Journal of Pharmaceutical Policy and Practice

ISSN: 2052-3211 (Online) Journal homepage: www.tandfonline.com/journals/jppp20

Translation and validation of the Pharmacy Services Questionnaire (PSQ) in a Chinese population

Chi Lam Cheung, Hei Hang Edmund Yiu, Frank Nim Kok Chan, Tommy Lok Hei Cho, Janet Hiu Tung Sun, Marco Tsun Lee, Tommy Ka Ho Lee, Gladys Daphne Cheung, Kitty Kit Ki Law, Janet Kit Ting Wong, Franco Wing Tak Cheng, Leo Kin Yip Lo, William Ho Ching Yuen, Reason Pui Yan Yuen, Timothy F. Chen, Esther Wai Yin Chan, Ian Chi Kei Wong, Vanessa Wai Sei Ng & Eric Yuk Fai Wan

To cite this article: Chi Lam Cheung, Hei Hang Edmund Yiu, Frank Nim Kok Chan, Tommy Lok Hei Cho, Janet Hiu Tung Sun, Marco Tsun Lee, Tommy Ka Ho Lee, Gladys Daphne Cheung, Kitty Kit Ki Law, Janet Kit Ting Wong, Franco Wing Tak Cheng, Leo Kin Yip Lo, William Ho Ching Yuen, Reason Pui Yan Yuen, Timothy F. Chen, Esther Wai Yin Chan, Ian Chi Kei Wong, Vanessa Wai Sei Ng & Eric Yuk Fai Wan (2025) Translation and validation of the Pharmacy Services Questionnaire (PSQ) in a Chinese population, Journal of Pharmaceutical Policy and Practice, 18:1, 2527409, DOI: 10.1080/20523211.2025.2527409

To link to this article: https://doi.org/10.1080/20523211.2025.2527409

JOURNAL OF PHARMACEUTICAL POLICY AND PRACTICE
2025, VOL. 18, NO. 1, 2527409
https://doi.org/10.1080/20523211.2025.2527409

Taylor & Francis
Taylor & Francis Group

RESEARCH ARTICLE

OPEN ACCESS

Check for updates

Translation and validation of the Pharmacy Services Questionnaire (PSQ) in a Chinese population

Chi Lam Cheung [a,b*], Hei Hang Edmund Yiu [a*], Frank Nim Kok Chan[a], Tommy Lok Hei Cho[a,b], Janet Hiu Tung Sun[a], Marco Tsun Lee[a], Tommy Ka Ho Lee[a], Gladys Daphne Cheung[a], Kitty Kit Ki Law[a], Janet Kit Ting Wong[a], Franco Wing Tak Cheng[a,c,i], Leo Kin Yip Lo[d], William Ho Ching Yuen[e], Reason Pui Yan Yuen[f], Timothy F. Chen[g], Esther Wai Yin Chan [a,h,i,j], Ian Chi Kei Wong [i,k,l,m], Vanessa Wai Sei Ng[a,h] and Eric Yuk Fai Wan [a,b,m,n]

[a]Centre for Safe Medication Practice and Research, Department of Pharmacology and Pharmacy, LKS Faculty of Medicine, University of Hong Kong, Hong Kong SAR, People's Republic of China; [b]Department of Family Medicine and Primary Care, School of Clinical Medicine, LKS Faculty of Medicine, The University of Hong Kong, Hong Kong SAR, People's Republic of China; [c]Pharmacy Department, Gleneagles Hong Kong Hospital, Hong Kong SAR, People's Republic of China; [d]St. James' Settlement, Hong Kong SAR, People's Republic of China; [e]The Lok Sin Tong Benevolent Society Kowloon, Hong Kong SAR, People's Republic of China; [f]Aberdeen Kai Fong Welfare Association, Hong Kong SAR, People's Republic of China; [g]The University of Sydney School of Pharmacy, Sydney, New South Wales, Australia; [h]Laboratory of Data Discovery for Health ($D^2$4H), Hong Kong Science and Technology Park, Hong Kong SAR, People's Republic of China; [i]Department of Pharmacy, The University of Hong Kong-Shenzhen Hospital, Shenzhen, People's Republic of China; [j]The University of Hong Kong Shenzhen Institute of Research and Innovation, Shenzhen, People's Republic of China; [k]Research Department of Practice and Policy, School of Pharmacy, University College London, London, United Kingdom; [l]Aston Pharmacy School, Aston University, Birmingham, United Kingdom; [m]Advanced Data Analytics for Medical Science Limited, Hong Kong SAR, People's Republic of China; [n]The Institute of Cardiovascular Science and Medicine, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong Special Administrative Region, People's Republic of China

ABSTRACT

Background: The Pharmacy Services Questionnaire (PSQ) was developed to measure patient satisfaction with pharmaceutical care. However, it has not

CONTACT Vanessa Wai Sei Ng vanwsng@hku.hk Centre for Safe Medication Practice and Research, Department of Pharmacology and Pharmacy, General Office, L02-56 2/F, Laboratory Block LKS Faculty of Medicine, The University of Hong Kong, 21 Sassoon Road, Pokfulam, Hong Kong SAR, People's Republic of China; Eric Yuk Fai Wan yfwan@hku.hk Department of Pharmacology and Pharmacy, LKS Faculty of Medicine, The University of Hong Kong, General Office, L02-56 2/F, Laboratory Block, 21 Sassoon Road, Pokfulam, Hong Kong, People's Republic of China
*Co-first authors with equal contributions.

