	60 (43.2)	136 (54.4)	
MNA	Malnourished	3 (2.7)	12 (8.8)	15 (6.0)	0.0001
	At risk	21 (18.9)	84 (61.8)	105 (42.0)	
	Well-nourished	87 (78.4)	40 (29.4)	127 (50.0)	
SNAQ	Poor appetite	33 (29.7)	91 (65.5)	124 (49.6)	0.0001
	Good appetite	78 (70.3)	48 (34.5)	126 (50.4)	
CNAQ	Poor appetite	48 (43.2)	94 (67.6)	142 (56.8)	0.0001
	Good appetite	63 (56.8)	45 (32.4)	108 (43.2)	

^a: Mean ± SD; ^b: Student *t*-test used for quantitative and Chi-square test used for qualitative variables; MNA: Mini-Nutritional Assessment; SNAQ: Simplified Nutritional Appetite Questionnaire; CNAQ: Council on Nutrition Appetite Questionnaire.

Table 3. Mean, standard deviation, minimum and maximum score for each item of the CNAQ and SNAQ.

Items	Men (n=110)			Women (n=140)			Total (n=250)		
	Mean	SD	Min-max	Mean	SD	Min-max	Mean	SD	Min-max
#1	3.77	0.84	2-5	3.05	0.89	1-5	3.37	0.94	1-5
#2	3.70	0.56	3-5	2.94	1.14	1-5	3.28	1.00	1-5
#3	2.98	0.63	2-4	2.81	0.77	1-5	2.88	0.72	1-5
#4	3.94	0.47	3-5	3.73	0.62	3-5	3.82	0.57	3-5
#5	2.98	0.80	1-5	2.85	0.79	2-5	2.91	0.79	1-5
#6	3.98	0.60	2-5	3.68	0.63	2-5	3.81	0.63	2-5
#7	4.53	0.74	3-5	3.94	1.04	1-5	4.20	0.96	1-5
#8	3.16	0.56	2-4	2.96	0.96	1-5	3.05	0.82	1-5
CNAQ	29.05	2.78	24-35	25.94	4.15	16-34	27.32	3.92	16-35
SNAQ	15.39	1.84	12-19	13.38	2.33	8-19	14.28	2.34	8-19

SNAQ: Simplified Nutritional Appetite Questionnaire; CNAQ: Council on Nutrition Appetite Questionnaire; SNAQ is consisted of items #1, #2, #4, and #6 of CNAQ.

Table 4. Correlations coefficient between CNAQ and SNAQ and weight, body mass index (BMI) and MNA.

		Men			Women			Total		
		Weight	BMI	MNA	Weight	BMI	MNA	Weight	BMI	MNA
CNAQ	Correlation	0.38	0.29	0.46	0.24	0.36	0.62	0.38	0.31	0.64
	P-value	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SNAQ	Correlation	0.39	0.43	0.38	0.29	0.39	0.52	0.42	0.36	0.57
	P-value	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

SNAQ: Simplified Nutritional Appetite Questionnaire; CNAQ: Council on Nutrition Appetite Questionnaire; BMI: body mass index; MNA: mini nutritional assessment.

Table 5. Confirmatory factor analyses.

Appetite questionnaire	GFI	AGFI	RMSEA
CNAQ	0.982	0.931	0.064
SNAQ	0.991	0.976	0.080

AGFI: adjusted goodness of fit index; Council on Nutrition Appetite Questionnaire; GFI: goodness of fit index; RMSEA: root mean square error of approximation; SNAQ: Simplified Nutritional Appetite Questionnaire

Table 6. Exploratory factor analyses.

Questions	Items	CNAQ factor loading	SNAQ factor loading
1	Appetite	0.99	0.91
4	Food taste	0.97	0.77
2	Feeling full	0.94	0.74
5	Food taste compared to when younger	0.90	-
3	Feeling hunger	0.71	-
8	Usual mood	0.59	-
6	Meal frequency a day	0.46	0.43
7	Feel sick when eating	0.42	-
Sum of factor loading values		5.98	2.85
Explained variance (%) of respective factor 1		26.21	32.64

Factor extraction method: Maximum likelihood method; Items listed according to the order of factor loading values of the CNAQ.

Table 7. Cronbach's a coefficient by appetite questionnaire.

Questionnaires	Male (n=110)	Female (n=140)	Total (n=250)
CNAQ	0.73	0.74	0.74
SNAQ	0.69	0.65	0.70

CNAQ, Council on Nutrition Appetite Questionnaire; SNAQ: Simplified Nutritional Appetite Questionnaire.

Discussion

The CNAQ and SNAQ were translated and back-translated into Persian and assessed their reliability and validity in Iranian community-dwelling older adults. An EFA showed that the CNAQ and SNAQ were constructed of one factor (appetite). Both CNAQ and SNAQ demonstrated satisfactory reliability and significant validity with

MNA, whereas they manifested less satisfactory validity with BMI and weight.

