

Research Article

Identifying Chinese Medicine Patterns of Tension-Type Headache and Understanding Its Subgroups

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Tension-type headache (TTH) is common among adults. Individualized management strategies are limited due to lack of understanding of subtypes of TTH. Chinese medicine (CM) uses the pattern differentiation approach to subtype all health conditions. There is, however, a lack of evidence-based information on CM patterns of TTH. This study aimed to identify common CM patterns of TTH. TTH sufferers were invited for a survey, consisting of a validated Chinese Medicine Headache Questionnaire (CMHQ), Migraine Disability Assessment Test, and Perceived Stress Scale. The CMHQ consisted of information about headache, aggravating and relieving factors, and accompanying symptoms. Principal component analysis was used for factor extraction and TwoStep cluster analyses for identifying clusters. ANOVA was used to compare cluster groups with disability and stress. In total, 170 eligible participants took part in the survey. The commonest headache features were continuous pain (64%); fixed location (74%); aggravated by overwork (74%), stress (74%), or mental strain (70%); and relieved by sleeping (78%). The commonest nonpain symptoms were fatigue (71%) and neck stiffness (70%). Four clusters, differing in their key signs and symptoms, could be assigned to three different CM patterns including ascendant hyperactivity of liver yang (cluster 1), dual qi and blood deficiency (cluster 2), liver depression forming fire (cluster 3), and an unlabelled group (cluster 4). Additionally, over 75% participants in clusters 1 and 2 have episodic TTH, over one-third participants in cluster 3 have chronic TTH, and a majority of participants in cluster 4 have infrequent TTH. The three patterns identified also differed in levels of disability and some elements of coping as measured with PSS. The three CM patterns identified are common clinical presentations of TTH. The new information will contribute to further understanding of the subtypes of TTH and guide the development of targeted intervention combinations for clinical practice and research.

1. Introduction

Tension-type headache (TTH), described as a dull, pressing, or tight quality [1], is found to be the second most prevalent chronic disorders in the world [2]. TTH is regarded as a featureless headache, as most TTH sufferers have no associated symptoms when compared with other type of headaches. Due to its nonspecific and lacking specific and distinguishing feature [3], diagnosis of TTH is, therefore,

largely based on negative features [3, 4] and by excluding symptoms, syndromes, and organ diseases mimicking other primary or secondary headache [5]. However, the treatment strategies for TTH remain unspecific as its underlying mechanisms are unknown [3, 6, 7]. In addition, it is well known that people with TTH have different headache features [8–11], yet there is no standard way to subtype TTH, except for categorizing into infrequent, episodic (ETTH), and chronic TTH (CTTH) based on the frequency of

headache within four weeks [1]. Such an approach does not lead to the development of effective, individualised treatment strategy [5].

Trigger factors could worsen TTH [12, 13]. Hence, identification of triggers and coping with these factors may be of value [14]. One hospital-based study confirmed that emotional stress was the major trigger factor of TTH, as outlined in other studies [8, 15]. Depression and anxiety levels in TTH sufferers have also been observed to be higher than headache-free controls [16, 17]. In addition, some triggers that are typically specific to migraine may also precipitate TTH [5], including a lack of sleep, fatigue, missing meals [18], menstruation, weather changes, relaxation after stress, exposure to bright lights, strong odors and loud noises, and ingestion of alcoholic beverages [18–20]. Presence of triggers for TTH is largely relied on patients' self-report, but has not been tested systematically [13].

Chinese medicine (CM), which has a long history of treating headaches, is viewed as “personalized medicine” as CM differential diagnostic approach guides the tailored treatment for each individual [21]. Given that TTH is not a diagnosis in CM, recognition and treatment of TTH must be based on the CM classification and common patterns of general headache. CM understands that the causes of most headaches are disorders of Qi and blood or lack of nourishment of the channels and collaterals [22]. The guiding principle of CM headache treatment is to enhance and strengthen any deficiency identified or eliminate and dispel the excessive pathogens, which vary from person to person. It is through addressing different forms of deficiency or excess that CM treatment is tailored to individuals.

Acupuncture, a key treatment modality of CM, has been reported to be effective for pain management [23, 24]. Acupuncture has been recommended as a prophylactic treatment for chronic TTH due to its effectiveness and safety profile [25, 26]. It is a valuable nonpharmacological option for patients suffering from frequent episodic or chronic TTH [27, 28]. In acupuncture treatment, each health condition is subdivided into a few common patterns based on signs and symptoms. Those patterns are important as they guide the selection of the supposed optimal individualised acupuncture protocol. Nevertheless, there is a lack of CM criteria for TTH patterns, which are important as they guide the determination of the optimal acupuncture protocol. Identifying CM patterns involves a complicated process of synthesising and analysing clinical symptoms and signs of the patient's condition to determine the location, cause, and nature of the condition [29]. Diagnosis of TTH largely relies on textbook information or expert opinion but not based on research evidence. Over the past several years, published CM studies specific to TTH in China proposed different TTH patterns based on clinical experiences and observations with some overlaps among them. Those include eleven (11) patterns of ascendant hyperactivity of liver yang, kidney deficiency, spleen deficiency, liver qi stagnation, stagnated gall bladder qi with disturbing phlegm, liver fire ascending, cold congealing in the jueyin meridian, static blood blocking collaterals, deficiency of heart and spleen, kidney yin deficiency, and deficiency of both liver yin and kidney yin [30].

Consequently, variations in the diagnosis of TTH among practitioners are common [31]. Studies have shown that it is possible to standardize and validate patterns using objective methods and evidence-based approaches [21, 32–37]. Cluster analysis has been recognized as a suitable technique to identify homogeneous subgroups for identifying CM patterns of diseases [38–40].

The aims of this study were (1) to explore CM patterns of TTH based on data collected using a validated Chinese Medicine Headache Questionnaire (CMHQ); and (2) to explore if identified CM patterns differed on information collected in modern TTH research and practice, including headache features, severity of headache-related disability assessed with Migraine Disability Assessment Test (MIDAS), and number of comorbidities, psychological profiles, such as anxiety, depression, and self-perceived level of stress. Findings of this research will lend a hand to understanding of subtypes of TTH.

2. Methods

2.1. Design. A bilingual cross-sectional survey was conducted from February 2011 to June 2012. A paper-based survey and an online survey were delivered in parallel. The online survey was performed via the SurveyMonkey® platform, whereas the paper-based survey was administrated at three sites: Melbourne, Beijing, and Chengdu. The Australian sample was from a clinical trial conducted from 2008–2012 entitled “Combined therapy of electroacupuncture and cognitive behavioural therapy for tension-type headache: a randomised controlled trial” (ANZCTR: ACTRN12608000239369) in Melbourne and from online survey. All Chinese samples were collected from two Chinese sites and through online. The two Chinese sites were of Beijing Hospital of Traditional Chinese Medicine (TCM) Affiliated to Capital Medical University and Affiliated Hospital of Chengdu University of TCM.

2.2. Ethics. The survey protocol was reviewed, assessed, and approved by the College Human Ethics Advisory Network of the College of Science Engineering and Health (CHEAN), RMIT University (BESHAPP10-11 HAO). The other two collaboration sites of Beijing and Chengdu were granted permission by the Department of Science Research of Beijing TCM Hospital and for the Chengdu site, by the Department of Science and Technology, Chengdu University of TCM, respectively. Those approvals were endorsed by CHEAN, RMIT.

2.3. Recruiting Criteria. Potential headache sufferers, aged from 18 to 65 years old, were eligible to participate if they were able to read English or Chinese; met the International Headache Society TTH diagnostic (ICHD-II) criteria of TTH or probable TTH [41]; and had one day or more of TTH attacks per month for at least one year. Exclusion criteria were TTH onset after 50 years old as those headaches are more likely to be secondary headache [42]; had more than 4 migraine attacks without aura per month, as

increased attacks of migraines should be classified under migraine, rather than TTH according to ICHD-II [41]; had any migraine attack with aura per month; had been hospitalized because of the head or neck injury; or had migraine attacks which were not able to be distinguished from TTH.