Supplemental data for this article can be accessed online at https://doi.org/10.1080/20523211.2025.2527409.

been translated into Cantonese-Chinese and validated in the Hong Kong population. To develop and validate a Cantonese-Chinese-translated PSQ among native Chinese patients who have used pharmacy services at community pharmacies in Hong Kong.
Methods: The PSQ was developed and translated into Cantonese-Chinese using iterative forward-backwards translation. Subjects were recruited by convenience sampling at three community pharmacies. Internal consistency, construct validity, discriminant validity, known-group comparison and Confirmatory Factor Analysis (CFA) were performed to confirm that the Cantonese-Chinese-translated PSQ is a valid measure of its intended constructs. Qualitative think-aloud interviews were carried out to test for comprehension and content validity. The subjects' views and interpretation of each questionnaire item were also explored to determine the relevance, comprehensiveness, and adequacy of the response options.
Results: A total of 236 adult subjects were recruited to complete the Cantonese-Chinese PSQ and the Chinese 5-Level EuroQol 5-Dimension (EQ-5D-5L HK) questionnaire. Additionally, think-aloud interviews were carried out with 15 subjects. Most subjects were able to understand and interpret the Cantonese-Chinese PSQ with relative ease. The internal consistency of Cantonese-Chinese PSQ was excellent (Cronbach's $\alpha > 0.96$) for the full-scale, Friendly explanation (FE) subscale and Managing therapy (MT) subscale. CFA confirmed the hypothesised two-factor structure of the Cantonese-Chinese PSQ. Individuals with higher education levels showed statistically significantly higher satisfaction levels in the overall PSQ score and MT scale score compared to those with lower levels of education. Additionally, there was no statistically significant correlation between the Cantonese-Chinese PSQ and EQ-5D-5L HK scores, demonstrating discriminant validity.
Conclusion: The Cantonese-Chinese translation of the PSQ is a validated, reliable, and semantically equivalent instrument used to assess satisfaction towards services provided by community pharmacies.

ARTICLE HISTORY Received 26 January 2025; Accepted 25 June 2025

KEYWORDS Satisfaction; community pharmacy; validation; questionnaire; translation

Highlights

- This is the first cross-cultural adaptation of the PSQ into Cantonese-Chinese using mixed methods.
- The Cantonese-Chinese PSQ is a valid and reliable tool for evaluating patients' satisfaction towards community pharmacy services.
- These findings suggest that the Cantonese-Chinese PSQ is both comprehensive and simple to administer in practice. It can serve as a standardised instrument for ensuring quality of care and inform further development of pharmaceutical care in the community.

Background

The patient's perception of technical competence, accessibility, and personal experiences in utilising healthcare services form the basis of patient

satisfaction in the healthcare context, and is important in evaluating the quality of healthcare services (Ng & Luk, 2019; Wong et al., 2015). Traditionally, pharmacy-based care in Hong Kong is typically only provided by privately owned commercial community pharmacies, such as independent pharmacies and franchised chain stores (So et al., 2024). Recently, community pharmacies operated by non-governmental organisations (NGOs) have been established, which provide more accessible and affordable pharmaceutical care, such as community dispensing services, minor ailment services, medication management services, smoking cessation and immunisation (So et al., 2024). As such, evaluating patient satisfaction is crucial in assessing service quality within the evolving landscape of new community pharmacy services in Hong Kong.

Currently, there are several English instruments developed to measure patient satisfaction with pharmaceutical care, such as the Pharmacy Services Questionnaire (PSQ) by Larson et al. (2002), the Patient Satisfaction Survey (PSS) by Moon et al. (2016), the Pharmaceutical Care Satisfaction Questionnaire (PCSQ) by Gourley et al. (2001), and the Pharmacist Services Questionnaire (PSPSQ) by Sakharkar et al. (2015). The PSQ consists of 20 items across two domains: Friendly Explanation (FE) and Managing Therapy (MT). The FE dimension included items related to overall satisfaction, the performance of pharmacists and other pharmacy staff, the relationship with the pharmacist and the pharmacy setting (Larson et al., 2002). Meanwhile, the MT dimension includes items related to the provision of pharmaceutical care, such as medication management, resolution of medication therapy problems, and other aspects of consultation with the pharmacist (Larson et al., 2002). The PSQ is the most widely used among these instruments to measure patient satisfaction within the community pharmacy setting. The PSQ has been translated into Korean and Portuguese, and each was validated in its respective healthcare context (Ferreira et al., 2005; Kim et al., 2017). The PSQ has also been widely adapted for use in countries such as Indonesia, South Africa, and Ethiopia (Govender & Suleman, 2019; Kebede et al., 2021; Kristina et al., 2021). Almost all studies have used the PSQ within the community pharmacy setting, with only one using the PSQ in the hospital outpatient pharmacy setting (Kebede et al., 2021). While these studies validated the PSQ using robust statistical methods, the complex reasoning process of patients completing the PSQ had not been previously explored by other studies.

Although the PSQ is widely translated and adapted worldwide, no currently available Cantonese-Chinese language instrument can be used to assess patient satisfaction with community pharmacy services in Hong Kong. In addition, the PSQ had not been pilot tested using think-aloud interviews. Therefore, this study aimed to validate a Cantonese-Chinese version of the PSQ that is cross-culturally adapted to the Hong Kong population and

provide insight into the reasoning process when patients complete the PSQ (Lo et al., 2001).

Methods

The translation and cross-cultural adaptation process followed internationally recommended methods (Wild et al., 2005; Zhang et al., 2020). The original PSQ was first independently translated by iterative forward-backwards translation. The intermediate draft of the translated PSQ was then administered to community pharmacy service users recruited by pharmacists who participated in validation or think-aloud interviews.

Translation of the Cantonese-Chinese PSQ

The translation and adaptation process of the PSQ is shown in Figure 1. Two translators (CLC & JHTS) fluent in English and Cantonese-Chinese independently performed forward translations from English into Cantonese-Chinese. The translations were reviewed and reconciled into the first draft of the Cantonese-Chinese PSQ by a panel consisting of the translators and two bilingual authors (EYFW & HHEY). The first draft of the Cantonese-Chinese PSQ was then independently back-translated into English by two translators (TLHC & VWSN), who were blind to the original PSQ instrument. The back translations of the PSQ were then reconciled and produced by the back translators (TLHC & VWSN). The translations were then reviewed by two bilingual authors who were pharmacists (JKTW & MTL) to ensure the questions aligned with pharmacy practice in Hong Kong while maintaining content equivalence between the original PSQ, the back-translated English PSQ, and the Cantonese-Chinese-translated PSQ. After review, all questions in the intermediate draft of the Cantonese-Chinese PSQ were deemed equivalent to the original PSQ.

