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Original Article

Development and validation of a self-management ability questionnaire for patients with chronic periodontitis

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ABSTRACT

Objective: This study aimed to develop and validate a self-management ability questionnaire for patients with chronic periodontitis.**Methods:** A questionnaire was developed through theoretical research, literature review, semi-structured interview, and expert consultation. A total of 231 patients with chronic periodontitis from the Department of Periodontics in the Stomatological Hospital of Tianjin Medical University were recruited by convenient sampling. Validity and reliability were analyzed.**Results:** The questionnaire consisted of 24 items. Exploratory factor analysis identified three principal factors, which explained 66.949% of the total variance. The item-level content validity was between 0.800 and 1.000, and the scale-level content validity was 0.969. The coefficient of correlation between the gold standard and the whole questionnaire was 0.869. Cronbach's α of the whole questionnaire was 0.931, and the test–retest reliability coefficient was 0.825.**Conclusion:** The questionnaire developed in this study satisfies the measurement standard and has good reliability and validity. It is useful for clinical work to measure self-management among patients with chronic periodontitis.© 2019 Chinese Nursing Association. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

What is known?

- Self-management ability changes can be effective in improving habits and compliance in treatment for chronic periodontitis, maintaining periodontal health, and enhancing the quality of life related to oral health.
- Tools that can directly assess the self-management ability of patients with chronic periodontitis have yet to be reported.

What is new?

- A self-management ability questionnaire for patients with chronic periodontitis is developed in this study through theoretical research, literature review, semi-structured interview, and expert consultation.

- The developed questionnaire has good reliability and validity and may be suited for patients with chronic periodontitis.

1. Introduction

Chronic periodontitis (CP) is a commonly known chronic disease, which is influenced by dental plaque biofilms, along with a loss of connective tissue attachment, alveolar bone resorption, periodontal pocket formation, and tooth loss [1]. CP can destroy the stomatognathic system, influence masticatory and phonatory functions, and adversely affect the other system [2,3]. According to the fourth national oral health epidemiological survey in China, the periodontal status of middle-aged Chinese is exceptionally poor, especially the detectable rate of gingival bleeding and dental calculus [4]. In the 35–44 age group, the detectable rates of gingival bleeding and dental calculus were higher in males than in females [4].

CP can be prevented via plaque control, initial periodontal therapy, and supportive periodontal therapy [2,5]. Moreover, patients with CP mainly include outpatients; hence, daily home oral

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hygiene is widely accepted as an important way to keep and preserve oral health [5].

Self-management presents three domains, medical management, role management, and emotional management, which was extended by Corbin and Strauss [6]. This technique is widely applied as an intervention to achieve a healthy life style [7]. Self-management involves the ability to monitor the symptoms of CP, manage physical and physiological conditions, maintain emotional balance, utilize relevant skills, and practice cognitive and behavioral changes that reflect efficacious self-management [8]. Changes in self-management ability may have prolonged effects on periodontal health, such as reducing rates of dental plaque biofilms and tooth loss [9–11].

Our literature review has revealed only the self-efficacy scale for self-care (SESS) among patients with periodontal disease [12]. With this scale, dentist consultation, tooth brushing, and dietary habits of patients with CP are assessed on the basis of efficacy, without emotion management and the selecting oral cleaning supplies [12]. In previous studies, researchers used the plaque index, the probing pocket depth, and the clinical attachment loss to indirectly assess the self-management of provisional restoration [10,11].

Therefore, three self-management tasks and development methodology were used as a reference tool to develop a self-management ability measure for patients with CP and examine its reliability and validity.

2. Methods

Ethical approval was obtained from the medicine ethics committee of the Stomatological Hospital of Tianjin Medical University. Patients participating in the survey signed informed consent. The process for developing the self-management ability questionnaire for patients with chronic periodontitis was shown in Fig. 1.

2.1. Research team

Our research team comprised a postgraduate supervisor in nursing, a periodontal specialist, a chief nurse working in the Department of Periodontics, and four nursing post-graduate students. The members of the research team are studying scientific research tasks.