2.4. Measurements. Demographic characteristics of the participants collected from this survey included gender, age, ethnicity, marital status, and education. Each of the listed instruments included in the survey was available in both English and Chinese versions.

Chinese Medicine Headache Questionnaire (CMHQ): the CMHQ is a symptom-based data collection tool consisting of a total 193 items which are grouped into three broad categories of pain description, aggravating and relieving factors, and accompanying symptoms. It has been used to assist CM pattern identification for headache disorders and found to be reliable and valid in capturing essential clinical indicators for making a CM diagnosis [30]. Responses to each item presented were on a 5-point Likert scale rating from 0 to 4 indicating never, seldom, sometimes, often and almost always (Appendix A).

2.4.1. Migraine Disability Assessment (MIDAS) Questionnaire. The MIDAS was initially designed for the migraine population to evaluate the severity of migraine. Studies have shown it is also valid and reliable in evaluating disability associated with TTH [43–48].

2.4.2. Perceived Stress Scale (PSS). The PSS is a widely used instrument in measuring nonspecific psychological stress. Its 10-item version is among the most widely used tool to measure global perceived stress in relation to the health-related outcomes [49, 50].

2.4.3. Comorbidity Checklist. A comorbidity checklist was used to assess both somatic and mental comorbidity of TTH. Development of the checklist was based on the Cumulative Illness Rating Scale (CIRS) [51] and the World Mental Health Composite International Diagnostic Interview (WMH-CIDI) [52]. The items in this checklist were reformatted in a coherent manner to detect both somatic comorbidity and the mental comorbidity.

2.5. Data Analysis. SPSS 18.0 was used for data analysis. A P value <0.05 was considered to be statistically significant. Chi-squared tests were used to examine the difference in categorical outcomes. Factor analysis and cluster analysis were conjunctively applied to obtain effective clusters and identify meaningful CM patterns for TTH. Specifically, the principal component analysis (PCA) was used for factor extraction in condensing respondents' responses to diagnostic information obtained from CMHQ items, whereas the TwoStep cluster algorithm was then used for grouping these identified factors into clusters for further evaluation [53, 54]. For PCA factor extraction, a cutoff value of 0.5 on a

coefficient ("factor loading") was adopted [55]. To determine if an identified factor was included in pattern identification based on the results from TwoStep cluster analyses, a cutoff value of 0.4 on clusters' mean scores was used. ANOVA was used to assess the cluster difference in MIDAS grades and in PSS levels. Chi-squared tests and ANOVA were employed to compare the characteristics of the resulting clusters, which enables further examination of the group differences among the CM pattern types, in MIDAS grades, and in PSS levels of the participants. Multiple comparisons were performed to compare group means via *post hoc* tests with Bonferroni correction when significant differences were observed in means across groups. For missing data handling, both case deletion and imputation methods were applied. Cases having more than 30% missing values within the total 193 items in CMHQ were deleted from the dataset, whereas cases having less than 30% missing values were remedied via the expectation-maximization algorithm [55].

Evaluation and interpretation of data for pattern identification had four sequential steps (Figure 1). The first step was to reduce the items of CMHQ into smaller datasets using factor analysis; the second step was to assess the factors extracted and to label those factors in a clinical meaningful manner; the third step was to group (clinical meaningful) factors into clusters using cluster analysis; the final step was the identification of TTH patterns, that is, to label the clusters into clinically meaningful CM patterns. Sixteen teaching and research staff across universities and hospitals with their professional backgrounds covering CM, acupuncture, modern medicine, statistics, etc., were invited to provide their experts' opinions in the 2nd and 3rd steps to ensure that the labels assigned to factors and clusters were of clinical relevance and significance. Only the labels that reached 70% agreement among 16 evaluators were retained.

3. Results

From February 2011 to June 2012, a total of 565 respondents took part in the survey and 497 completed it. 170 participants were eligible and included for data analysis. Figure 2 illustrates the participant selection process. Among them, 70.6% were female and 29.4% were male ($F:M = 2.1:1$). The average age was 38 years ($SD = 12$). Defined by headache days per month, a majority (63%) of the included participants suffered from ETTH, whereas 23% and 14% were of CTTH and infrequent subtypes, respectively. Sociodemographic characteristics including ethnicity, marital status, and education are shown in Table 1, which indicates a majority of participants were female with a higher level of education degree in the age range of 20 to 40.

According to the CMHQ, the key features of the headaches were pain with a fixed location (74%), of continuous (66.7%) and intermittent (52.7%) nature, with tight (35.3%), heavy (34.1%), and pulsating (34.1%) sensations, and affecting the neck (61.3%) and eyes (57.2%). Overwork (74.1%), stress (73.6%), mental strain (70%), being tired (68.1%), lack of sleep (68.1%), anger or irritability (65.8%), anxiety (excessive worry) (65.5%) nervousness (56.3%), and muscular strain (muscle tightness) (53.1%) were identified as

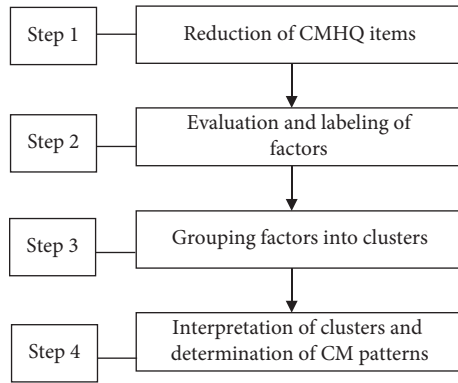


FIGURE 1: Process of CM pattern identification.