Validation

All subjects aged 18 years or older who utilised any pharmacy services (such as community dispensing service, minor ailment service, and medication management services) were conveniently sampled at one of the three

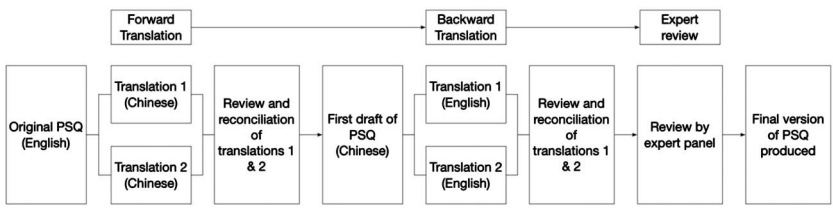

Figure 1. Translation and adaptation of the Chinese Pharmacy Satisfaction Questionnaire.

community pharmacies (The Philanthropic Community Pharmacy operated by The St. James' Settlement (New Territories branch), The A-lively Community Pharmacy operated by Aberdeen Kai-fong Welfare Association Limited and The Lok Sin Tong Mr. & Mrs. Lee Yin Yee Community Pharmacy operated by The Lok Sin Tong Benevolent Society, Kowloon) operated by NGOs in Hong Kong between 20th February 2024 and 20th May 2024 (Stratton, 2021). All study procedures and objectives were explained to the subjects before obtaining written informed consent. Subjects who could not give informed consent, communicate in Cantonese, or complete the survey were excluded from the study. All subjects completed a simple demographics questionnaire, the Cantonese-Chinese PSQ (Supplemental Material S1) and the Cantonese-Chinese version of the 5-level EuroQoL Group's 5-dimension (EQ-5D-5L HK) questionnaire. Subjects completed the EQ-5D-5L HK alongside the Cantonese-Chinese PSQ to explore the discriminant validity of the Cantonese-Chinese PSQ. Since the Cantonese-Chinese PSQ measures satisfaction towards pharmacy service and EQ-5D-5L measures health-related quality of life, which are unique constructs, discriminant validity is indicated by the lack of correlation between the Cantonese-Chinese PSQ and EQ-5D-5L HK (Schwab, 2004). The EQ-5D-5L HK consists of a descriptive system with five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) to assess health-related quality of life. Each dimension has five response levels (no problems, slight problems, moderate problems, severe problems and extreme problems) to describe the level of severity. Additionally, study subjects rated their perceived health on a vertical visual analogue scale ranging from 0 (worse health) to 100 (best health) in the EQ-5D-5L HK (EuroQol Research Foundation, 2019).

Outcome measures and statistical analyses

The Cantonese-Chinese PSQ score was calculated by summating all individual questions and dividing by the total number of questions scored (Larson et al., 2002). Responses with one or more missing or 'not applicable' items were excluded. Meanwhile, the EQ-5D-5L HK score was calculated using the methodology specified in the questionnaire user guide (EuroQol Research Foundation, 2019). Descriptive statistics, including mean, standard deviation and normality of the data, were examined. The internal consistency of the Cantonese-Chinese PSQ was assessed using Cronbach's alpha coefficient, where $\alpha = 0.6\text{-}0.7$ indicates an acceptable level of reliability, and $\alpha \geq 0.8$ indicates an excellent level of reliability (Ursachi et al., 2015). Additionally, the item-total correlation was used to determine the correlation between the individual question items and the total PSQ score. The internal construct validity of the Cantonese-Chinese PSQ was assessed using confirmatory factor analysis (CFA). Factor loadings represent the relationship

between each question item and the latent factor. Variables with higher factor loadings are considered good indicators of the underlying latent factor. Several goodness-of-fit indices, including Chi-square, Chi-square to degrees of freedom ratio, Root Mean Square Error of Approximation (RMSEA), Standardised root mean square residual (SRMR), Tucker–Lewis Index (TLI) and Comparative fit index (CFI) were used to assess if the sample data is consistent with the original latent variable structure. RMSEA and SRMR are deemed acceptable if values ≤ 0.08 and ≥ 0.9 are considered adequate for TLI and CFI (Byrne, 2001; Hu & Bentler, 1999). Known group comparison was used to compare the Cantonese-Chinese PSQ score by age, sex, level of education, marital status, employment status and household income. Student's t-tests were used to assess differences between subgroups. All data analyses were performed using R Studio version 4.2.2 and STATA version 18.5. Two-tailed tests were employed for all analyses in this study, and results with a $P < 0.05$ were considered statistically significant. Three individual analysts (CLC, FNKC and HHEY) performed all statistical analyses independently for quality assurance. Ethical approval for this study was granted by the Institutional Review Board of The University of Hong Kong/Hospital Authority Hong Kong West Cluster (HKU/HA HKW IRB), with reference number UW 23-538.

Think-aloud interview

Additionally, think-aloud interviews were performed to evaluate the interpretation and comprehensibility of each question and its respective response options, which are listed in Supplemental Material S3. All subjects were conveniently sampled from three community pharmacies operated by NGOs in Hong Kong (Stratton, 2021). Subjects were asked to verbalise their thoughts and feelings while completing the Cantonese-Chinese PSQ. The interviewer inquired how the subjects interpreted and understood each question using a semi-structured interview guide detailed in Supplemental Material S3. Probing questions were asked to help subjects elaborate on their viewpoints. General reflective questions were asked at the end of the interview to determine the overall thoughts and perceptions towards the Cantonese-Chinese PSQ. Think-aloud interviews identified issues to inform the production of the final version of Cantonese-Chinese PSQ.

Results

A total of 236 eligible subjects from three community pharmacies took part in the validation of the Cantonese-Chinese PSQ. The mean age of the subjects was 60.6 ± 14.8 years. Most of the study subjects had received at least primary school education or higher. The demographics of the subjects are

Table 1. Participant demographics.