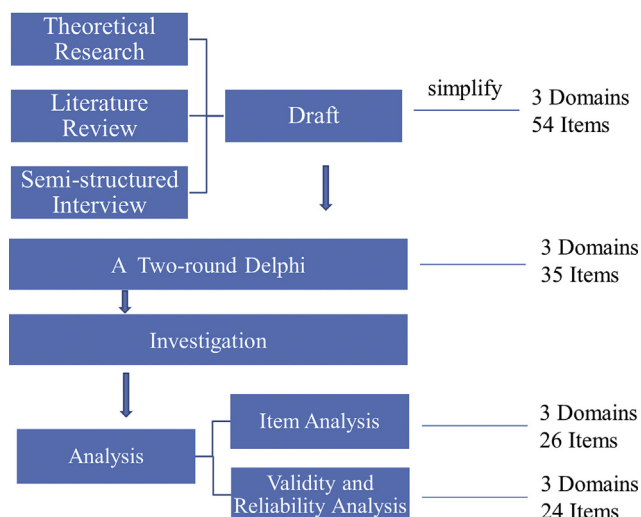


Fig. 1. Process for developing the questionnaire.

2.2. Sampling

A cross-sectional study was conducted on 250 patients with CP who visited the Department of Periodontics in the Stomatological Hospital of Tianjin Medical University.

The diagnostic criteria were in accordance with the American Dental Association and the Classification of Periodontal Diseases and Conditions in 1999 [13,14]. The inclusion criteria were as follows: at least 18 years of age, diagnosed CP more than 3 months, clear consciousness and smooth communication, and volunteered for this study. The exclusion criteria were as follows: less than 20 teeth [15], hand movement disorder, pregnant and breastfeeding women, and in the process of involving other studies.

2.3. Source of draft

A pre-test questionnaire draft was developed through a theoretical research, a literature review, and a semi-structured interview.

2.3.1. Theoretical research

Corbin and Strauss qualitatively studied self-management among patients with CP and divided it into three domains: medical, role, and emotional management [6]. Lorig provided an exact definition of self-management, that is, patients monitor the signs of a disease and improve their behavior and compliance to reduce the negative effect of social function, interpersonal relationship, and emotional experience [7].

2.3.2. Literature review

Eight databases (China National Knowledge Infrastructure, Chinese Science and Technology Journal Database, WanFang Data, China Biology Medicine disc, PubMed, Web of Science, Embase, and The Cochrane Library) were extensively reviewed to collect the ability elements relevant to the self-management of CP. The following keywords were used: “chronic periodontitis”, “periodontal disease”, “periodon*”, “personnel management”, “disease management”, “self management”, “self monitoring”, “self regulatory”, “self care”, “self control”, “self administration”, “self efficacy”, “self report”, “self assessment”, “education” behavior”, “competence”, “psychol*”, “cognit*” and so on.

2.3.3. Semi-structured interview

According to the three domains and literature review, a semi-structured interview among patients with CP was conducted to obtain supplementary information and perfect draft. The patients who participated in semi-structured interviews should meet the diagnostic, inclusion, and exclusion criteria.

The outline of semi-structured interviews included the following questions: “a. What are the symptoms of chronic periodontitis that you manifest? b. With such symptoms, what do you do for disease management? c. Where do you obtain the information of disease management? d1. Does the chronic periodontitis have an impact of role management? d2. How do you deal with the impact of chronic periodontitis on role management? e1. Does the chronic periodontitis have an impact of emotional management? e2. How do you deal with the impact of chronic periodontitis on emotional management?”

A sample of a semi-structured interview was collected until enough information was obtained. With the three methods, three domains and 61 items were obtained. The research team discussed and streamlined items. Lastly, three domains and 54 items were obtained.

2.4. Delphi method

Delphi technique is the main method used to solicit experts' opinions, and experts express their opinions according to their level of professional experience and knowledge [16]. The credibility and reliability of Delphi studies depend on the quality of the participants selected [17]. In the present study, the Delphi method was used to conduct expert consultation. In particular, 17 experts were invited to join the expert consultation, and 15 experts replied. According to the correlation between items and CP self-management, a 5-point Likert scale ranging from completely relevant to completely irrelevant was employed for the responses. Through the way of Delphi, the items were screened and revised.