According to Wilson *et al.*, a CNAQ score ≤ 28 and the SNAQ score ≤ 14 may predict being "at risk" of a 5%-10% weight reduction (Wilson *et al.*, 2005). In this study, unlike men, older women were found to be at risk of malnutrition according to both CNAQ (25.94 ± 4.15) and SNAQ ($13.38 \pm$

2.33). This is in accordance with previous investigations among the Iranian elderly population, who found the prevalence of malnutrition to be higher among older women (Aliabadi *et al.*, 2008, Nazemi *et al.*, 2015).

When the items of the questionnaires were analyzed separately, item 4 received a score of 3 to 5 and item 6 received a score of 2 to 5, indicating that the participants did not find the taste of food bad or very bad, and ate at least one meal a day. The scores of other items ranged from their minimum to the maximum (1–5). Females were generally more likely to give lower scores to most of the items.

Both SNAQ and CNAQ reached a satisfactory level of Cronbach's coefficient (> 0.70) in the present study. However, Cronbach's α was slightly lower in females (0.65) than males (0.69) regarding SNAQ. Nakatsu *et al.* evaluated the reliability and validity of the Japanese version of the SNAQ among 84 older people in the community (Nakatsu *et al.*, 2015). They reported a Cronbach's α coefficient of 0.5 for this questionnaire. İlhan *et al.* evaluated the reliability and validity of the Turkish version of SNAQ among geriatric outpatients (İlhan *et al.*, 2018). They reported a Cronbach's alpha coefficient of 0.522. Sties *et al.* (Sties *et al.*, 2012) assessed the reliability of SNAQ among participants in a cardiopulmonary and metabolic rehabilitation program in Brazil, and reached an internal consistency of 0.61 (Sties *et al.*, 2012). In another study conducted in Japan, Cronbach's alpha coefficient was calculated to be 0.73 for the CNAQ and 0.64 for SNAQ (Tokudome *et al.*, 2017). The lower Cronbach's alpha for SNAQ in comparison to CNAQ might be due to the fact that SNAQ limited the number of items (4 vs 8), which was associated with lower Cronbach's alpha values of instruments in general (Bland and Altman, 1997).

Through CFA, all the items of the questionnaires were unified and loaded on one factor entitled "appetite". Also, all items of both questionnaires had a factorial load higher than 0.4. Similarly, Sties *et al.* reported factor loadings of above 0.40 for all items of SNAQ (Sties *et al.*,

2012). Mohammadi *et al.* reported factor loadings of above 0.68 for SNAQ, which is even higher than the original version of the questionnaire (0.51) (Mohammadi *et al.*, 2019). In the study of Tokudome *et al.*, all factor loadings for CNAQ were above 0.4, except for item #6 (meal frequency per day) (Tokudome *et al.*, 2017). Hence, they decided to omit this item from SNAQ and create SNAQ-JE, in which item #8 of CNAQ was replaced item #6.

Regarding concurrent validity, the association of SNAQ and CNAQ with nutritional status, weight, and BMI was investigated. The results of the present study showed that both SNAQ and CNAQ had an adequate association with MNA although this association was stronger in women than men. Rolland *et al.* similarly showed that the total SNAQ score was associated with MNA (Rolland *et al.*, 2012). On the other hand, Nakatsu *et al.* and Tokudome *et al.* found a correlation coefficient of ≤ 0.3 among SNAQ and CNAQ and MNA. However, they used the short version of MNA (MNA-SF) (Nakatsu *et al.*, 2015, Tokudome *et al.*, 2017). The hypothesis that SNAQ and CNAQ would correlate with weight and BMI was also weakly approved by the present study, resembling the result of the study of Mohammadi *et al.* (Mohammadi *et al.*, 2019). This could be understandable, as these questionnaires predict weight loss and malnutrition in the future, and the participants may already have a normal weight and BMI. Also, the fact that the correlation was assessed among the community-dwelling older adults could have affected this result.

This study had some limitations. First, the researchers could not follow the participants for six months to examine the actual ability of SNAQ and CNAQ in predicting malnutrition and weight loss. Also, the participants were not asked about the medication they were using. This could have affected the results, as some medications could increase or decrease the appetite. Another limitation of this study was the online forms used to obtain the data. Given that this project was performed during the COVID-19 epidemic, face to face interview was not feasible, and hence, the

robustness of the data regarding anthropometric indices was questionable. The strength of the present study was the adequate sample size for the analysis, including both men and women in this study and performing both EFA and CFA.

Conclusion

This study showed that the SNAQ and CNAQ have sufficient reliability and validity and are simple and useful measurement tools that can be used to assess the appetite of community-dwelling older adults in Iran. Further research is required for adaptation with different age groups, and to determine the perfect cut-off point for predicting weight loss.

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Conflict of interest

The authors declare that there is no conflict of interest.

Authors' contributions

The concept of the study was developed by Sajadi Hezaveh Z and Mohammadreza V. Data acquisition was done by Golafrouz H and Piran A. Sajadi Hezaveh Z participated in statistical analysis and interpretation of the data. Golafrouz H and Piran A drafted the paper. All authors critically revised the manuscript and provided the final approval of the version to be published. All authors are accountable for all aspects of the work, and ensure that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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