ORIGINAL ARTICLE

PLS-SEM MEASUREMENT MODEL VALIDATION OF SOCIAL MEDIA NEEDS, PATIENT EMPOWERMENT, AND QUALITY OF LIFE IN CHRONIC PATIENTS

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ABSTRACT

The increasing burden of chronic diseases highlights the need to improve patients' quality of life through a holistic approach that considers the potential of social media to fulfil their needs and empower them. This study aimed to develop and validate a measurement model integrating social media needs, patient empowerment, and quality of life, tailored to Malaysian primary care. The proposed model comprised seven constructs: affective needs, cognitive needs, diversion needs, personal integrative needs, social integrative needs, patient empowerment, and quality of life domains, including physical health, psychological health, social relationships, and environmental health. Content validation by experts and face validation ensured the adapted instruments were appropriate and clearly understood. Data was collected through purposive sampling of 130 chronic patients from selected clinics in Sibu. Measurement model assessments were conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM) with SmartPLS to validate the constructs, including a higher-order reflective-reflective construct assessed with the disjoint two-stage approach. Results showed that all 50 indicators met convergent and discriminant validity criteria. Indicator loadings exceeded recommended thresholds, average variance extracted values were above 0.5, and composite reliability values were satisfactory. Discriminant validity was confirmed using the Fornell-Larcker criterion, cross-loadings, and the HTMT ratio with a bootstrapping procedure of 10,000 samples. These findings provide evidence that the validated model can reliably assess how social media needs and patient empowerment relate to quality of life among chronic patients in Malaysia. This measurement model offers a strong foundation for future research and practical use in primary care.

Keywords*: *Social media, empowerment, quality of life, validation study

INTRODUCTION

Over recent decades, the prevalence of chronic diseases has risen significantly due to an epidemiological shift from infectious to non-communicable diseases, advances in treatment, and an ageing population[1-3]. Although there is no universal definition, chronic diseases are generally described as health conditions that last for extended periods, usually more than three months, but sometimes as six months or longer. They commonly include diabetes, cardiovascular disease, hypertension, cancer, and chronic respiratory diseases, the main categories identified by the World Health Organisation (WHO)[4,5]. In Malaysia, statistics from the National Health and Morbidity Survey (NHMS) 2023 show a substantial burden of chronic diseases, with one in six adults living with diabetes and nearly a third of the population suffering from hypertension[6]. Chronic diseases are often associated with a decline in patients' overall health, restricting their ability to live well, impairing functional status, productivity, and quality of life. They also contribute substantially to healthcare costs[7-9]. As a result, many patients now live longer but face challenges that affect their quality of life (QoL)[10].

QoL is a multidimensional concept that covers physical health, psychological well-being, social relationships, and environmental factors[11]. This aligns with the World Health Organisation's view that health goes beyond the absence of disease to include overall well-being[12]. Therefore, enhancing QoL for chronic patients requires a holistic approach addressing all health aspects.

In the era of rapid technological advancements, social media has emerged as a promising tool for managing the health challenges associated with chronic diseases[13]. Many patients use these platforms for information, social support, and self-care[14], fulfilling needs such as diversion (escaping from illness-related stress), cognitive (acquiring knowledge and health information), personal integrative (reinforcing self-identity and self-esteem), social integrative (interacting with others for social connection), and affective needs (receiving emotional support)[15,16]. Meeting these social media needs may enhance QoL by facilitating social connectedness, providing access to health-related information and emotional support; however, excessive or problematic use may also lead to some adverse effects such as heightened anxiety and stress, unrealistic

expectations, irritability when deprived of social media use, and addictive behaviours[17,18].

Although studies show that social media use affects QoL, few explain how this relationship works. Empowerment theory offers a valuable framework, emphasising enabling individuals to understand their circumstances and regain control[19]. Patient empowerment plays a vital role in helping individuals manage chronic health conditions and has the potential to improve their overall quality of life. Numerous studies support this argument, demonstrating that patient empowerment can enhance well-being and improve health outcomes[20-22]. This finding signifies that empowering patients and addressing their social media needs is essential for supporting self-management, informed decision-making, and enhancing their quality of life.

To assess the various factors that affect a particular population, it is essential to ensure that the instruments are valid and that the indicators in the measurement models of the constructs accurately capture the underlying constructs of social media needs, patient empowerment, and quality of life. Rigorous and reliable measurement is vital for producing meaningful findings that inform evidence-based practice and policy, and enabling future studies to use these validated instruments and models to advance understanding in this field. Therefore, this study aimed to develop an indigenous model that integrates social media needs, patient empowerment, and quality of life, tailored to the Malaysian context. It also sought to adapt and validate the relevant scales, and to evaluate the measurement model's reliability and validity among chronic patients using Partial Least Squares Structural Equation Modelling (PLS-SEM).