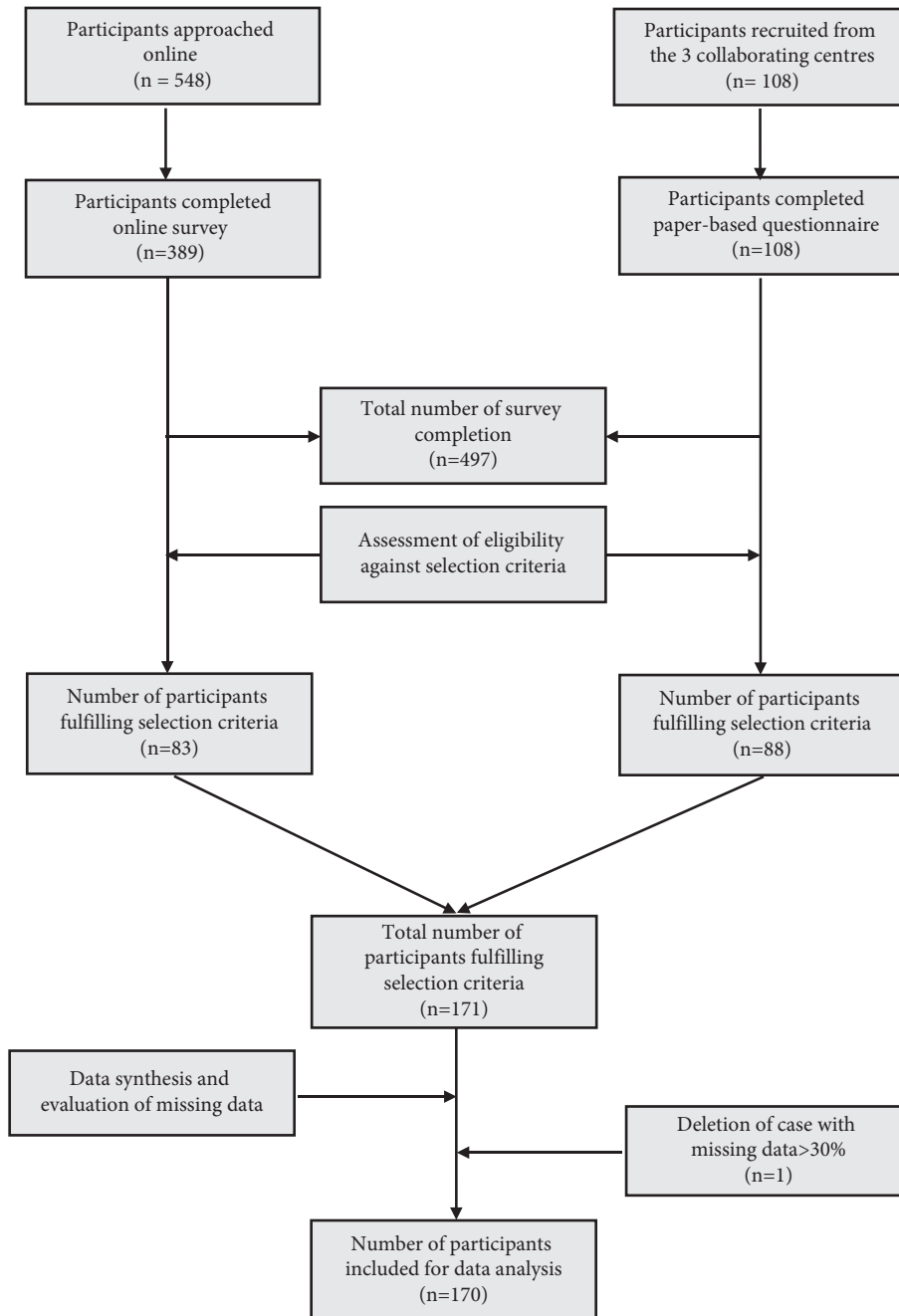


FIGURE 2: Flow chart of participant recruitment and screening process.

TABLE 1: Sociodemographic characteristics of the included participants.

	Frequency (<i>n</i>)	Percent
Gender (<i>n</i> = 170)		
Women	120	70.6
Men	50	29.4
Age range (<i>n</i> = 166)		
20–29	55	33.1
30–39	44	26.5
40–49	31	18.7
50–59	26	15.7
60+	10	6.0
Marital status (<i>n</i> = 165)		
Single	64	38.8
Married	77	46.7
Partnered	9	5.5
Divorced	13	7.9
Separated	2	1.2
Ethnicity distribution (<i>n</i> = 164)		
Asian	85	51.8
Oceanian	45	27.4
European	25	15.2
Arab	1	.6
Had >1 ethnicity	8	4.9
Level of education (<i>n</i> = 164)		
Postgraduate degree level	40	24.4
Graduate diploma and graduate certificate level	8	4.9
Bachelor degree level	72	43.9
Advanced diploma and diploma level	18	11.0
TAFE level	10	6.1
Secondary education	14	8.5
Primary education	2	1.2

Note: designing of the sociodemographic categories were referenced from the Australian Bureau of Statistics website (<http://www.abs.gov.au>).

the commonest aggravating factors of headache, whereas sleeping (77.7%), medication (62.7%), lying down (62.4%), pressing on the pain area (62.1%), and massage (50.9%) were the commonest relieving factors of the headaches. Apart from headaches, neck (60%), shoulder (45.3%), and lower back (35.3%) were the most common painful areas. Of the female-related items, bright red-coloured menstrual blood (50.5%), dark-coloured menstrual blood (62.4%), headache before period (51.6%), and abdominal pain during periods (52.7%) were common referred items. Overall, the most common accompanying symptoms were fatigue (71.3%), neck stiffness (70%), and neck pain (60%).

3.1. TTH Pattern Identification. The exploratory analytic methods of factor analysis and cluster analysis were jointly used given the relatively large number of CMHQ items. Firstly, PCA was used to extract factors on each part of CMHQ separately. Based on CM theory, only 41 clinical meaningful factors, including 12 factors from CMHQ part 1, 13 from part 2, and 16 from part 3, were labelled and retained for TTH pattern identification (Appendix B and C). Secondly, using the TwoStep cluster analysis, four distinct cluster groups were identified. Lastly, experts analysed the clinical characteristics of each cluster and labelled them as ascendant hyperactivity of liver yang (cluster 1), dual qi and

blood deficiency (cluster 2), liver depression forming fire (cluster 3), and an unlabelled group (cluster 4) (Table 2). The first three are common patterns of headache presented in CM clinical practice.

3.2. Cluster Comparisons. Table 3 summarizes the characteristics of participants according to the four clusters. The four clusters differed in the aspects of demographic characteristics, stress levels, pain intensity (indicated by MIDAS item B), disability grades (indicated by MIDAS), and TTH subtypes. There were no cluster differences in gender, marital status, or education level. There was statistical age difference among the clusters ($P < 0.001$). Participants in cluster 1 were older than those in clusters 3 and 4; however, those in cluster 2 were older than those in cluster 4. Statistically significant cluster differences were also found in ethnicity distribution. Over three quarters of participants in clusters 3 and 4 were of Asian origin, but over three quarters of those in clusters 1 and 2 were of non-Asian (Oceania and European) origin.

More than half of the participants were suffering from frequency TTH in all clusters. Cluster 1 had more infrequent ETTH headache than clusters 1–3, and cluster 3 had more CTTH than the other three clusters ($P < 0.001$). ANOVA results indicated no cluster differences in the overall MIDAS

TABLE 2: Summary of cluster characteristics according to the CMHQ data.

	Cluster 1 (n = 46)	Cluster 2 (n = 34)	Cluster 3 (n = 46)	Cluster 4 (n = 44)
Location and quality	(i) Forehead; Back of the head; Top of the head (ii) Pain quality: Throbbing; Pulsating; Pounding; Tight; A “band-like” sensation	(i) Forehead, Back of the head, Top of the head; Both side of the head (ii) Pain quality: Throbbing; Pulsating; Pounding (iii) Worse in the morning; Worse at night; All day	Whole head; No particular location	Explosive; Not dull; Sharp; Piercing
Aggravating and relieving factors	Aggravating by Dehydration; Hunger; Chocolate; Muscular strain (muscle tightness); Poor posture in sitting, standing or sleeping; Teeth grinding	Aggravating by Change of weather; Change in temperature; Hot weather; Cold weather; Dehydration; Hunger; Chocolate	Relieving by Exercise; Massage; Pressing the pain area; Warmth Coldness; Medication; Eating	Aggravating by Stress; Nervousness Irritability Excessive worry; Depression Tension or conflict-related Aggravating by Windy days; Damp weather/ Humid weather; Rainy days
Accompanying symptoms	Sensitivity to light (or to bright lights); Sensitivity to sound	“Pins and needles” or numbness in the hands and feet; Faintness; Dizziness; Watery bowel motion; Loose bowel motion	Dry mouth; Thirst; Bitter taste in the mouth	Belching; Bloating/ Flatulence; Indigestion; Fear of being hot

Cluster 1: ascendant hyperactivity of liver yang. Cluster 2: dual qi and blood deficiency. Cluster 3: liver depression forming fire. Cluster 4: unlabelled group.

TABLE 3: Cluster comparisons of demographic data, TTH subtypes, MIDAS, PSS, and CIRS items.

	TTH clusters				Total (n)	Missing value (n)	P value [†] Chi-square	P value [†] ANOVA
	C1 (46)	C2 (34)	C3 (46)	C4 (44)				
Age (mean ± SD) (n)	45 ± 12 44	39 ± 11 33	37 ± 12 37	30 ± 9 29	143	27	N/A	≤0.001*05
Gender (n)	F	35	27	30	28	0	.307	N/A
	M	11	7	16	16			
Age range (n)	20–29	6	8	17	24	4	0.001 *0125	N/A
	30–39	10	12	10	12			
	40–49	10	8	6	7			
	50–59	14	4	8	0			
	60+	5	2	2	1			
Marriage status (n)	Single	13	10	16	25	5	0.047	N/A
	Married	22	15	25	14			
	Partnered	3	4	0	2			
	Divorced	6	4	1	2			
	Separated	0	1	0	1			
Education level (n)	Postgraduate	13	8	8	11	5	0.968	N/A
	Graduate	3	2	1	2			
	Bachelor	17	14	21	20			
	Diploma	4	5	3	6			
	TAFE	4	1	3	2			
	Secondary edu	4	4	4	2			
Primary edu	0	0	1	1				
Ethnicity a (n)	Oceania	19	18	4	4	6	≤0.001*0125	N/A
	European	14	7	2	2			
	Arab	0	0	1	0			
	Asian	7	5	35	38			
	had >1 ethnicity	5	3	0	0			
Ethnicity B (n)	Asian	7	5	35	38	5	≤0.001	N/A
	Non-Asian	39	28	7	6			

TABLE 3: Continued.