Variable Age	N	%
Mean (SD)	60.6(14.8)	
>80	9	3.81
71–80	57	24.15
61–70	78	33.05
51–60	38	16.1
41–50	20	8.47
31–40	21	8.9
≤30	11	4.66
Missing	2	0.85
Gender		
Male	91	38.56
Female	145	61.44
Education		
Tertiary Level	78	33.05
Secondary Level	106	44.92
Primary Level	48	20.34
No schooling/Pre-primary	4	1.69
Marital status		
Currently married	150	63.56
Divorced/separated	15	6.36
Widowed	20	8.47
Never married	51	21.61
Household income ($HKD)		
> $40,000	15	6.36
$30,000–$39,999	8	3.39
$25,000–$29,999	10	4.24
$20,000–$24,999	18	7.63
$15,000–$19,999	27	11.44
$10,000–$14,999	28	11.86
$5,000–$9,999	22	9.32
<$5,000	44	18.64
Don't know	26	11.02
Refuse to answer	38	16.1
Employment status		
Full-time	63	26.69
Half-time/Part-Time	29	12.29
Home-makers	16	6.78
Retired	107	45.34
Unemployed	17	7.2
Full-time Student	4	1.69
Pharmacy Visited		
Philanthropic Community Pharmacy operated by St. James' Settlement	80	33.9
A-lively Community Pharmacy	76	32.2
Lok Sin Tong Community Pharmacy	80	33.9

SD = standard deviation.

summarised in Table 1. Out of the total 236 responses, a total of 215 valid responses were included in the statistical analysis. Three missing responses and eighteen responses with one or more items answered with 'not applicable' were excluded from the statistical analysis. In addition, fifteen subjects participated in individual think-aloud interviews (8 males and 7 females, mean age ± SD: 52.8 ± 13.5 years).

Psychometric properties of the Cantonese-Chinese PSQ

The Cronbach's alpha coefficient (α) of the whole scale Cantonese-Chinese PSQ was 0.98 and 0.96 for both FE and MT subscales respectively, demonstrating excellent internal consistency. The mean, standard deviation, and corrected item-total correlation of each item in the Cantonese-Chinese PSQ are summarised in Table 2. Subjects rated items in the FE subscale (4.00 ± 0.65) higher than those in MT (3.87 ± 0.68). The maximum possible score (ceiling) was observed in 7.3% (N = 17) of all responses. No instances of the lowest possible score (floor) were observed. The proportion of responses scoring the highest or lowest possible score was < 15%; floor and ceiling effects were not observed in this study (Garin, 2014). All items show relatively high item-total correlations ($r \geq 0.73$) after correction for overlap, indicating a strong association between each item and its respective latent construct, further supporting the consistency and reliability of the Cantonese-Chinese PSQ. All subjects were stratified into subgroups based on age groups, gender, level of education, marital status, employment status, and household income (Table 3). Subjects with tertiary education or above gave statistically

Table 2. Descriptive statistics, construct validity and internal consistency.

	Mean (SD)	Item-total correlation[a]
Friendly Explanation Scale (α = 0.960)		
Q1. The professional appearance of the pharmacy	3.96 (0.77)	0.73
Q2. The availability of the pharmacist to answer your questions	4.07 (0.75)	0.85
Q3. The pharmacist's professional relationship with you	3.94 (0.84)	0.83
Q4. The pharmacist's ability to advise you about problems that you might have with your medications	3.88 (0.81)	0.85
Q5. The promptness of prescription drug service	3.80 (0.86)	0.78
Q10. The pharmacist's efforts to solve problems that you have with your medications	3.90 (0.78)	0.87
Q11.The responsibility that the pharmacist assumes for your drug therapy	3.84 (0.75)	0.86
Q12.How well the pharmacist instructs you about how to take your medications	3.92 (0.78)	0.87
Q14.How well the pharmacist answers your questions	4.00 (0.75)	0.86
Q18.The pharmacist's efforts to assure that your medications do what they are supposed to	3.86 (0.80)	0.89
Managing Therapy Scale (α = 0.960)		
Q6. The professionalism of the pharmacy staff	4.09 (0.75)	0.82
Q7. How well the pharmacist explains what your medications do	3.97 (0.80)	0.87
Q8. The pharmacist's interest in your health	3.91 (0.85)	0.82
Q9. How well the pharmacist helps you to manage your medications	3.92 (0.79)	0.88
Q13.Your pharmacy services overall	4.00 (0.74)	0.82
Q15.The pharmacist's efforts to help you improve your health or stay healthy	3.82 (0.78)	0.82
Q16.The courtesy and respect shown you by the pharmacy staff	4.13 (0.74)	0.82
Q17.The privacy of your conversations with the pharmacist	3.83 (0.77)	0.77
Q19.How well the pharmacist explains possible side effects	3.87 (0.81)	0.88
Q20.The amount of time the pharmacist offers to spend with you	3.79 (0.80)	0.82

[a]Corrected for overlap.
SD = standard deviation.

Table 3. Known-group comparison.

Variable	PSQ total (SD)	FE (SD)	MT (SD)
Age group			
18–64	3.93 (0.72)	3.98 (0.71)	3.88 (0.76)
≥65	3.95 (0.56)	4.00 (0.59)	3.90 (0.57)
p	0.858	0.804	0.833
Gender			
Male	4.02 (0.63)	4.07 (0.65)	3.94 (0.66)
Female	3.89 (0.66)	3.94 (0.65)	3.85 (0.68)
p	0.168	0.145	0.336
Level of education			
Tertiary Level or above	4.10 (0.66)*	4.15 (0.64)	4.03 (0.69)*
Secondary Level or below	3.87 (0.64)*	3.91 (0.65)	3.82 (0.65)*
p	0.0152*	0.114	0.0241*
Marital status			
Currently married/Divorced/separated/Widowed	3.95 (0.63)	4.00 (0.64)	3.90 (0.64)
Never Married	3.90 (0.74)	3.96 (0.71)	3.84 (0.78)
p	0.637	0.717	0.607
Employment status			
Full-time/Full-time student/Half-time/Part-Time/Home-makers	3.92 (0.69)	3.97 (0.68)	3.87 (0.71)
Retired/Unemployed	3.96 (0.62)	4.01 (0.63)	3.90 (0.64)
p	0.697	0.645	0.714
Household income ($HKD)			
≥25,000	4.06 (0.60)	4.13 (0.57)	4.02 (0.62)
<25,000	3.91 (0.61)	3.95 (0.63)	3.86 (0.62)
p	0.212	0.154	0.184

FE = friendly explanation; MT = managing therapy; SD = standard deviation.
*$p < 0.05$.

higher satisfaction scores in the total and MT subscale than those with lower education levels. Overall, there were no significant differences in the total, FE and MT subscale scores across all other subgroups (Table 3).