METHODS

Partial Least Squares Structural Equation Modelling (PLS-SEM), Reflective Model and Higher-order Construct

This study employed PLS-SEM for path modelling and factor analysis of the constructs. PLS-SEM, a second-generation multivariate technique, enables simultaneous analysis of relationships between multiple independent and dependent variables[23]. One of the primary strengths of second-generation methods, such as SEM, is their capacity to analyse complex relationships among various variables within a single model. SEM is typically divided into two distinct techniques: Covariance-Based Structural Equation Modelling (CB-SEM) and PLS-SEM. Unlike CB-SEM, which focuses on model fit, PLS-SEM aims to maximise the explained variance in dependent variables, making it well-suited for prediction and theory development[24].

This study's measurement model includes reflective constructs for social media needs and patient empowerment. In reflective models, indicators are manifestations of the latent construct and are expected to be highly correlated and interchangeable, provided the construct remains reliable and valid[23]. Key criteria for reflective measurement include strong indicator correlations, allowance for measurement error in the indicator level, and theoretical consistency when indicators are removed[25].

Furthermore, this study conceptualised quality of life as a higher-order reflective–reflective construct, consistent with previous research[26-29]. Higher-order constructs (HOCs), also known as hierarchical component models in PLS-SEM, allow researchers to model abstract constructs alongside their specific subdimensions (lower-order components, LOCs)[30]. PLS-SEM effectively handles such hierarchical complexity without identification issues[23]. Figure 1 illustrates the measurement model, consisting of 50 indicators across seven constructs: social media needs (reflective), patient empowerment (reflective), and quality of life as a higher-order reflective–reflective construct.

Measurement assessments were used to conduct PLS analysis with SmartPLS 4.1.0.0 software[31]. The measurement model evaluation aimed to assess how well the selected indicators represented the latent constructs[32]. This assessment focused on establishing the construct measures' reliability and validity.

For the reflective measurement model, validity was examined through convergent and discriminant validity[23]. Convergent validity was assessed using three criteria: (i) internal consistency reliability/ composite reliability (CR), (ii) indicators' outer loadings, and (iii) average variance extracted (AVE)[23]. Discriminant validity was evaluated by: (i) examination of cross-loadings criterion, (ii) applying the Fornell–Larcker criterion[33], and (iii) evaluation using the Heterotrait–Monotrait ratio of correlations (HTMT)[23].

Convergent validity indicates the extent to which a construct correlates strongly with its indicators, as demonstrated by the AVE, which reflects the variance explained by the construct. Discriminant validity verifies that each construct is distinct from other constructs in the model by examining the correlations between constructs and ensuring indicators load higher on their assigned construct than on others[23].

The measurement model for HOC was assessed using the disjoint two-step approach, as recommended by previous researchers[30,34]. This method enhances the model's predictive accuracy and reduces potential biases when

estimating relationships between HOCs and their lower-order components (LOCs), primarily when indicators are unevenly distributed. In stage one, the latent variable scores for domains were calculated by linking the constructs directly to the domains of the HOC, as illustrated in Figure 2.

Subsequently, once the latent variable scores for each domain were obtained in Stage 1, Stage 2 involved linking these latent variables to form the HOC, allowing for an accurate assessment of the HOC measurement model, as shown in Figure 3.