TTH subtypes (<i>n</i>)		TTH clusters				Total (<i>n</i>) 170	Missing value (<i>n</i>)	<i>P</i> value [†] Chi-square	<i>P</i> value [†] ANOVA
		C1 (46)	C2 (34)	C3 (46)	C4 (44)				
	Infrequent ETTH	1	1	7	15	24			
	Frequent ETTH	36	26	23	22	107	0	≤0.001* ⁰¹²⁵	
	CTTH	9	7	16	7	39		N/A	
MIDAS item, <i>n</i> (%)	Q1	44 (1.07)	33 (2.30)	43 (2.74)	44 (3.86)	164 (7.771)		N/A	
	Q2	44 (5.34)	33 (9.67)	43 (9.81)	44 (5.50)	164 (7.43)		N/A	
	Q3	44 (3.95)	33 (6.82)	43 (4.00)	44 (3.23)	164 (4.35)		N/A	
	Q4	44 (6.05)	33 (8.15)	43 (4.35)	44 (2.93)	164 (5.19)		N/A	
	Q5	44 (2.18)	33 (4.24))	432.65	443.86	164 (3.17)		N/A	
	MIDAS a	44 (20.45)	33 (26.73)	43 (20.53)	44 (15.82)	164 (20.49)		N/A	
	MIDAS B	44 (5.45)	33 (6.30) v.4	43 (5.42)	44 (4.68) v.2	164 (5.41)		N/A	
	MIDAS SUM (mean score)	44 (18.59)	33 (31.18)	43 (23.56)	44 (19.39)	164 (22.64)		N/A	
MIDAS grade, <i>n</i> (%)	Grade I	12 (27%)	3 (1%)	14 (33%)	22 (50%)	51 (31%)		0.017* ⁰⁵	
	Grade II	5 (11%)	7 (21%)	3 (7%)	4 (9%)	19 (12%)		N/A	
	Grade III	14 (32%)	8 (24%)	8 (19%)	7 (16%)	37 (23%)		N/A	
	Grade IV	13 (30%)	15 (45%)	18 (42%)	11 (25%)	57 (35%)		N/A	
PSS score (score by item)	Sum	16.68	16.19	18.79	15.11	16.72		N/A	
	Perceived distress	9.85	10.06	10.22	7.52	9.39		N/A	
	Perceived coping	5.04 ^{v.3,4}	5.18 ^{v.3,4}	7.35 ^{*v.1,2}	7.59 ^{*v.1,2}	6.35		≤0.001* ⁰¹⁷	
Comorbidity checklist (number of items)	Somatic comorbidity	46	34	46	44	42.9%		0.588	
	Mental comorbidity	8	9	5	0	12.9%		0.060	

Note 1: Australia is a country of immigration. In the section of ethnicity, the category of “had more than 1 ethnicity” indicated a group of participants in this country shares more than one ethnicity. For example, an Australian person may have his/her mother of Irish ethnicity and father of Greek. In such case, these participants may tick two options, and in data analysis, he/she was classified as participant had more than one ethnicity. Note 2: both Chi-square and ANOVA were applied to access cluster differences for comparison. Chi-square tests examine categorical outcomes, whereas ANOVA assesses the means of each cluster. *P* values correspond to comparisons between the clusters using Chi-square test or ANOVA, as appropriate. Note 3: in PSS-10, there are no cutoffs for “Perceived Distress” nor “Perceived Coping.” A lower score in “Perceived Coping” factor reflects better coping ability since the four positively stated items (4, 5, 7, and 8) in this factor are reversed scored and then summing across all items when calculating the overall score. Note 4: *05—the mean difference is significant at the 0.05 level; *0125—the mean difference is significant at the 0.0125(0.05/4) level; *017—the mean difference is significant at the 0.017(0.05/3) level; “v” denotes the clusters differed with post hoc Bonferroni correction, whereas the “x (figure)” after “v” indicates specific cluster or clusters.

scores. The level of disability, which ranged from grade I to grade IV (from low to high), was classified based on the MIDAS scores. The mean MIDAS SUM score of the current sample was 22.64 lost days, at a severe disability level (grade IV). There was a statistically significant cluster difference in the disability level ($P = 0.17$). This was largely due to about 50% the participants in clusters 2 and 3 having a higher level of disability (grades III and IV), whereas 50% of cluster 4 had the lowest level of disability (grade I). There were statistically significant cluster group differences in MIDAS items 4, which indicate the reduced productivity in household because of headaches, and MIDAS B, detecting the average pain on a 0–10 scale. Post hoc *t*-tests with Bonferroni correction found clusters 2 and 4 were statistically different,

with cluster 2 having more nonproductive days at home (8.2 days) due to headache and more severe headache (6.3) than cluster 4 (mean: 3 days, mean intensity: 4.7).

The average PSS score was 16.72. Compared with the normative data mean score of PSS-10 around 13 [49, 50], the existing sample had a relatively higher perceived stress than the general population. There was no cluster difference on PSS. PSS has two subscales: general distress (perceived distress; sum of items: 1, 2, 3, 6, 9, and 10) and coping ability (perceived coping; sum of items: 4, 5, 7, and 8) [56]. In this study, the average score for the “Perceived Distress” factor was 9.39, indicating a trend for a statistically significant cluster difference in this item ($P = 0.066$) with cluster 4 perceiving lower level of stress. A lower score of 6.35 was observed in “Perceived Coping” factor,

reflecting better coping ability. The cluster difference in this item was statistically significant ($P < 0.001$) with participants in clusters 1 and 2 coping with stress better than the other two clusters.

Comorbidities of TTH participants were calculated by counting the total number of somatic comorbidities and mental comorbidities separately. All participants had a low number of comorbidities (Table 4). There were no significant differences in somatic comorbidities among the identified four TTH clusters. Although there was no statistically significant cluster difference in mental comorbidity, cluster 4 participants reported no mental comorbidity at all (Table 3).

3.3. Profile of the Clusters. Table 5 illustrates the profile of the four clusters. Cluster 1 had a moderate level of pain, moderate level of disability, and moderate distribution in both physical and mental comorbidity. Participants in this cluster tended to perform the best in coping ability (PSS “Perceived Coping” factor) when compared with other three clusters. Cluster 2 had the highest pain intensity and severest disability among all four patterns. This cluster also had the largest number of participants having a physical comorbidity. Cluster 3 had a very similar pattern to cluster 2 with moderate headache intensity and severe disability. However, based on CM understanding, they differed significantly in their presentation of headache and nonpainful symptoms. In addition to the symptomatology, they were also being significantly different from their coping with stress (cluster 3 is significant among clusters, whereas cluster 2 is not). Cluster 4 was unlabelled as there were insufficient characteristics of the symptoms and signs for CM diagnosis. It had the lowest level (mild) of pain intensity and lowest disability level among the four clusters.

4. Discussion

4.1. Summary of Findings. The present study identified three distinct CM patterns of TTH through a cluster analysis of 170 TTH participants in a bilingual cross-sectional survey. The results of this study suggest that TTH can be subdivided based on symptoms and signs that are significant to the CM diagnostic process. Those clusters may or may differ in the subtypes of TTH (ETTH, frequent ETTH, and CTTH), stress level, pain intensity, and disability level. These findings expand the existing understanding of TTH symptomatology in Western medicine and TTH patterns in CM, which may help advance our understanding of the symptoms associated with TTH and subgroups of TTH as well as contribute to enhanced clinical practice in CM.