2.5. Investigation

Through convenient sampling, 30 outpatients with CP from the periodontics of a tertiary stomatological hospital in Tianjin were recruited into this small-sample-size survey. The method was used to test whether the questionnaire worked and whether the meaning of the questionnaire for the outpatients with CP was easily understood. The results of the small-sample-size survey indicated that the questionnaire worked.

Data were collected from outpatients with CP who received treatment in the periodontics department of a tertiary stomatological hospital in Tianjin by convenience sampling. The inclusion of 5–10 patients per item was recommended to calculate the sample size for a cross-sectional survey [18].

2.6. Statistical analysis

Data were statistically analyzed using SPSS 20.0 (IBM Corp, New York, USA). Item analysis, validity and reliability analysis were conducted to examine sample data. Content validity, criterion validity, and construct validity were considered. Reliability was assessed through Cronbach's α and test–retest reliability. A significance level of $P < 0.05$ was applied.

3. Results

3.1. Results of Delphi

The experts involved were from medical universities, tertiary stomatological hospitals, and stomatology departments of tertiary general hospitals. The experts had an average age of 45.93 ± 7.86 years and an average length of service of 24.27 ± 7.92 years. Experts with a master's degree and above accounted for 40%, and 53.33% of the experts had senior professional titles. Experts from the fields of nursing education, nursing management in stomatology department/hospital, oral clinical/periodontal nursing, and periodontology were included. During expert consultation, progress, communication, and coordination problems during production at any time were followed up. These processes guaranteed the quality of expert consultation and the acquisition of truthful and reliable results.

Items with an average value of less than 3.5 and a variation coefficient of greater than 2.5 were removed, and items were revised in accordance with the experts' suggestions [19]. After two rounds of consultation, the domains and the items had Kendall's W^a of 0.344 and 0.347, respectively. The second round Kendall's W^a was higher than the first round; hence, the experts' opinions came to an agreement [19]. Here was the example of the experts' suggestion: changing the item “when the periodontal tissue not easy, I felt suffering” into “I feel suffering when I have the symptom of gingival bleeding/gingival recession/wide gap of teeth/teeth loosen.” We

should materialize the symptoms so that the patients would understand the meaning of the items.

After a two-round Delphi, 35 items were included in the item analysis.

3.2. Results of the investigation

3.2.1. Essential characteristics of participants

We collected data, including basic demographic data and disease-related information (Table 1).

3.2.2. Results of item analysis

A total of 250 questionnaires were distributed and returned, 231 questionnaires of which were valid. The effective rate was 92.40%. The selection criteria of the items and the results of item analysis are shown in Table 2. In this step, items 3, 8, 12, 13, 14, 16, 23, 31, and 34 were removed.

3.2.3. Results of validity analysis

Content validity. According to expert consultation, the item-level content validity (I-CVI) was between 0.800 and 1.000, and the scale-level content validity (S-CVI) was 0.969.

Criterion validity. The behavior part scale of Chronic Disease Self-management Study Measure (CDSMS) was regarded as the gold standard [20]. The coefficient of correlation between the gold standard and the three domains ranged from 0.626 to 0.743. The coefficient of correlation between the gold standard and the whole questionnaire was 0.869.

Construct validity. The construct validity of the questionnaire was determined through exploratory factor analysis (EFA) [21]. The data were examined with Bartlett's test of sphericity coefficient and Kaiser Meyer Olkin (KMO) test to verify whether the questionnaire was fit for EFA [21]. As a rule, the recommended threshold of the KMO test was 0.60 [22].

The KMO test result was 0.870, and the chi-square value of Bartlett's test was 5703.300 ($df = 325$, $P < 0.001$). In first round of EFA, the cumulative variance reached 69.578%, and all the factor loadings of the items were above 0.40. According to EFA, four factors were considered. However, one domain needed more than three items. Hence, the second round of EFA should be conducted to reduce the domain. The KMO test result was 0.886, and the chi-square value of Bartlett's test was 4834.391 ($df = 276$, $P < 0.001$). In the second round of EFA, three principal factors were identified, which explained 66.949% of the total variance (Table 3, Fig. 2).

As indicated above, 11 items were removed, and the questionnaire was formed. The next step was to name three factors. Factor 1 contained 12 items, factor 2 comprised 7 items, and factor 3 included 5 items. Considering the meaning of the items, we defined the three factors as CP-medical, CP-role, and CP-emotional management. Chinese version and English version of the self-management ability questionnaire for patients with chronic periodontitis are provided in the appendices.