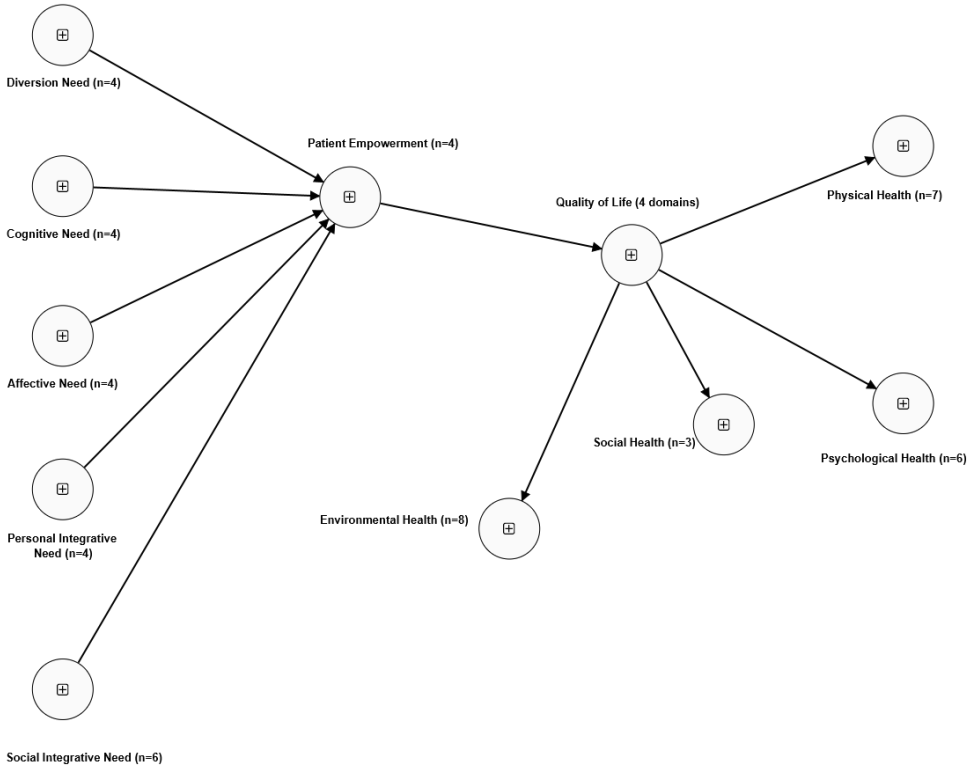

Figure 1 Measurement Model of Social Media Needs, Patient Empowerment and QoL

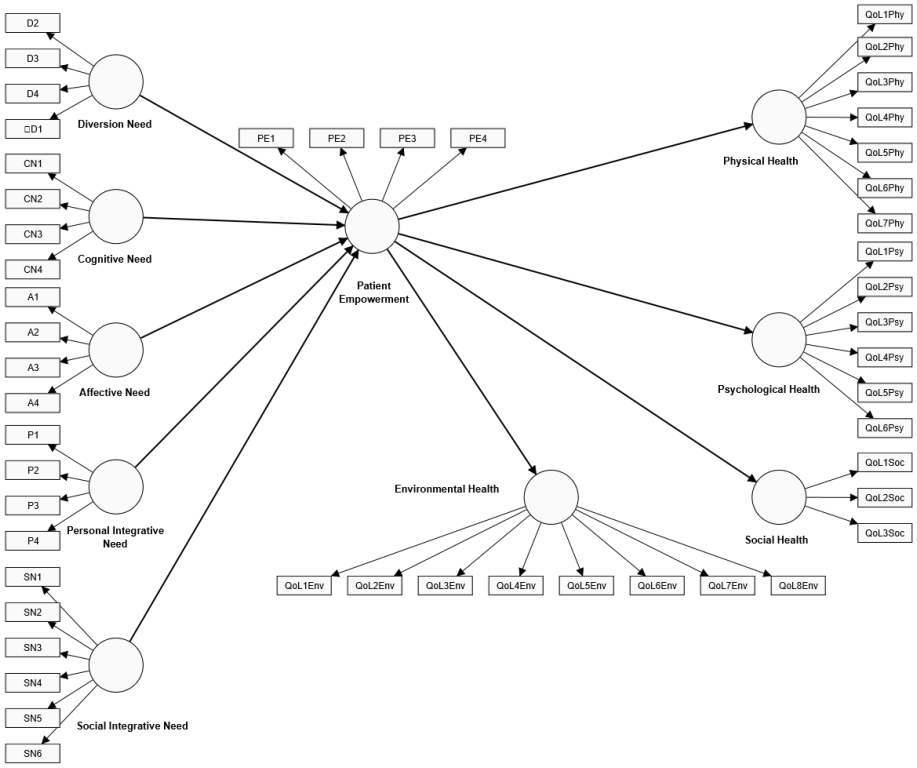

Figure 2 Disjoint two-stage approach of the Measurement Model (Stage 1)