4.2. Pros and Cons of Explorative Analytic Methods for CM Pattern Identification. The essence of factor analysis and cluster analysis is to classify a set of observations into groups. Such an approach could be a suitable technique in supporting and verifying the CM patterns as it has been used to explore and study CM patterns in order to understand a series of diseases and conditions defined by modern medicine [57–60]. Generally, those studies identified explainable CM patterns and

interpreted those modern illness/diseases in a reasonable fashion.

Although the explorative analysis could be a valuable method for the study of CM pattern identification, the results of such analysis cannot be used directly in research or clinical practice without integration with CM theory. Hence, it is necessary to incorporate experts’ opinions and clinical experience in order to ensure the results being clinically meaningful. In this study, we combined the two approaches for pattern identification.

Initially, through the TwoStep cluster analysis, we identified a four-cluster solution and a five-cluster solution. Experts agreed that the patterns within the four-cluster solution tended to coincide more with the actual clinical observation and were meaningful for pattern identification. By contrast, the five-cluster solution did not lead to distinct sound/logical CM patterns. Finally, the four-cluster solution was used, resulting in three identifiable patterns and one unidentifiable cluster. However, it is likely the unidentifiable cluster including a few factors that are not powerful enough to form their own patterns. From the statistical perspective of the PCA results, we observed that the overall mean score (“power”) of the factors in cluster 4 was relatively “weak” (lower than 0.4) with most of the factor mean scores between 0.04 and 0.09. Consequently, those factors were considered having little diagnostic value for CM pattern recognition. In addition, our relatively small sample size may have restricted the number of identifiable patterns.

In PCA, the coefficient, known as the “factor loading,” refers to how strong each variable is associated with the proposed factor, is used to explain the correlation between the individual item and the overall factor [32]. As a rule of thumb, a factor loading below 0.4 indicates the loading condition is weak; 0.6, a moderate level; between 0.6 and 0.8, being large; and 0.8 or above, being very high [61]. We adopted 0.5 as the cutoff point. In contrast, in interpreting the results from TwoStep cluster analysis, the existing literature does not provide clear guiding rules for the cutoff mean score for including or excluding a factor within a cluster. In the present study, we used 0.4 of the cluster mean as the cutoff point. We then invited experts to interpret symptoms and signs and named each cluster to ensure clinical relevance. Three out of four clusters were labelled, reflecting this approach is workable (Appendix D).

4.3. Interpretation of Findings. The common TTH characteristics and associated symptoms identified in the present study are consistent with the findings of other studies [8–11]. The main similarities are the precipitating factors such as physical activity, stress/tension, when tired, lack of sleep, specific foods/drinks, alcohol, and skipping meals, and some accompanying symptoms such as fatigue, insomnia, and irritability. Emotion-related factors may have impacted on the presence of TTH. The present study found that stress and/or tension (73.6%) was the leading precipitating factors, and the finding is consistent with others (49.4% [8], 74.5% [62], and 63% in men and 77% [63] and 52.5% [11] in women). Only a small percentage of anxiety disorders and mood disorders

TABLE 4: Summary of comorbidity checklist results.

	Item	Frequency (<i>n</i>)	(%)
1	Cardiac	6	3.5
2	Vascular	11	6.5
3	Hematology	2	1.2
4	Respiratory	13	7.6
5	Ophthalmology and otorhinolaryngology	15	8.8
6	Upper gastrointestinal	16	9.4
7	Lower gastrointestinal	4	2.4
8	Hepatic and pancreatic	3	1.8
9	Renal	3	1.8
10	Genitourinary	3	1.8
11	Musculoskeletal-integumentary	13	7.6
12	Neurological	4	2.4
13	Endocrine-metabolic	6	3.5
14	Psychiatric	13	7.6
15	Female hormonal and reproductive	10	5.9
+1	Anxiety disorders	12	7.1
+2	Mood disorders	12	7.1
+3	Substance use disorders	2	1.2

were detected (7.1%, respectively). This is probably due to more than three quarters of the respondents were ETTH sufferers, as it has been shown that psychiatric comorbidities are more common in CTTH patients [64, 65], whereas those having less frequent TTH tend to have less psychiatric comorbidity [66]. Such method has been used in other exploratory research [67, 68].

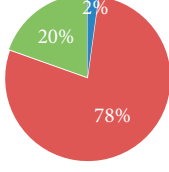
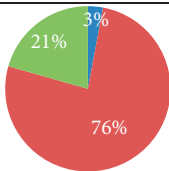
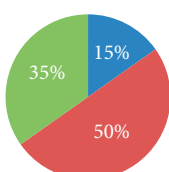
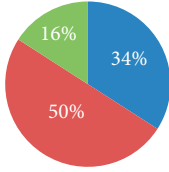
Very few studies have examined the differences between ETTH and CTTH beyond headache days. In the present study, the four CM patterns differed in the TTH subtypes. The three CM patterns not only differ in headache frequency but also in headache intensity and disability. Over three quarters of participants in clusters 1 and 2 had frequent ETTH, and about one-fifth had CTTH, whereas one-third in cluster 3 had CTTH, and half had frequent ETTH. All these three clusters had very few participants with infrequent ETTH, whereas one-third of cluster 4 was having infrequent ETTH (<1 day). Those results indicate that subtypes of TTH go beyond frequency of TTH. They could differ in clinical presentation of headache as well as accompanied signs and symptoms.

We also found that, over three quarters of participants in clusters 3 and 4 were of Asian origin, but over three quarters of those in clusters 1 and 2 were of non-Asian (Oceania and European) origin. In our further analysis (Appendix E), over 40% of Asian participants were at MIDAS level 1, comparing with 20% in the non-Asian group, reflecting mild impact of TTH on function. Consistently, over one-fifth of Asian participants (22%) suffered from infrequent headache, compared with 5% of non-Asian participants did. The former also tended to have poor coping ability as assessed with PSS. Those findings are consistent with differences in four clusters identified in the current study. The ethnic difference in cluster is, therefore, likely due to the frequency and severity of headache and coping strategies, rather than differences in ethnicity. This question is, however, beyond the scope of this paper, which aims to assess if advanced statistical methods could help with TTH CM syndrome differentiation. Future studies with larger sample sizes

could examine the impact of demographic features on TTH patterns.

4.4. Implications of the Pattern Exploration for Clinical Treatment. Currently, there is a significant gap in understanding subtypes of TTH. The IHS diagnostic criteria for TTH are designed to distinguish TTH from other types of headaches to some degree and to classify TTH into three subtypes based upon attack frequency only. Non-headache symptoms associated with TTH are, however, not explained or accounted for. Furthermore, despite several epidemiological studies observing a series of aggravating and relieving factors and accompanying symptoms of TTH, clinical practice to date has not given adequate attention to TTH symptoms. The current study fills those gaps by using knowledge of pattern identification in CM and advanced statistical methods and identified three clinically meaningful subgroups of TTH. In addition, the identified four clusters not only differed in symptoms and signs but also in the level of disability and stress. Among them, cluster 2 had the most severe headache and highest disability level, whereas cluster 4 had mildest headache intensity, moderate disability, and was free from mental comorbidity. The presence of these subgroups of TTH indicates that there is a need to go beyond frequency of TTH, as it is possible to subcategorize TTH from a multidimensional perspective, but not just limited to the frequency of headache. Addressing headache as well as accompanying nonheadache symptoms may lead to more efficient, individualised treatment strategies. The PSS score in ascendant hyperactivity of liver yang and liver depression forming fire is high, indicating emotional stress. This needs to be acknowledged by CM practitioners. Whether CM treatment modalities are adequate for addressing those emotional difficulties is yet to be examined. In the West, psychological interventions are often used to specifically address those

TABLE 5: Relationship between patterns and other outcome measures.