The correlation between the PSQ mean scores and the main instrument and visual-analogue scale of EQ-5D-5L HK was very weak ($r = 0.0675$ and $r = 0.109$, respectively), indicating no meaningful relationship between the constructs measured by the PSQ and EQ-5D-5L HK (Table 4). The lack of correlation was anticipated, as the EQ-5D-5L HK assesses health-related quality of life (primarily physical health and function), whereas the PSQ evaluates patient satisfaction with pharmacy services, perceptions of care and service quality, and the patient-pharmacist relationship. Therefore, the lack of correlation between PSQ and the EQ-5D-5L HK suggests that there are no confounding variables between patient satisfaction and quality of life, and the PSQ and EQ-5D-5L HK both measure different constructs with no measurement overlap.

Table 4. Divergent validity.

	EQ5D-5L	EQ5D-5L VAS
PSQ total	0.0675	0.109
FE	0.0944	0.120
MT	0.0297	0.0862

Data are the absolute values of the Pearson's correlation coefficient.
FE = friendly explanation; MT = managing therapy.

The data were normally distributed as kurtosis (3.03), and skewness (−0.39) were less than 7 and 2, respectively, based on Finney and DiStefano (Finney & DiStefano, 2006). CFA results are summarised in Supplemental Material Table S1. Overall, factor loadings were high for all items (>0.5), indicating a strong relationship between the observed variables and their respective latent constructs. The standard errors for most factor loadings were relatively low (<0.050), suggesting reasonably precise estimates of the factor loadings. The findings illustrated an adequate model-data fit for PSQ total, FE, and MT subscales (Supplemental Material Table S2). The values for the fit indices indicate that the models are a relatively adequate fit to the two-dimensional structure proposed in the original questionnaire, as the $\chi 2/df$, RMSEA, SRMR, CFI, and TLI values generally fall within acceptable ranges (Byrne, 2001; Hu & Bentler, 1999). Meeting these thresholds suggests that the specified factor structure accurately represents the observed data, and the PSQ appropriately captures the relationships between observed variables and their underlying latent constructs. The results of the CFA confirmed the two-dimensional structure of the PSQ.

Think-aloud interviews

Overall, most subjects were able to interpret all items in the questionnaire. All subjects agreed that the Cantonese-Chinese PSQ was easy to understand while adequately representing their views towards the pharmacy service. Most study subjects thought that the Cantonese-Chinese PSQ was of appropriate length. Additionally, almost all subjects (86.7%, 13/15 total) believe the 5-level rating scale 'Excellent' – 'Poor' was sufficient. However, some subjects felt that the number of questions could be reduced, while some suggested that there may be some repetitive questions. With respect to specific items, a few subjects initially expressed confusion about the meaning of the term 'manage your medications' in question 9 (Table 2). Various comments made throughout the think-aloud interviews suggested that some patients did not fully understand the concepts of the role of pharmacists in managing their medications and general health.

> Pharmacists don't really manage my medications, as they just follow the prescription set out by doctors. (Subject 1)

While another subject stated that they are not sure how pharmacists help them manage their medications, as it is their own responsibility.

> I think managing medications is my responsibility, I am not very sure how pharmacists can help me manage it. (Subject 5)

Nevertheless, nearly all subjects were able to articulate constructs and examples related to the general meaning of medication management, such

as the safe and effective use of medications, proper storage practices, and adherence to dosage instructions, when prompted to expand on their perceptions about 'medication management'. Subjects reported no additional problems concerning comprehensibility during think-aloud interviews.

A few modifications were made to the Cantonese-Chinese PSQ after the expert review process and think-aloud interviews. The direct translation of 'promptness' in Cantonese-Chinese was not linguistically appropriate for the context of question 5 (The promptness of prescription drug service). Therefore, a Chinese term with the meaning 'efficiency' was used instead. Additionally, the response option 'not applicable' was added to some questions (questions 4, 5, 7, 9, 10, 11, 12, 18 and 19) due to differences in practice, laws and regulations of community pharmacy services provision between the United States and Hong Kong. The final translated version of the PSQ is shown in Supplemental Material S1.

Discussion

The results indicate that the Cantonese-Chinese PSQ is a valid tool for evaluating satisfaction with community pharmacy services in Hong Kong. The think-aloud interviews confirmed that the items in the Cantonese-Chinese PSQ were easy to understand, comprehensive, and relevant.

Validity of Cantonese-Chinese PSQ

The Cantonese-Chinese PSQ demonstrated a high level of internal consistency (FE scale $\alpha = 0.960$ and MT scale $\alpha = 0.960$), which was consistent with the original study conducted by Larson et al. (2002) (FE scale $\alpha = 0.957$ and MT scale $\alpha = 0.962$), and previous cross-cultural adaptations of PSQ in Korea (FE scale $\alpha = 0.91$ and MT scale $\alpha = 0.93$) and Portugal (FE scale $\alpha = 0.939$ and MT scale $\alpha = 0.960$) (Ferreira et al., 2005; Kim et al., 2017; Larson et al., 2002). The high Cronbach's α of $\alpha = 0.98$ suggests that there may be some redundant items in the questionnaire, and the length could be shortened (Tavakol & Dennick, 2011). The mean Cantonese-Chinese PSQ scores (FE 4.00 ± 0.65; MT 3.87 ± 0.68) were higher than those reported in the Korean version of the PSQ (PSQ-K) (FE 3.39 ± 0.79; MT 2.87 ± 0.9), while it was lower than the means in the original study (FE 4.31 ± 0.66; MT 3.94 ± 0.85) and the Portuguese study (FE 4.17 ± 0.68; MT 3.96 ± 0.72) (Ferreira et al., 2005; Kim et al., 2017; Larson et al., 2002). Similar to the findings reported by Kim et al. (2017) in the PSQ-K, the mean score for the FE scale was higher than the MT scale in this study (Kim et al., 2017). The similar response pattern with the PSQ-K may be because clinicians are primarily responsible for the population's medical care in both Korea and Hong Kong, where pharmacists do not have prescription rights (Kim et al., 2017; So et al., 2024; World