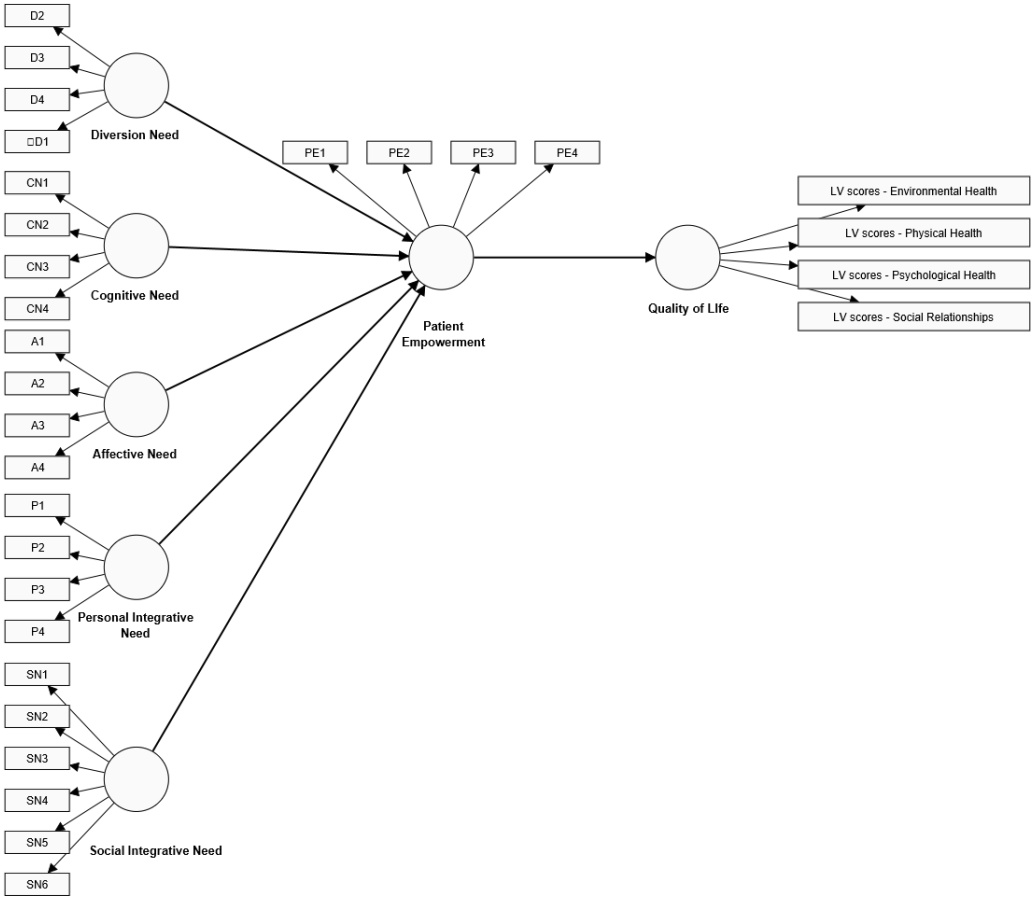

Figure 3 Disjoint two-stage approach of the Measurement Model (Stage 2)

Item Validity and Reliability

This quantitative study used a Content Validity Index (CVI) process to assess the relevance and clarity of each item for measuring its respective constructs[35]. Content validation was conducted through expert panel review following Polit and Beck's guidelines[36], calculating item-level (I-CVI) and scale-level (S-CVI/Ave) indices. An I-CVI was obtained by dividing the number of expert agreements by the total number of experts, with a minimum acceptable threshold of 0.78. The S-CVI/Ave assessed overall agreement across the instrument, with an acceptable cut-off of 0.90[37]. Six subject matter experts evaluated the instrument's relevance, clarity, and alignment with the study objectives. These included two social science academics from Universiti Malaysia Sarawak (UNIMAS), three public health professionals, and one primary care clinician. The I-CVI values ranged from 0.83 to 1.0, and the S-CVI/Ave ranged from 0.96 to 1.0, indicating strong content validity[37].

Face validity, or response process validity, was also assessed to confirm the items were clear and appropriate for the target group[38,39]. This was conducted with 30 chronic patients using the Face Validity Index (FVI). The item-level FVI (I-FVI) and scale-level FVI (S-FVI/Ave) were calculated with a recommended threshold of 0.80[39]. The results showed I-FVI values from 0.90 to 1.0 and S-FVI/Ave values from 0.97 to 1.0, exceeding the recommended cut-offs.

Research Instrument

This quantitative study employed a structured questionnaire comprising 50 items adapted from established instruments used in previous research. Items measuring social media needs were adapted from Ali et al.(2020)[40], the four items for patient empowerment were adapted from Johnston et al.(2013)[41], and the quality of life items were adapted from Harper et al.(1998)[11].

The social media needs constructs, which included diversion, cognitive, social integrative, personal integrative, affective needs, and quality of life, were measured using a 5-point Likert scale. Response options ranged from strongly disagree (1) to strongly agree (5). The patient empowerment construct was measured using a 7-point Likert scale, with options ranging from strongly disagree (1) to strongly agree (7).

The original questionnaire items, adapted in English, were first translated into Malay by a certified bilingual translator fluent in both languages. The other certified translator then back-translated the items into English. Bilingual evaluators and back-translators without prior exposure to the original items reviewed the final version using a dual-blind approach. All forward and backwards translation steps were completed via email.

The questionnaire consisted of two sections. The first section gathered participants' demographic

information, including age, gender, marital status, education level, ethnicity, living arrangement, and income group. The second section contained 50 items related to social media needs, patient empowerment, and quality of life. A participant information sheet was also included, providing instructions, study details, and a consent section.

Population and Sample

This study was conducted in the Sibu Division of Sarawak, Malaysia, where purposive sampling was used to recruit chronic patients receiving follow-up care at selected primary care facilities to meet the study's objectives. According to Hair et al.(2018)[42], a minimum sample size of 50 is required for measurement model validation studies. However, a sample of at least 100 is generally recommended to ensure robust and reliable results. To satisfy this requirement and strengthen the findings' reliability, 130 participants were recruited, exceeding the recommended minimum.