Clusters	Corresponding TTH subtypes	MIDAS		Outcome measures PSS (mean ± SD)		Comorbidity (%)	
		Intensity (0–10)	Disability level	By PSS items (scores of item 3: the higher, the worse) (reversed scoring of item 5 and 8: the lower, the better)	By “perceived coping” factor (combined items of 4, 5, 7, and 8; the lower, the better in coping)	Physical	Mental
Cluster 1: ascendant hyperactivity of liver yang (n = 46)		Moderate pain (5.5)	Moderate disability (grade III; 9 days)	Item 3: (2.46 ± 0.925) most often <i>‘In the last month, how often have you felt nervous and “stressed”?’</i> Item 5: (1.39 ± 0.755) most often <i>‘In the last month, how often have you felt that things were going your way?’</i>	(5.04 ± 3.025) Best performance in perceived coping among clusters. Cluster being different from clusters 3 and 4	43.40%	17.40%
Cluster 2: dual Qi and blood deficiency (n = 34)		Moderate pain (6.3)	Severe disability (grade IV; 31 days)	Item 8: (1.44 ± 0.982) most often <i>‘In the last month, how often have you felt that you were on top of things?’</i>	(5.18 ± 3.070) Cluster being different from clusters 3 and 4	55.90%	26.50%
Cluster 3: liver depression forming fire (n = 46)		Moderate pain (5.4)	Severe disability (grade IV; 24 days)	Item 5: (2.14 ± 1.104) least often <i>‘In the last month, how often have you felt that things were going your way?’</i> Item 8: (2.26 ± 1.049) LEASTLY often <i>‘In the last month, how often have you felt that you were on top of things?’</i>	(7.35 ± 4.018)* Cluster being different from clusters 1 and 2	41.30%	10.90%
Cluster 4: unlabelled group (n = 44)		Mild pain (4.7)	Moderate disability (grade III; 19 days)	Item 3: (1.39 ± 0.868) LEASTLY often <i>‘In the last month, how often have you felt nervous and “stressed”?’</i>	(7.59 ± 3.329)* Poorest performance in perceived coping. Cluster being different from clusters 1 and 2	34.10%	0.00%

Note 1: in this table, “iETTH” stands for “infrequent ETTH,” whereas the “fETTH” is the abbreviation of “frequent ETTH.” Note 2: “*”: the mean difference of PSS is significant among clusters at the 0.17 (0.05/3) level.

problems. Patients presented with either of the two patterns may require additional psychological interventions to bring out the best therapeutic effects.

4.5. Strengths. To our best knowledge, the present investigation is the first study using exploratory statistical method to research TTH-related symptoms as well as identifying CM

patterns of TTH. Our study is the first step towards a better understanding of TTH from both CM and modern medicine aspects. This study has a few important strengths. Firstly, our method provides an alternative to current modern medicine approaches in understanding features of TTH and its subgroups, contributing essential information for future research. These results expanded the common understanding of TTH symptomatology in terms of its pain description,

TABLE 6: In which areas does your headache mostly occur and how often? (Please tick (✓) one box for each item).

Location of headache	Never	Seldom	Sometimes	Often	Almost always
Forehead (front of the head)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Side of the head (left side)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Side of the head (right side)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Back of the head	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Top of the head	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Whole head	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
No particular location	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others (please specify)					

TABLE 7: When you have a headache, do you ever have discomfort (pain, tension, or tenderness) in the following areas? (Please tick (✓) one box for each item).

Affected area	Never	Seldom	Sometimes	Often	Almost always
Neck	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shoulders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ears	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eyebrow	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cheeks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jaw	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nose/bridge of nose	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others (please specify)					

TABLE 8: What is the sensation of your headache? (Please tick (✓) as many items as applicable).

<input type="checkbox"/> Pressing	<input type="checkbox"/> Explosive	<input type="checkbox"/> Burning	<input type="checkbox"/> Drilling	<input type="checkbox"/> Cutting
<input type="checkbox"/> Sharp	<input type="checkbox"/> Vague	<input type="checkbox"/> Heavy	<input type="checkbox"/> Dull	<input type="checkbox"/> Throbbing
<input type="checkbox"/> Pulling	<input type="checkbox"/> Empty	<input type="checkbox"/> Tight	<input type="checkbox"/> Distending	<input type="checkbox"/> Piercing
<input type="checkbox"/> Pulsating	<input type="checkbox"/> Radiating	<input type="checkbox"/> Pounding	<input type="checkbox"/> A “band-like” sensation around the head	
Others (please specify)				

TABLE 9: When you have a headache, what is the nature of the headache? (Please tick (✓) one box for each item).

	Never	Seldom	Sometimes	Often	Almost always
Fixed (headache with fixed location)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Moves (headache moves around the head or shifting from side to side)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Continuous (constant, persistent, nonstop headache)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Intermittent (headache comes and goes, occasional, or periodically occurring)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

TABLE 10: Over the last 3 months, on average, how many days per month did you have a headache? (Please tick (✓) one of the three options).

<input type="checkbox"/> Less than one day	<input type="checkbox"/> Between 1 and 14 days	<input type="checkbox"/> 15 days or more
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trigger factors, and accompanying symptoms. Secondly, our results fill the significant gap in the existing literature of CM on headaches, which there is lack of differentiation of TTH from other types of headaches, such as migraine or secondary headache. Through recruiting only TTH sufferers and using a validated questionnaire, we were able to collect comprehensive data of TTH that are of clinical significance to CM. Thirdly, the existing CM patterns of TTH in the literature relied on expert opinions alone. Our study used the evidence-based approach of combining exploratory data analysis with expert opinions to ensure the objectivity and clinical significance of our findings.

4.6. Limitations. There are several limitations of the current study. Firstly, the present results could be limited due to its sample size, as some other possible patterns may be observed with a larger sample size. Secondly, relying on exploratory analysis or expert opinion alone has its drawbacks. Statistically determined clusters can be affected by many factors. Expert opinions may be subjective. The present study combines both approaches to minimize this limit. Lastly, this study is a cross-sectional study, which only analyses the symptom distribution collected at a specific duration over the last 3 months. The presence and the severity of symptoms observed may change over time. Future studies may use

TABLE 11: During the course of the day, when does your headache get worse? (Please tick (✓) as many items as applicable).

<input type="checkbox"/> Worse in the morning	<input type="checkbox"/> Worse in the afternoon	<input type="checkbox"/> Worse at the end of the day
<input type="checkbox"/> Worse at night	<input type="checkbox"/> All day	<input type="checkbox"/> No particular time

TABLE 12: What aggravates your headache? (Please tick (✓) one box for each item).

	Don't know	Never	Seldom	Sometimes	Often	Almost always
Increased tension						
Overwork (e.g., prolonged working hours, long periods of studying/typing)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When tired	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mental strain (e.g., overthinking or other concentration)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eyestrain (e.g., reading, computer, or TV)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Muscular strain (muscle tightness)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physical labour	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of sleep	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Poor posture in sitting, standing or sleeping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diet						
Alcohol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coffee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dehydration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hunger/being hungry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chocolate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cigarette smoking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Soft drink/sodas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cheese	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dairy foods (e.g., milk, ice cream, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Monosodium glutamate (MSG)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sugar/too much sugar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spicy food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overconsumption of oily food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Irregular diet (e.g., eating on the run, skip meals)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Weather						
Change of weather	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Change in temperature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Exposure to bright lights or sunshine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hot weather	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cold weather	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Windy days	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Damp weather/humid weather	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rainy days	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stress and emotional changes						
Stress	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nervousness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Anger or irritability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Anxiety (excessive worry)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Depression (feeling unhappy or depressed)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tension or conflict-related (e.g., from financial constraints, family, relationship, and/or work)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other factors						
Sneezing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Teeth grinding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify)						

TABLE 13: What relieves your headache? (Please tick (✓) one box for each item).

	Don't know	Never	Seldom	Sometimes	Often	Almost always
Rest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lying down	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sleeping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Exercise/light exercise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Massage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pressing/applying pressure on the pain area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Warmth (e.g., warm environment, hot drink, hot pack, hot shower, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coldness (e.g., cold environment, cold drink, cold pack, cold shower, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others (please specify)						

TABLE 14: Do you have any of the following symptoms that may or may not be related to your headache? (Please tick (✓) one box for each item).