Health Organization. Regional Office for the Western, 2015). Consequently, most of the Korean and Hong Kong populations are not familiar with the services offered by community pharmacies and the roles of primary care pharmacists in managing their therapy, which may cause subjects to rate lower scores for the MT subscale in both studies (Kang et al., 2002; Kim et al., 2017; So et al., 2024). Furthermore, significantly higher satisfaction levels in the total PSQ score and MT scale score were observed in subjects with tertiary education compared to those with lower education levels. The relationship between higher levels of education and satisfaction was consistent with other studies conducted in primary health clinics in mainland China and the perceived need for pharmaceutical care services in Korea (Kang et al., 2017; Li et al., 2023). Subjects with a higher level of education may be able to communicate more effectively with pharmacists (Li et al., 2023). Since pharmaceutical care is not currently widely utilised by the general public in both Korea and Hong Kong, subjects with higher levels of education may be more self-aware and curious about their health (Kang et al., 2017; Kim et al., 2017; So et al., 2024). Therefore, individuals with higher education may be more interested in services offered by community pharmacies, such as medication reconciliation and advice on over-the-counter drugs and supplements, than individuals of lower education levels (Kang et al., 2017). On the other hand, there were no statistically significant correlations between the Cantonese-Chinese PSQ score and the EQ-5D-5L HK score. Since the EQ-5D-5L HK is known to measure quality of life, the lack of correlation between the PSQ and EQ-5D-5L HK confirms that two distinct constructs (patient satisfaction towards pharmacy services and health-related quality of life, respectively) are being measured by each instrument, which do not correlate with each other. In addition, the discriminant validity also confirms that quality of life does not confound with satisfaction score measured by the PSQ, as interventions aimed at improving patient satisfaction may not necessarily translate into changes in patients' overall health-related quality of life, and vice versa.

The results of CFA supported the two-factor structure (FE and MT) proposed in the original PSQ by Larson et al. (2002). The RMSEA, SRMR, CFI, and TLI values all fall into acceptable reference ranges compared to commonly accepted thresholds in literature (RMSEA ≤ 0.08, SRMR ≤ 0.08, TLI ≥ 0.9, CFI ≥ 0.9), suggesting an adequate-to-good fit of the data to the hypothesised model (Byrne, 2001; Hu & Bentler, 1999). The high CFI and TLI values ($\geq$0.90) indicate that the hypothesised model is robust and meaningful with good explanatory power. The low SRMR values < 0.05 also show that the model reproduces observed correlations well. The SRMR was below 0.08, and the RMSEA was adequate, suggesting acceptability of the fit indices and a robust factor structure. High item-own scale correlations between each questionnaire item and item-total correlation further support

the semantic equivalence between the Cantonese-Chinese PSQ and the original PSQ.

Think-aloud interviews were used to determine if subjects could understand the questionnaire as intended and whether they found the questions relevant for expressing their views. Additionally, subjects were asked to articulate their understanding of the questions and provide examples to explain their rationale for scoring each question where appropriate. The think-aloud methodology offered valuable insights into the clarity and comprehensibility of the instrument. A few subjects were unsure with the term 'manage your medications' in question 9. Subjects have stated that pharmacists don't really manage their medications, as they just follow the prescription set out by doctors, while some believe it to be their own responsibility and are unsure how pharmacists could help them in managing their medications. This could be explained by the current physician-dominated medical culture in Hong Kong, patients may be unaware of the pharmacist's ability to help them manage their medications and other potential roles of pharmacists in community healthcare (So et al., 2024). Additionally, this may also be attributed to a general lack of awareness regarding medication management in Hong Kong population, which could be further investigated in future research (So et al., 2024). With regards to the think-aloud interview method, there are some notable weaknesses which were consistent with a previous study conducted by Hagen et al. (2008), such as subjects not being proficient at thinking aloud whilst simultaneously answering the questionnaire, not all cognitive processes are captured as the subject processes the questions and a time-consuming analysis process (Hagen et al., 2008). In order to mitigate these issues, a semi-structured interview guide was produced (Supplemental Material S3), which consists of a demonstration and warm-up question that asked subjects to verbalise about windows inside their home, a set of pre-set open-ended probes to be used for each questionnaire item and a standardised set of summary questions before ending the interview (Hagen et al., 2008; Willis, 2005).

To the best of our knowledge, this is the first study to translate the PSQ into Cantonese-Chinese and validated using mixed methods and diverse demographics. Additionally, an adequate sample size was used for the validation of PSQ. Results of the think-aloud interview provided valuable insights on the appropriateness, relevance, and comprehension of each questionnaire item.

Cultural adaptation of the Cantonese-Chinese PSQ

Few modifications were made to the Cantonese-Chinese PSQ after the expert review process and think-aloud interviews. For instance, in question 5 (the promptness of prescription drug service). As pharmacists in community pharmacies predominantly only offer over-the-counter drugs to patients suffering from minor ailments, dispense prescription-only medications as prescribed

by physicians or provide general health and lifestyle advice to patients. Furthermore, community pharmacy services such as minor ailment services and medication management services are being newly developed and implemented into the healthcare system in Hong Kong, while these are long-established in Western countries such as the United States and the United Kingdom (So et al., 2024). Therefore, not all questions relating to the pharmacist's performance in managing or explaining their medications apply to all patients, as some patients may not go to the community pharmacy to purchase over-the-counter drugs, or have their prescription refilled.

Usage of the Cantonese-Chinese PSQ in practice

The Cantonese-Chinese PSQ is a comprehensive yet simple-to-administer instrument to evaluate patient satisfaction in practice. As primary healthcare pharmacy services are beginning to develop rapidly in Hong Kong, having a valid tool to assess patient satisfaction in the community pharmacy setting is crucial for advancing pharmacist-led services, such as minor ailment services and medication management services in Hong Kong (So et al., 2024). The Cantonese-Chinese PSQ can serve as a standardised quality assurance tool in community pharmacies throughout Hong Kong, enabling the comparison of scores across various time points and pharmacies, which may be used to identify potential areas for improvement. In addition, all Chinese share the same written language, with the only variance being in Traditional or Simplified characters. The Cantonese-Chinese PSQ could potentially be adapted and applied to other Chinese-speaking populations worldwide (Lam et al., 2010).

Limitations

Regarding this study's limitations, it was conducted in three community pharmacies that provide a wide range of pharmaceutical care, such as community dispensing, minor ailments, and medication management services. Therefore, our findings may not be generalisable to other retail-based or chain community pharmacy settings. Additionally, some NGO-operated community pharmacies involved in this study were located on the upper floors of commercial buildings; therefore, service users tend to be more intentional in seeking pharmaceutical care by making deliberate journeys to these locations. Furthermore, self-selection and sampling bias of subjects might have been potentially introduced by convenience sampling. Recruited subjects are likely frequent users of community pharmacy services compared to the general population, who may be more familiar with or aware of the roles of primary care pharmacists and services offered by community pharmacies. Further studies should be carried out to test the sensitivity of PSQ to other potential determinants associated with patient satisfaction, such

as social status, education level and comorbidities. In addition, further iterations of a shortened version of the PSQ could also be developed.