Data Analysis Techniques for Reflective Measurement Model Evaluation

The reflective measurement model was assessed by evaluating internal consistency, indicator reliability, convergent validity, and discriminant validity to ensure the constructs' reliability and validity[43].

(i) Internal Consistency / Composite Reliability (CR)

Internal consistency was assessed using Cronbach's alpha, Composite Reliability (CR), and McDonald's Omega coefficient (ω). While Cronbach's alpha is widely used, its limitations have been noted, prompting the inclusion of McDonald's Omega to complement the analysis[44,45]. Acceptable reliability was indicated by Cronbach's alpha values above 0.70, McDonald's Omega values above 0.80 for first-order constructs, and 0.65 for higher-order constructs[32,46]. CR was also examined, with values above 0.70 preferred, though 0.60–0.70 is acceptable for exploratory research[24].

(ii) Indicator Reliability/ Outer Loadings

Indicator reliability was demonstrated when outer loadings exceeded 0.708, indicating that the construct explains more than 50% of the variance in the indicators[42,43]. While higher indicator reliability values reflect strong reliability, loadings above 0.95 may suggest redundancy. For loadings between 0.40 and 0.70, it is advisable to remove the item if this substantially improves AVE and CR[47].

(iii) Average Variance Extracted (AVE)

AVE represents the average squared loadings of all indicators linked to a construct and should exceed 0.50, confirming that the construct explains more than half of the variance in its indicators[42,43].

(iv) Discriminant Validity

Discriminant validity was assessed using cross-loadings, the Fornell–Larcker criterion, and the HTMT ratio[48]. Cross-loadings ensure that each indicator loads higher on its assigned construct than on others by at least 0.10[43]. The Fornell–Larcker criterion requires that the square root of the AVE is greater than any inter-construct correlations, ensuring distinctiveness[43]. However, because these methods have limitations in fully addressing discriminant validity concerns, the HTMT ratio was also applied to provide a more robust assessment[47]. HTMT values above 0.90 for similar constructs, or above 0.85 for dissimilar constructs, may indicate poor discriminant validity. However, if the 90% bootstrapped with a 10,000 sample, the confidence interval does not include 1, discriminant validity is still acceptable[49].

RESULTS

Participants Information

A total of 130 chronic patients from selected primary care clinics participated in this study (n=130). Among the participants, 53% were male (n=69). The participants' ages ranged from 23 to 87 years, with the largest group being those aged 50 to 65, accounting for 43% (n=56). In terms of ethnicity, the majority were Chinese, comprising 53% (n=69), followed by Iban at 39% (n=51), Malay at 11% (n=14), and other ethnicities at 3% (n=4). Most participants were married, representing 82% (n=107), while 14% (n=18) were single, and 4% (n=5) were either divorced or widowed. Regarding education, 62% (n=81) had completed secondary school, 19% (n=25) had attained tertiary education or higher, 17% (n=22) had primary school education, and 2% (n=2) reported no formal education. In terms of income, 89% (n=116) belonged to the B40 group, 6% (n=8) were in the M40 group, and 5% (n=6) were in the T20 group. For living arrangements, 58% (n=75) lived with their spouse and children, 21% (n=27) lived with their spouse only, 14% (n=18) lived alone, and 7% (n=9) lived with their children.

Measurement Model Results

Table 1 presents the indicator reliability, AVE, CR, Cronbach's alpha, and McDonald's Omega values for all constructs, including the reflective constructs (social media needs and patient empowerment) and the higher-order construct (quality of life). Most indicators had loadings above the recommended threshold of 0.708, while some items' loadings (SN4, QoL3Phy, QoL7Phy, QoL1Psy, QoL2Psy, QoL4Psy, QoL2Soc, QoL1Env, QoL2Env, and QoL3Env) were below this level. However, all items were retained because each construct's overall reliability and AVE met the recommended thresholds, with AVE values above 0.50 and CR values exceeding 0.60 for all constructs.

Table 2 shows that most constructs meet the criteria for discriminant validity, as indicated by the bold diagonal values representing the square

roots of the AVE, which are greater than the inter-construct correlations. However, there was a slight overlap between Social Integrative Needs and Affective Needs, with their correlation (0.797) exceeding the square root of the AVE for Affective Needs (0.776).

Table 3 and Figure 4 present the cross-loading results for all construct items. All indicators showed high loading on their respective constructs and substantially lower loading on other constructs, supporting discriminant validity.

In such cases, when the Fornell and Larcker criterion indicates potential overlap between constructs, specifically Social Integrative Needs and Affective Needs as shown in Table 2, the HTMT ratio provides a more robust check to assess whether discriminant validity may be compromised. Table 4 presents the HTMT results for all constructs in this study, indicating that most constructs met the recommended criterion that HTMT values did not exceed 0.90, which is required for acceptable discriminant validity. However, the correlation between Affective Needs and Social Integrative Needs slightly exceeded this value, with an HTMT result of 0.905.