	Never	Seldom	Sometimes	Often	Almost always
Eye-related					
Sensitivity to light (or to bright lights)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dry eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tearful eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blurred vision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sore eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Red eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Swollen eyelids	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Eye twitching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Floater in the eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Burning sensation in the eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Itchy sensation in the eyes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Face related (mouth, ear, and nose)					
Sensitivity to sound (or to loud noises)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dry mouth	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thirst	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bitter taste in the mouth	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Runny nose	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sore throat/feeling of foreign body in the throat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ear discharge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tinnitus (ringing in the ears)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flushed face/hot red face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Digestion-related					
Nausea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vomiting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reflux	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Belching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bloating/flatulence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Indigestion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Poor appetite/loss of appetite	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Urine and bowel related					
Yellowish urine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Frequent urination (especially at night)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Watery bowel motion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loose bowel motion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dry stools	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Constipation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Muscle- and joint-related					
Joint stiffness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neck stiffness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Muscle twitching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Weak legs and knees	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

TABLE 14: Continued.

Feeling weak in the lower back	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feeling cold in the lower back or lower back pain worsened by coldness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cold hands and feet/cold limbs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hot sensation in the palms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
“Pins and needles” or numbness in the hands and/or feet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other symptoms					
Increased forgetfulness or poor memory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feeling depressed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Irritability/irascibility (short-tempered, easily angered)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Restlessness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fatigue/tiredness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Faintness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heavy sensation in the body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Insomnia (difficulty falling asleep or staying asleep)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sighing often	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feverish sensation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shortness of breath	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dizziness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excessive phlegm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Palpitation (feeling the heart beats quickly or unusually)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inability to concentrate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night sweating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sweating upon mild activity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aversion to cold or fear of being cold	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aversion to hot or fear of being hot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sensitive to temperature changes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others (please specify)					

TABLE 15: Apart from headache, do you experience pain in any other parts of your body? (Please tick (✓) as many items as applicable).

<input type="checkbox"/> Neck	<input type="checkbox"/> Shoulder	<input type="checkbox"/> Jaw	<input type="checkbox"/> Throat
<input type="checkbox"/> Ears	<input type="checkbox"/> Eyes	<input type="checkbox"/> Chest	<input type="checkbox"/> Breasts
<input type="checkbox"/> Upper back	<input type="checkbox"/> Middle back	<input type="checkbox"/> Lower back	<input type="checkbox"/> Abdomen
<input type="checkbox"/> Arms	<input type="checkbox"/> Legs	<input type="checkbox"/> Knees	<input type="checkbox"/> Heel
<input type="checkbox"/> Hips	<input type="checkbox"/> Buttocks	<input type="checkbox"/> Flank (side of the body)	<input type="checkbox"/> Hypochondria (lower abdomen)
Others (please specify)			

TABLE 16: Information related to women’s health (Only female participants need to fill in this section. This section is about women’s health which may relate to your headache.).

3.3.1. Do you still have periods?	
<input type="checkbox"/> No	If no, please ignore section (3.3.2) and tick the following reasons
	<input type="checkbox"/> Menopause <input type="checkbox"/> Hysterectomy <input type="checkbox"/> Contraceptive pill <input type="checkbox"/> Other medications <input type="checkbox"/> Other underlying diseases <input type="checkbox"/> Pregnancy <input type="checkbox"/> Others (please specify)
<input type="checkbox"/> Yes	If Yes, please complete the next section (3.3.2)

TABLE 17: Information related to women’s health (continued) (please tick (✓) one box for each item).

	Never	Seldom	Sometimes	Often	Almost always
Irregular period cycle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Early periods (shortened menstrual cycle)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Delayed periods (prolonged menstrual cycle)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Light bleeding (bleeding less than normal)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excessive bleeding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

TABLE 17: Continued.

	Never	Seldom	Sometimes	Often	Almost always
Bleeding with clots	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bright red-coloured menstrual blood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Light red-coloured menstrual blood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dark-coloured menstrual blood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excessive watery discharge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yellow discharge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Headache during period	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Headache after period	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Abdominal pain before periods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Abdominal pain during periods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Abdominal pain after periods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lower back pain before periods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lower back pain during periods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lower back pain after periods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Others (please specify)					

TABLE 18: Do you have any other diseases or health conditions diagnosed by your medical doctor? No. Yes. If yes, please tick the following listed conditions that apply to you (Please tick (✓) as many items as applicable).

<input type="checkbox"/> Cardiac	Heart problem (such as cardiopathy, pericarditis, coronary heart disease, myocarditis, angina, myocardial infarction, arrhythmia, and valve problems)
<input type="checkbox"/> Vascular	Circulatory problem (such as peripheral atherosclerotic disease and aneurysm of the abdominal aorta), hypertension, or cholesterol problem
<input type="checkbox"/> Hematological	Blood problem (anemia, leukemia, hypercoagulability, or any other problem affecting the blood, the blood cells, the spleen, or the lymphatic system)
<input type="checkbox"/> Respiratory	Respiratory problem (such as asthma, emphysema, bronchitis, pulmonary embolism, or any problems related to the lungs, bronchi, and trachea)
<input type="checkbox"/> Ophthalmological and otorhinolaryngology	Problems of the eyes (such as glaucoma, cataract, and loss of vision); ears (such as important hearing impairment and otitis media); nose (such as sinusitis and rhinitis); throat (pharyngitis), and voice
<input type="checkbox"/> Upper gastrointestinal (does not include diabetes)	Problems of the stomach or digestion (such as problems of the esophagus, stomach, and duodenum (such as gastritis, peptic ulcer, and duodenal ulcer)
<input type="checkbox"/> Lower gastrointestinal	Intestinal problems (such as intestinal hernias, enteritis, intestinal tuberculosis, chronic diarrhea, colitis, constipation, anal problems and bowel incontinence)
<input type="checkbox"/> Hepatic and pancreatic	Problems of the liver (impairment in function, liver infection, etc.), pancreas (such as pancreatitis), gallbladder (such as cholecystitis)
<input type="checkbox"/> Renal	Problems of the kidneys (impairment in function, kidney infection, etc.)
<input type="checkbox"/> Genitourinary	Problems of the urination system, such as ureters, bladder, urethra, prostate, and genitals (such as kidney stone, urinary incontinence, bladder infection, prostate diseases, and sexual dysfunction)
<input type="checkbox"/> Musculoskeletal-integumentary	Problems of the muscles, joints, bones, connective tissue, and skin (such as fibromyalgia, rheumatoid arthritis, osteoarthritis, osteoporosis, and other forms of arthritis, carpal tunnel syndrome, Sjogren's syndrome, systemic lupus erythematosus, polymyositis etc.) and any skin (such as atopic dermatitis, eczema, and herpes) or other musculoskeletal problems
<input type="checkbox"/> Neurological	Neurological (brain, spinal cord, and nerves) problem (such as cerebrovascular accident, peripheral neuropathy, facial neuritis, polyneuropathy, Gearan-Kaizer syndrome, myelitis, myasthenia gravis, and multiple sclerosis)
<input type="checkbox"/> Endocrine-metabolic	Problems of the thyroid gland, obesity, diabetes, or any other hormonal problems
<input type="checkbox"/> Psychiatric	Problems of depression, anxiety, alcohol, drug abuse, or other problems
<input type="checkbox"/> Female hormonal and reproductive (for females only)	Problems of reproductive system (such as the uterus, ovary, and fallopian tubes) and other gynaecological problems (such as premenstrual syndrome, polycystic ovary syndrome, and pelvic inflammatory disease)
<input type="checkbox"/> Others (please specify)	

TABLE 20: Continued.