Conclusion

The Cantonese-Chinese PSQ is a validated and translated version of the original PSQ. Our results have demonstrated its reliability, validity, and semantic equivalence. The Cantonese-Chinese PSQ is deemed to be a valid instrument for measuring and reporting patient satisfaction with community pharmacy services in Hong Kong.

Acknowledgments

The authors would like to thank Professor John Rovers for providing us permission to adapt the PSQ to the Chinese population. We thank all subjects who have joined the study for their time and contribution. Furthermore, we would also like to acknowledge all support provided by the participating community pharmacies, pharmacists and students studying Bachelor of Pharmacy at the University of Hong Kong. The computations were performed using research computing facilities offered by Information Technology Services at the University of Hong Kong.

Authors contributions

Concept and design by CLC, HHEY, VWSN and EYFW. Funding acquisition by EYFW and ICKW. Statistical analysis by CLC, HHEY, FNKC. Qualitative analysis by CLC, FNKC, TLHC. Drafting of the manuscript by CLC, HHEY and VWSN. Critical revision of the manuscript for important intellectual content by all authors. Administrative, technical, or material support by EYFW and ICKW. Supervision by EYFW and ICKW. EYFW and ICKW are the guarantors of this work and, as such, had full access to all the data in the study and took responsibility for the integrity of the data and the accuracy of the data analysis.

Disclosure statement

HHEY reported receiving research grants from the Health Bureau of the Government of the Hong Kong SAR (HMRF) and Viatris, outside the submitted work. EWYC has received grants from Research Grants Council of the Hong Kong SAR, Research Fund Secretariat of the Health Bureau of the Hong Kong SAR, National Natural Science Fund of China, Bayer, Pfizer, Novartis, AstraZeneca, the RGA Reinsurance Company, Narcotics Division of the Security Bureau of the Hong Kong SAR, and the National Health and Medical Research Council Australia; consulting fees from AstraZeneca, Pfizer and Novartis; and honorarium from the Hospital Authority of the Hong Kong outside the submitted work. EYFW has received research grants from the Health Bureau, the Hong Kong Research Grants Council, Narcotics Division, Security Bureau, Social Welfare Department, Labour and Welfare Bureau of the Government of the Hong Kong SAR and National Natural Science Foundation of China; serves on member of Core Team for Expert Group on Drug Registration of Pharmacy and Poisons Board, and is the director of Advance Data Analytics for Medical Science

(ADAMS) Limited (HK). These are outside the submitted work. ICKW received research grants from Amgen, Janssen, GSK, Novartis, Pfizer, Bayer and Bristol-Myers Squibb and Takeda, Institute for Health Research in England, European Commission, National Health and Medical Research Council in Australia, The European Union's Seventh Framework Programme for research, technological development, Research Grants Council Hong Kong and Health and Medical Research Fund Hong Kong; consulting fees from IQVIA and World Health Organization; payment for expert testimony for Appeal Court in Hong Kong; serves on advisory committees for Member of Pharmacy and Poisons Board; is a member of the Expert Committee on Clinical Events Assessment Following COVID-19 Immunization; is a member of the Advisory Panel on COVID-19 Vaccines of the Hong Kong Government; is the non-executive director of Jacobson Pharma Corp. Ltd. in Hong Kong; and is the founder and director of Therakind Limited (UK), Advance Data Analytics for Medical Science (ADAMS) Limited (HK) and OCUS Innovation Limited (HK, Ireland and UK). The remaining authors have nothing to disclose.

Funding

This work was supported by the Hong Kong Jockey Club Charities Trust.

Availability of data and materials

Data in this study are available from the corresponding authors upon reasonable request.

ORCID

Chi Lam Cheung http://orcid.org/0009-0000-5880-5854
Hei Hang Edmund Yiu http://orcid.org/0000-0002-1492-9414
Esther Wai Yin Chan http://orcid.org/0000-0002-7602-9470
Ian Chi Kei Wong http://orcid.org/0000-0001-8242-0014
Eric Yuk Fai Wan http://orcid.org/0000-0002-6275-1147

References

Byrne, B. M. (2001). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (1 ed.). Psychology Press. https://doi.org/10.4324/9781410600219

EuroQol Research Foundation. (2019). *EQ-5D-5L user guide*. Retrieved July 24, 2024, from https://euroqol.org/publications/user-guides.

Ferreira, P., Santos, H., Fernandez-Llimos, F., Fontes, H., González, E., & Monteiro, C. (2005). Translation and validation of the "Pharmacy Services Questionnaire"/ Traducción y validación del "Pharmacy Services Questionnaire" al portugués (europeo). *Seguimiento Farmacoterapéutico*, *3*(1), 43–56.

Finney, S. J., & DiStefano, C. (2006). *Structural equation modeling: A second course*. Information Age Publishing.

Garin, O. (2014). Ceiling effect. In A. C. Michalos (Ed.), *Encyclopedia of quality of life and well-being research* (pp. 631–633). Springer Netherlands. https://doi.org/10.1007/978-94-007-0753-5_296

Gourley, G. K., Gourley, D. R., La Monica Rigolosi, E., Reed, P., Solomon, D. K., & Washington, E. (2001). Development and validation of the pharmaceutical care satisfaction questionnaire. *The American Journal of Managed Care*, *7*(5), 461–466.