3.2.4. Results of reliability analysis

Cronbach's α . Reliability analysis was carried out by calculating Cronbach's α to examine the consistency of the questionnaire [23]. Cronbach's α of the three domains ranged from 0.926 to 0.937, and Cronbach's α of the questionnaire was 0.931.

Test–retest reliability. Reliability analysis is conducted through test–retest to examine the stability of the questionnaire [23]. In our study, 30 patients were chosen for retest after 2 weeks. The test–retest reliability coefficient of the three domains ranged from 0.811 to 0.894, and the test–retest reliability coefficient of the questionnaire was 0.825.

Table 1
Essential characteristics of participants ($n = 231$).

Variables	Groups	n (%)
Gender	Man	94 (40.7)
	Woman	137 (59.3)
Body mass index (BMI)	<18.5	16 (6.9)
	18.5–23.9	117 (50.6)
	≥ 24	98 (42.4)
Education history	Primary School or below	5 (2.2)
	Middle School	11 (4.8)
	Senior School or Technical Secondary School	29 (12.6)
	College	47 (20.3)
	Bachelor's degree or above	139 (60.2)
Household income per person (CNY)	<3000	23 (10.0)
	3000–5000	70 (30.3)
	>5000	138 (59.7)
Medical expenses	Self-supporting	32 (13.9)
	Medical insurance	199 (86.1)
Employment status	Employed	134 (58.0)
	Unemployed	97 (42.0)
Smoking history	Yes	53 (22.9)
	No	178 (77.1)
Alcohol history	Yes	68 (29.4)
	No	163 (70.6)
Duration of illness	Three months to less than one year	148 (64.1)
	One year to less than three year	67 (29.0)
	Three years to less than five year	4 (1.7)
	Five years and longer	12 (5.2)
Severity of periodontitis	Mild	22 (9.5)
	Moderate	99 (42.9)
	Severe	110 (47.6)
Miss teeth	Yes	117 (50.6)
	No	114 (49.4)
Family history of oral disease	Yes	95 (41.1)
	No	136 (58.9)
History of oral health education	Yes	52 (22.5)
	No	179 (77.5)

4. Discussion

Self-management has been widely applied to different chronic conditions, such as chronic hepatitis B, diabetes, and arthritis [24–27]. Self-management can help patients manage their health and healthcare, decrease healthcare utilization, and minimize wasteful use across primary and secondary care [24]. Changes in self-management ability can be effective in improving habits and compliance of patients with CP, maintaining periodontal health, and improving oral health-related quality of life [9–11]. Therefore, a measurement tool, such as a self-management ability questionnaire, should be developed for patients with CP.

After item analysis, validity and reliability analysis, the final draft of questionnaire was formed. The result showed that the final draft of questionnaire had three domains. The first domain, named “CP-medical management,” included 12 items used to measure the medical management ability of patients with CP. Some of these items were monitoring the condition of CP, observing treatment compliance, managing the information of CP, and selecting oral cleaning supplies. The second domain, named as “CP-role management,” included seven items used to measure the role management ability of patients with CP. Some of these items were ability of adaptive behavior, ability of changing bad behavior, and giving up a bad habit. The third domain, named as “CP-emotional management,” included five items used to measure the emotional management ability of patients with CP. Some of these items were managing negative emotions and expressing emotions among people with chronic periodontitis.

The developed questionnaire had a high Cronbach's α of 0.931, which reflected that the items were interrelated [23]. The test–retest reliability coefficient of 0.825 was satisfactory [23]. The

retest survey results were consistent with the cross-sectional survey results, and the measurement had good stability. The high S-CVI and criterion validity showed that the questionnaire could achieve the measurement purpose with a good structure [23].

Our study presented the following advantages. To the best of our knowledge, an assessment tool that measures self-management ability is not yet available for patients with CP. Although a 12-item behavior part scale of CDSMS has been developed for chronic conditions, its sensitivity to self-management ability is less than that of disease-specific assessment tools [20]. The behavior part scale of CDSMS assesses self-management through excise, cognitive symptom management, and communication with physicians [20]. Without the assessment of managing symptoms, treatments, lifestyle alteration, the behavior part scale of CDSMS was not suited for patients with CP. SESS assesses self-care in terms of self-efficacy rather than self-management [12]. As such, we cannot directly assess the related self-management ability of patients with CP.