CMHQ item	Part I component																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
3.2.11	0.584																
3.2.12					0.665												
3.2.13		0.700															
3.2.14		0.778															
3.2.15																	
3.2.16			0.639														
3.2.17																	
3.2.18																	
3.2.19				0.664													
3.2.20				0.744													
3.3.2.1					0.753												
3.3.2.2				0.548													
3.3.2.3					0.810												
3.3.2.4					0.591												
3.3.2.5		0.675															
3.3.2.6	0.638																
3.3.2.7																	
3.3.2.8		0.629															
3.3.2.9	0.521																
3.3.2.10		0.805															
3.3.2.11		0.763															
3.3.2.12				0.624													
3.3.2.13				0.791													
3.3.2.14				0.699													
3.3.2.15	0.782																
3.3.2.16	0.735																
3.3.2.17			0.801														
3.3.2.18			0.660														
3.3.2.19			0.622														
3.3.2.20			0.870														

Extraction method: principal component analysis. Rotation method: varimax with Kaiser normalization.

TABLE 21: Extraction of factors.

CMHQ part 1: pain description	CMHQ part 2: aggravating and relieving factors	CMHQ part 3: accompanying symptoms
FAC 1.1F1CentralHead	FAC 2.1F1Mental	FAC 3.1F1Liver-Qi&Fire
FAC 1.1F2WholeHead	FAC 2.1F2Food	FAC 3.1F2Eye
FAC 1.1F3LateralHead	FAC 2.1F3WeatherChange	FAC 3.1F3BoneJointWind
FAC 1.3F1RhythmHeadache	FAC 2.1F4NoFood&Drink	FAC 3.1F4PoorDigestion
FAC 1.3F2ExplosiveNotDull	FAC 2.1F5MentalStrain	FAC 3.1F5LiverSpleenFire
FAC 1.3F3SharpHeadache	FAC 2.1F6MuscularStrain	FAC 3.1F6YinDeficiency
FAC 1.3F4TightHeadache	FAC 2.1F7Oil&Spicy	FAC 3.1F7LiverAttackStomach
FAC 1.3F7DistendingHeadache	FAC 2.1F8WindDamp	FAC 3.1F8ENT
FAC 1.3F8EmptyHeadache	FAC 2.1F9PhysicalStrain	FAC 3.1F9LightSound
FAC 1.5F1LateOfDay	FAC 2.1F10Alcohol-DrugCigar	FAC 3.1F10TemperatureSensitivity
FAC 1.5F2BothEnd	FAC 2.2F1Rest	FAC 3.1F11Constipation
FAC 1.5F3AllDay	FAC 2.2F2PhysicalStimulation	FAC 3.1F12BloodDeficiency
	FAC 2.2F3EatingRelated	FAC 3.1F13YangDeficiency
		FAC 3.1F14SpleenDeficiencyOfBowel
		FAC 3.1F16Tinnitus
		FAC 3.1F17Insomnia
Included: <i>n</i> = 12	Included: <i>n</i> = 13	Included: <i>n</i> = 16

*: In this table, "FAC" is the abbreviation of "factor," whereas the numbers 1.X after it indicate their section number. For instance, FAC1.6F1 denotes the extracted first factor of Table 11, which summarised items of forehead, back of the head, and top of the head.

TABLE 22: Results of the cluster analysis.

Clusters	Factors (PCA mean score)		
	CMHQ part 1 factors	CMHQ part 2 factors	CMHQ part 3 factors
Cluster 1: ascendant hyperactivity of liver yang	(i) 1.3F4TightHeadache (0.68)	(i) 2.1F4NoFood&Drink (0.69)	
	(ii) 1.3F1RhythmHeadache (0.53)	(ii) 2.1F6MuscularStrain (0.42)	(i) 3.1F9LightSound (0.61)
	(iii) 1.1F1CentralHead (0.51)		
Cluster 2: dual Qi and blood deficiency	(i) 1.6F2BothEnd (0.72)	(i) 2.2F2PhysicalStimulation (0.65)	(i) 3.1F14SpleenDeficiencyOfBowel (0.71)
	(ii) 1.1F3LateralHead (0.66)	(ii) 2.1F3WeatherChange (0.55)	
	(iii) 1.6F3AllDay (0.65)	(iii) 2.2F3EatingRelated (0.44)	
	(iv) 1.3F1RhythmHeadache (0.56)	(iv) 2.1F4NoFood&Drink (0.42)	(ii) 3.1F12BloodDeficiency (0.49)
	(v) 1.1F1CentralHead (0.51)		
Cluster 3: liver depression forming fire	(i) 1.1F2WholeHead (0.66)	(i) 2.1F1Mental (0.42)	(i) 3.1F5LiverStomachFire (0.51)
	(ii) 1.3F2ExplosiveNotDull (0.29)		(ii) 3.1F4PoorDigestion (0.07)
Cluster 4: nonspecific cluster	(iii) 1.3F3SharpHeadache (0.04)	(ii) 2.1F8WindDamp (0.08)	(iii) 3.1F10TemperatureSensitivity (0.09)
			(iv) 3.1F11Constipation (0.04)

*: this table reports the results of the TwoStep cluster analyses. Computed from the TwoStep cluster algorithm, mean scores of extracted factors that exceeded value 0.4 are listed for clusters 1, 2, and 3. The cutoff of 0.4 was determined as those clusters being considered to be clinically relevant.

TABLE 23: Group comparisons on MIDAS, PSS, and TTH subtypes between Asian and Non-Asian participants.

MIDAS	Asian vs. Non-Asian		Chi	t-test	
	MIDAS LEVEL		0.007*	N/A	
	MIDAS SUM		N/A	0.122	
	MIDAS a (item)		N/A	0.073	
	MIDAS B (item)		N/A	0.000*	
PSS	Asian vs. Non-Asian		Chi	t-test	
	PSS SUM		N/A	0.615	
	PSS perceived distress		N/A	0.445	
	PSS perceived coping ability		N/A	0.000*	
TTH subtypes	Asian	Non-Asian	Total	Chi	t-test
(1) Infrequent ETTH	19	4	23	0.005*	N/A
(2) Frequent ETTH	47	56	103		
(3) Chronic TTH	18	20	38		
Total	84	80	164		

*: the mean difference is significant at the 0.05 level.

longitudinal cohort approaches to evaluate the stability of the identified CM patterns over time and to assess the effect of interventions.

5. Conclusions

This study provides new and critical information for determining the symptom patterns of TTH. The finding will contribute to the subgroup or pattern classification and guide targeted intervention design, including

acupuncture, for future clinical practice and research. Future studies with a large sample size will identify other patterns in addition to those reported in the current study (Tables 6–23)

Abbreviations

ANOVA: One way analysis of variance
 CIRS: Cumulative Illness Rating Scale
 CM: Chinese medicine

CMHQ:	Chinese Medicine Headache Questionnaire
CTTH:	Chronic tension-type headache
ETTH:	Episodic tension-type headache
ICHD-II:	Headache Society TTH Diagnostic Criteria (2nd edition)
IHS:	International Headache Society
MIDAS:	Migraine disability assessment test
PCA:	Principal component analysis
PSS:	Perceived Stress Scale
SD:	Standard deviation
TCM:	Traditional Chinese medicine
TTH:	Tension-type headache
WMH-CIDI:	World Mental Health Composite International Diagnostic Interview.

Appendix

A. Chinese Medicine Headache Questionnaire (CMHQ)

Please tick the listed items that best describe your headache and other symptoms you experienced over the last 3 months.

Part I: Pain Description

Part II: Aggravating and Relieving Factors

Part III: Accompanying Symptoms

Part IV: Other Conditions

B. Rotated Component Matrix for CMHQ Factor Extraction

C. Extraction of Factors

D. Results of the Cluster Analysis

E. Group Comparisons on MIDAS, PSS, and TTH Subtypes between Asian and Non-Asian Participants

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethical Approval

The study was approved by the College Human Ethics Advisory Network (CHEAN) of Science Engineering and

Health, RMIT University (protocol approval number: BSEHAPP 10–11 HAO) and subsequently ratified by collaboration sites. Participation to the study was on a voluntary basis. All data were anonymous.

Consent

All participants were provided information explaining the purpose of the study and informed consent was obtained from them before inclusion.

Disclosure

The authors have submitted a draft version of the manuscript to Research Square previously. The current manuscript is our updated version for submission, which is different from the preprint on Research Square <https://www.researchsquare.com/article/rs-10234/v1>.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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