DISCUSSION

A measurement instrument must be valid and reliable, function effectively across diverse populations, and remain simple to administer, score, and interpret. This is especially important in primary care practice in Malaysia, where patients come from varied cultural and educational backgrounds. Therefore, in this study, the original questionnaires were carefully adapted and modified to suit the local context and the needs of primary care settings. While all original indicators were retained due to their theoretical relevance, some were refined to better align with the study's objectives. In total, 22 indicators were improved in this study, resulting in 50 final indicators across the seven constructs in the measurement model.

The findings confirmed that the measurement model assessed through PLS-SEM is valid and reliable for measuring social media needs, patient empowerment, and the QoL domains, including physical health, psychological health, social relationships, and environmental health. This validation process, which achieved both convergent and discriminant validity, demonstrates that the indicators adequately represent the seven constructs in the local context. These results provide confidence that the adapted instruments can be used to reliably measure how fulfilling diverse social media needs and enhancing patient empowerment may relate to patients' quality of life in future structural model analyses.

Strengths and Limitations

This study in Malaysia successfully cross-culturally adapted and validated a measurement model to examine the impact of social media needs and patient empowerment among chronic patients. The findings contribute to the growing body of literature on social media, patient empowerment, and quality of life measurement. This study provides a validated tool for assessing social media needs, patient empowerment, and quality of life among chronic patients in Malaysian primary care settings, helping to address a gap in culturally relevant instruments for this context.

Despite these strengths, several limitations should be acknowledged. First, the study sample was limited to chronic patients in primary care settings in the Sibu Division, Sarawak. Given that this study employed a purposive sampling method, findings may have limited generalisability beyond this specific geographic scope and the unique characteristics of the local population. Furthermore, the scope of this study was focused on the specific types of chronic illnesses, primarily non-communicable diseases such as diabetes and hypertension, managed in primary care settings. Consequently, the findings may not be wholly representative of patients with other chronic conditions or in different healthcare settings, who may present different perspectives and social media needs. Future studies should include larger and more diverse samples and a wider variety of chronic conditions to enhance the instrument's applicability across different clinical and regional contexts.

Another consideration involves the relatively simple measurement model that was tested. Social media can be explored through additional contexts and pathways; for example, social media support and eHealth literacy were not included in the current model. Future research should consider these indicators using this validated measurement model as a foundation. Taken together, such investigations could gradually expand the complexity of the model by incorporating additional constructs and contextual factors.

Table 1a Measurement Model Result and Indicators for Construct

		Indicator Reliability	Internal Consistency Reliability			Convergent Validity
Construct	Items	Outer Loadings	Composite Reliability (CR)	Cronbach's Alpha	McDonald Omega	Average Variance Extracted (AVE)
Affective Needs	A1 Social media helps me to share my emotions with others easily.	0.821	0.917	0.881	0.877	0.735
	A2 Social media helps me make good friendships.	0.865				
	A3 I use social media to talk about my health problems.	0.892				
	A4 I use social media to get health advice.	0.850				
Cognitive Needs	CN1 I use social media to find information about my disease.	0.936	0.946	0.923	0.923	0.813
	CN2 I use social media to connect with others who have the same disease.	0.845				
	CN3 I use social media to learn about my disease.	0.910				
	CN4 Social media helps clear my doubts about my disease.	0.913				
Diversion Needs	D1 Social media makes me feel less lonely.	0.869	0.927	0.896	0.896	0.762
	D2 I use social media to pass the time when I am bored.	0.897				
	D3 Social media helps me forget about my worries.	0.871				
	D4 I use social media to relax.	0.854				

Table 1b Measurement Model Result and Indicators for Construct

		Indicator Reliability	Internal Consistency Reliability			Convergent Validity
Construct	Items	Outer Loadings	Composite Reliability (CR)	Cronbach's Alpha	McDonald Omega	Average Variance Extracted (AVE)
Personal Integrative Needs	P1 Social media helps me feel good about myself.	0.906	0.935	0.908	0.905	0.783
	P2 Social media shows others how I am.	0.889				
	P3 Social media helps me feel confident about my health.	0.900				
	P4 I use social media to seek recognition from others.	0.843				
Social Integrative Needs	SN1 Social media allows me to communicate with my friends.	0.840	0.900	0.867	0.853	0.602
	SN2 Social media allows me to stay in touch with family.	0.786				
	SN3 Social media helps me make new friends.	0.713				
	SN4 Social media helps me meet more interesting people than in real life.	0.635				
	SN5 Social media helps me reach people who are hard to contact.	0.784				
	SN6 I use social media to gain support among friends.	0.873				
Patient Empowerment	PE1 I am confident about managing my daily healthcare routines.	0.881	0.944	0.921	0.919	0.809
	PE2 I feel in control of managing my healthcare.	0.920				