Govender, N., & Suleman, F. (2019). Comparison of patient satisfaction with pharmaceutical services of postal pharmacy and community pharmacy. *Health SA*, *24*(1025-9848), 1–7. https://doi.org/10.4102/hsag.v24i0.1105

Hagen, N. A., Stiles, C., Nekolaichuk, C., Biondo, P., Carlson, L. E., Fisher, K., & Fainsinger, R. (2008). The Alberta breakthrough pain assessment tool for cancer patients: A validation study using a Delphi process and patient think-aloud interviews. *Journal of Pain and Symptom Management*, *35*(2), 136–152. https://doi.org/10.1016/j.jpainsymman.2007.03.016

Hu, L.-t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Kang, H.-Y., Park, C. Y., & Joong Kim, H. (2002). Public attitude and knowledge on a new health policy for pharmaceutical care in Korea. *Health Policy*, *62*(2), 195–209. https://doi.org/10.1016/S0168-8510(02)00019-2

Kang, J. S., Rhew, K. Y., Oh, J. M., Han, N., Lee, I.-H., Je, N. K., Ji, E., Lee, E., Yoon, J. H., & Rhie, S. J. Y. (2017). Satisfaction and expressed needs of pharmaceutical care services and challenges recognized by patients in South Korea. *Patient Preference and Adherence*, *11*, 1381–1388. https://doi.org/10.2147/PPA.S141562

Kebede, H., Tsehay, T., Necho, M., & Zenebe, Y. (2021). Patient satisfaction towards outpatient pharmacy services and associated factors at Dessie Town Public Hospitals, South Wollo, North-East Ethiopia. *Patient Preference and Adherence*, *15*, 87–97. https://doi.org/10.2147/ppa.S287948

Kim, K. I., Suh, H. S., Kwak, A., Kim, S., Han, N., Lee, E., & Oh, J. M. (2017). Development and validation of a modified Korean version of the Pharmacy Services Questionnaire (PSQ-K) for the quality assessment of community pharmacy services. *PLoS One*, *12*(4), e0174004–e0174004. https://doi.org/10.1371/journal.pone.0174004

Kristina, S., Lienaningrum, A. S., & Aditama, H. (2021). Assessing patient satisfaction with community pharmacy services in Yogyakarta, Indonesia. *International Journal of Pharmaceutical Research*, *13*(0975–2366), 4641–4645. https://doi.org/10.31838/ijpr/2021.13.01.652

Lam, C. L., Yuen, N. Y., Mercer, S. W., & Wong, W. (2010). A pilot study on the validity and reliability of the patient enablement instrument (PEI) in a Chinese population. *Family Practice*, *27*(4), 395–403. https://doi.org/10.1093/fampra/cmq021

Larson, L. N., Rovers, J. P., & MacKeigan, L. D. (2002). Patient satisfaction with pharmaceutical care: Update of a validated instrument. *Journal of the American Pharmaceutical Association (1996)*, *42*(1), 44–50. https://doi.org/10.1331/108658002763538062

Li, H., Swe, K. M. M., Jabbar, M. A., & Ching, S. M. (2023). Patients' satisfaction on primary healthcare services in China and its associated factors during COVID-19 pandemic: A cross-sectional study. *Malaysian Family Physician*, *18*, 4–8. https://doi.org/10.51866/oa.194

Lo, R. S. K., Woo, J., Zhoc, K. C. H., Li, C. Y. P., Yeo, W., Johnson, P., & Mak, Y. (2001). Cross-cultural validation of the McGill quality of life questionnaire in Hong Kong Chinese. *Palliative Medicine*, *15*(5), 387–397. https://doi.org/10.1191/026921601680419438

Moon, J., Kolar, C., Brummel, A., Ekstrand, M., Holtan, H., & Rehrauer, D. (2016). Development and validation of a patient satisfaction survey for comprehensive

medication management. *Journal of Managed Care & Specialty Pharmacy*, *22*(1), 81–86. https://doi.org/10.18553/jmcp.2016.22.1.81

Ng, J. H. Y., & Luk, B. H. K. (2019). Patient satisfaction: Concept analysis in the healthcare context. *Patient Education and Counseling*, *102*(4), 790–796. https://doi.org/10.1016/j.pec.2018.11.013

Sakharkar, P., Bounthavong, M., Hirsch, J. D., Morello, C. M., Chen, T. C., & Law, A. V. (2015). Development and validation of PSPSQ 2.0 measuring patient satisfaction with pharmacist services. *Research in Social and Administrative Pharmacy*, *11*(4), 487–498. https://doi.org/10.1016/j.sapharm.2014.10.006

Schwab, D. P. (2004). *Research methods for organizational studies*. Taylor & Francis Group. http://ebookcentral.proquest.com/lib/hkuhk/detail.action?docID=238933

So, S. P. Y., Yung, J. C.-H., Li, A. Y.-T., Lee, M. T., Wong, J. K.-T., Cheng, F. W.-T., Lam, M. P.-S., Chiu, P. K.-L., & Wong, I. C.-K. (2024). Primary care pharmacy – A review of current situation and future in Hong Kong. *Hong Kong Pharmaceutical Journal*, *31*(1), 21–28. https://www.hkpj.org/en/blog-detail.php?id=62&vol=75

Stratton, S. J. (2021). Population research: Convenience sampling strategies. *Prehospital and Disaster Medicine*, *36*(4), 373–374. https://doi.org/10.1017/S1049023X21000649

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Ursachi, G., Horodnic, I. A., & Zait, A. (2015). How reliable are measurement scales? External factors with indirect influence on reliability estimators. *Procedia Economics and Finance*, *20*, 679–686. https://doi.org/10.1016/S2212-5671(15)00123-9

Wild, D., Grove, A., Martin, M., Eremenco, S., McElroy, S., Verjee-Lorenz, A., & Erikson, P. (2005). Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: Report of the ISPOR task force for translation and cultural adaptation. *Value in Health*, *8*(2), 94–104. https://doi.org/10.1111/j.1524-4733.2005.04054.x

Willis, G. (2005). *Cognitive interviewing*. https://doi.org/10.4135/9781412983655

Wong, E. L. Y., Coulter, A., Hewitson, P., Cheung, A. W. L., Yam, C. H. K., Lui, S. f., Tam, W. W. S., & Yeoh, E.-k. (2015). Patient experience and satisfaction with inpatient service: Development of short form survey instrument measuring the core aspect of inpatient experience. *PLoS One*, *10*(4), e0122299–e0122299. https://doi.org/10.1371/journal.pone.0122299

World Health Organization. Regional Office for the Western, P. (2015). *Republic of Korea health system review* (Vol. 5). WHO Regional Office for the Western Pacific. http://iris.wpro.who.int/handle/10665.1/11358.

Zhang, L., Ding, D., Fethney, J., Neubeck, L., & Gallagher, R. (2020). Tools to measure health literacy among Chinese speakers: A systematic review. *Patient Education and Counseling*, *103*(5), 888–897. https://doi.org/10.1016/j.pec.2019.11.028