Considering the methodology, we comprehensively reviewed relevant references, developed a disease-specific questionnaire, and examined the reliability and validity of the questionnaire. The size of sample was enough for exploratory factor analysis. A moderate number of items could be convenient to use in clinics. The self-management ability questionnaire for patients with CP could be used as a self-reported tool for patients to determine their conditions of self-management ability.

This study had some limitations. First, the proportion of the experts with a master's degree and above was less than 50%. Second, in the semi-structured interview, patients were interviewed, but no dentists and nurses were interviewed. Third, although exploratory factor analysis was conducted, confirmatory factory

Table 2Item analysis of the self-management ability questionnaire for patients with chronic periodontitis ($n = 231$).

Item	Critical ratio (CV)	Item-total correlation	Corrected item-total correlation	Cronbach's α if item deleted	Communalities	Factor loading
1	13.456	0.677**	0.645	0.910	0.480	0.693
2	12.653	0.639**	0.607	0.911	0.438	0.662
3	2.045	0.119	0.068	0.918	0.010	0.098
4	9.505	0.572**	0.538	0.912	0.349	0.591
5	10.393	0.620**	0.586	0.911	0.445	0.667
6	11.217	0.652**	0.618	0.911	0.487	0.698
7	11.706	0.646**	0.613	0.911	0.474	0.688
8	3.090	0.191**	0.126	0.918	0.009	0.095
9	10.260	0.638**	0.603	0.911	0.440	0.663
10	11.439	0.625**	0.593	0.911	0.429	0.655
11	10.816	0.643**	0.610	0.911	0.475	0.689
12	3.433	0.200**	0.142	0.917	0.035	0.186
13	7.780	0.428**	0.384	0.914	0.179	0.423
14	4.385	0.250**	0.187	0.917	0.023	0.152
15	11.704	0.625**	0.590	0.911	0.434	0.659
16	1.936	0.121	0.055	0.919	0.005	0.071
17	13.664	0.645**	0.609	0.911	0.452	0.672
18	10.637	0.637**	0.602	0.911	0.445	0.667
19	10.057	0.599**	0.561	0.912	0.377	0.614
20	11.233	0.600**	0.560	0.911	0.386	0.621
21	6.741	0.515**	0.481	0.913	0.267	0.517
22	6.741	0.511**	0.477	0.913	0.264	0.514
23	4.176	0.274**	0.208	0.917	0.048	0.219
24	9.362	0.604**	0.564	0.911	0.383	0.619
25	10.935	0.628**	0.593	0.911	0.404	0.635
26	10.508	0.621**	0.583	0.911	0.384	0.620
27	10.664	0.625**	0.589	0.911	0.400	0.632
28	8.583	0.603**	0.563	0.911	0.387	0.622
29	8.893	0.545**	0.503	0.912	0.254	0.504
30	5.852	0.529**	0.486	0.913	0.240	0.490
31	8.091	0.443**	0.399	0.914	0.159	0.398
32	8.460	0.511**	0.467	0.913	0.214	0.463
33	5.807	0.563**	0.523	0.912	0.276	0.525
34	9.109	0.420**	0.373	0.914	0.144	0.379
35	13.456	0.548**	0.508	0.912	0.258	0.507
Criteria	≥ 3.00	≥ 0.400	≥ 0.400	≤ 0.915	≥ 0.200	≥ 0.450

Note: ** $P < 0.01$.**Table 3**

Rotated factor loading coefficient matrix.