Table 1c Measurement Model Result and Indicators for Construct

		Indicator Reliability	Internal Consistency Reliability			Convergent Validity
Construct	Items	Outer Loadings	Composite Reliability (CR)	Cronbach's Alpha	McDonald Omega	Average Variance Extracted (AVE)
Patient Empowerment	PE3 I can make decisions about how I manage my personal healthcare.	0.914				
	PE4 I can keep track of my health.	0.882				
Quality of Life (Higher order)	Physical Health	0.908	0.942	0.918	0.938	0.804
	Psychological Health	0.901				
	Social Relationships	0.824				
	Environmental Health	0.948				
Physical Health	QoL1Phy To what extent are you able to carry out your daily activities without being limited by physical pain?	0.780	0.878	0.839	0.844	0.514
	QoL2Phy How able are you to function healthy in your daily life without relying on medical treatment?	0.821				
	QoL3Phy Do you have enough energy for everyday life?	0.684				
	QoL4Phy How well are you able to get around?	0.734				
	QoL5Phy How satisfied are you with your sleep?	0.751				
	QoL6Phy How satisfied are you with your ability to perform your daily living activities?	0.742				
	QoL7Phy How satisfied are you with your capacity for work?	0.443				

Table 1d Measurement Model Result and Indicators for Construct

		Indicator Reliability	Internal Consistency Reliability			Convergent Validity
Construct	Items	Outer Loadings	Composite Reliability (CR)	Cronbach's Alpha	McDonald Omega	Average Variance Extracted (AVE)
Psychological Health	QoL1Psy How much do you enjoy life?	0.683	0.882	0.842	0.812	0.557
	QoL2Psy To what extent do you feel your life to be meaningful?	0.687				
	QoL3Psy How well are you able to concentrate?	0.805				
	QoL4Psy Are you able to accept your bodily appearance?	0.630				
	QoL5Psy How satisfied are you with yourself?	0.801				
	QoL6Psy How often are you free from negative feelings such as blue mood, despair, anxiety, or depression?	0.847				
Social Relationships	QoL1Soc How satisfied are you with your personal relationships?	0.831	0.842	0.721	0.674	0.644
	QoL2Soc How satisfied are you with your sex life?	0.663				
	QoL3Soc How satisfied are you with the support you get from your friends?	0.895				
Environmental Health	QoL1Env How safe do you feel in your daily life?	0.581	0.891	0.863	0.853	0.508
	QoL2Env How healthy is your physical environment?	0.637				
	QoL3Env Have you enough money to meet your needs?	0.706				
	QoL4Env How available to you is the information that you need in your day-to-day life?	0.712				

Table 1e Measurement Model Result and Indicators for each construct

		Indicator Reliability	Internal Consistency Reliability			Convergent Validity
Construct	**Items**	**Outer Loadings**	**Composite Reliability (CR)**	**Cronbach's Alpha**	**McDonald Omega**	**Average Variance Extracted (AVE)**
Environmental Health	QoL5Env To what extent do you have the opportunity for leisure activities?	0.720				
	QoL6Env How satisfied are you with the conditions of your living place?	0.728				
	QoL7Env How satisfied are you with your access to health services?	0.798				
	QoL8Env How satisfied are you with your transport?	0.794				

Table 2 Fornell-Larcker Criterion

	Affective Needs	Cognitive Needs	Diversion Needs	Patient Empowerment	Personal Integrative Needs	QoL	Social Integrative Needs
Affective Needs	**0.857**						
Cognitive Needs	0.772	**0.902**					
Diversion Needs	0.760	0.620	**0.873**				
Patient Empowerment	0.628	0.483	0.532	**0.899**			
Personal Integrative Needs	0.791	0.633	0.700	0.596	**0.885**		
Quality of Life	0.435	0.406	0.453	0.630	0.383	**0.896**	
Social Integrative Needs	0.797	0.597	0.749	0.656	0.716	0.556	**0.776**