Items	Factors		
	1	2	3
6. I usually brush my teeth for at least 3 min.	0.850		
5. I brush my teeth with the Bass method.	0.830		
11. I see a dentist right away when I feel periodontal discomfort.	0.826		
17. I would inform the dentist about the symptoms of my chronic periodontitis under treatment.	0.772		
15. I obtain information about chronic periodontitis through internet/books/lectures.	0.750		
9. I observe the situation of my periodontal tissue daily.	0.730		
7. I brush the space between the gum and the teeth.	0.718		
1. I use a small and soft-bristled toothbrush when I suffer from chronic periodontitis.	0.704		
18. I consult with the dentist in time about unclear information on chronic periodontitis.	0.702		
2. I use interdental brush/dental floss to clean my teeth when I suffer from chronic periodontitis.	0.701		
10. I go to the dentist following a doctor's advice, when I suffer from chronic periodontitis.	0.698		
4. I brush my teeth/rinse my mouth after every meal.	0.637		
19. I do not smoke.		0.876	
27. I do not eat food that can damage my teeth, such as betel nut, carbonated drink and coffee.		0.847	
24. I take calcium- and vitamin D-rich foods, such as dried small shrimp, fish, and milk.		0.847	
28. I avoid habits that can damage teeth, such as sucking fingers, clenching teeth, biting nails, and biting pencils.		0.808	
20. I do not breathe through my mouth.		0.798	
26. I deal with food impaction just in time.		0.733	
25. I eat food with bilateral chewing.		0.667	
29. I feel suffering when I have the symptom of gingival bleeding/gingival recession/wide gap of teeth/teeth loosen.			0.934
30. I share how I feel with others when my periodontal tissue is unwell and triggers a negative emotion.			0.929
33. I divert my attention when my periodontal tissue is unwell and triggers a negative emotion.			0.919
35. I stay optimistic even though I suffer from chronic periodontitis.			0.903
32. I make myself comfortable by imagining and relaxing when my periodontal tissue is unwell and triggers a negative emotion.			0.688
Eigenvalue	7.021	4.929	4.118
Variance (%)	29.254	20.535	17.160
Cumulative of variance (%)	29.254	49.789	66.949

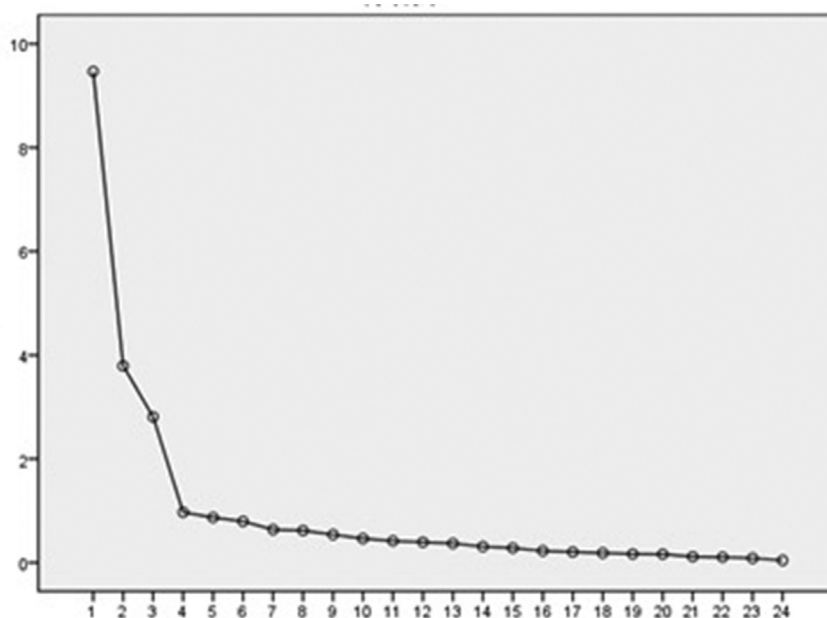


Fig. 2. Scree plot of the factor analysis.

analysis should be performed to assess model fitness. Fourth, the questionnaire was developed in Chinese version, and only patients from the university periodontal clinic were investigated.

According to the results, we had some suggestions of the application and future studies. First, in the future, we should include additional experts and interview dentists and nurses during revision. Second, further measures should be employed to explore the influencing factors of the self-management ability of patients with CP for the development of personalized oral health education for these patients. Third, further studies should be performed to verify whether the questionnaire is fit for patients from different areas.

5. Conclusion

The developed questionnaire satisfied the measurement standard. The good reliability, validity, and moderate number of items were suited for patients with CP. However, further clinical epidemiological multicenter studies with a large sample size should be performed to obtain rigorous results.

Conflicts of interest

The authors have declared that no conflicts of interest exist.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2019.06.006>.

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