Table 3a The Results of Cross-Loadings

	Affective Needs	Cognitive Needs	Diversion Needs	Personal Integrative Needs	Social Integrative Needs	Patient Empowerment	Environmental Health	Physical Health	Psychological Health	Social Relationships	QoL
A1	**0.821**	0.665	0.642	0.618	0.668	0.405	0.176	0.188	0.233	0.261	0.238
A2	**0.865**	0.593	0.727	0.621	0.791	0.566	0.447	0.412	0.483	0.395	0.485
A3	**0.892**	0.670	0.637	0.745	0.609	0.607	0.270	0.328	0.293	0.277	0.329
A4	**0.850**	0.732	0.606	0.718	0.676	0.538	0.376	0.364	0.413	0.334	0.415
CN1	0.716	**0.936**	0.623	0.549	0.545	0.457	0.327	0.369	0.344	0.353	0.393
CN2	0.675	**0.845**	0.567	0.612	0.559	0.416	0.310	0.343	0.316	0.331	0.367
CN3	0.673	**0.910**	0.509	0.527	0.486	0.428	0.219	0.313	0.255	0.319	0.311
CN4	0.718	**0.913**	0.536	0.599	0.563	0.438	0.374	0.345	0.380	0.364	0.410
D1	0.654	0.518	**0.869**	0.700	0.701	0.539	0.504	0.417	0.464	0.422	0.505
D2	0.652	0.558	**0.897**	0.564	0.652	0.446	0.330	0.331	0.364	0.322	0.377
D3	0.713	0.599	**0.871**	0.655	0.616	0.446	0.346	0.364	0.406	0.223	0.381
D4	0.634	0.492	**0.854**	0.496	0.634	0.408	0.266	0.236	0.270	0.286	0.295
P1	0.763	0.585	0.718	**0.906**	0.699	0.568	0.371	0.393	0.367	0.328	0.412
P2	0.664	0.512	0.545	**0.889**	0.559	0.515	0.265	0.366	0.319	0.242	0.340
P3	0.754	0.640	0.676	**0.900**	0.722	0.561	0.349	0.326	0.328	0.292	0.363
P4	0.600	0.491	0.516	**0.843**	0.533	0.454	0.169	0.247	0.196	0.208	0.234
SN1	0.649	0.509	0.649	0.537	**0.840**	0.570	0.532	0.473	0.537	0.468	0.559
SN2	0.583	0.442	0.509	0.427	**0.786**	0.570	0.484	0.427	0.493	0.468	0.517
SN3	0.513	0.296	0.488	0.553	**0.713**	0.425	0.205	0.235	0.257	0.175	0.245
SN4	0.468	0.254	0.518	0.578	**0.635**	0.336	0.065	0.141	0.113	0.087	0.117
SN5	0.668	0.569	0.558	0.559	**0.784**	0.486	0.466	0.367	0.402	0.475	0.468
SN6	0.783	0.619	0.740	0.718	**0.873**	0.599	0.499	0.461	0.479	0.472	0.531
PE1	0.609	0.494	0.553	0.578	0.622	**0.881**	0.592	0.611	0.622	0.494	0.652
PE2	0.636	0.524	0.507	0.570	0.654	**0.920**	0.471	0.550	0.510	0.432	0.553
PE3	0.499	0.347	0.402	0.507	0.530	**0.914**	0.458	0.556	0.428	0.382	0.513
PE4	0.493	0.348	0.433	0.474	0.536	**0.882**	0.481	0.563	0.461	0.391	0.533
QoL1Env	0.164	0.269	0.259	0.204	0.317	0.300	**0.581**	0.484	0.589	0.451	

Table 3b The Results of Cross-Loadings

	Affective Needs	Cognitive Needs	Diversion Needs	Personal Integrative Needs	Social Integrative Needs	Patient Empowerment	Environmental Health	Physical Health	Psychological Health	Social Relationships	QoL
QoL2Env	0.160	0.146	0.195	0.151	0.216	0.308	**0.637**	0.494	0.565	0.522	
QoL3Env	0.270	0.224	0.363	0.287	0.367	0.342	**0.706**	0.622	0.490	0.518	
QoL4Env	0.240	0.255	0.329	0.212	0.390	0.242	**0.712**	0.590	0.523	0.603	
QoL5Env	0.248	0.247	0.284	0.193	0.406	0.421	**0.720**	0.551	0.610	0.482	
QoL6Env	0.364	0.242	0.336	0.287	0.403	0.506	**0.728**	0.569	0.693	0.474	
QoL7Env	0.324	0.339	0.288	0.256	0.435	0.499	**0.798**	0.555	0.674	0.609	
QoL8Env	0.309	0.324	0.366	0.279	0.375	0.442	**0.794**	0.607	0.607	0.575	
QoL1Phy	0.252	0.296	0.239	0.301	0.344	0.525	0.479	**0.780**	0.456	0.505	
QoL2Phy	0.251	0.347	0.264	0.300	0.284	0.457	0.564	**0.821**	0.531	0.517	
QoL3Phy	0.259	0.171	0.257	0.300	0.247	0.411	0.559	**0.684**	0.500	0.446	
QoL4Phy	0.311	0.300	0.344	0.299	0.401	0.414	0.734	**0.734**	0.637	0.514	
QoL5Phy	0.248	0.247	0.284	0.193	0.406	0.421	0.720	**0.751**	0.610	0.482	
QoL6Phy	0.444	0.366	0.407	0.329	0.477	0.612	0.716	**0.742**	0.700	0.510	
QoL7Phy	0.028	0.060	0.074	0.112	0.092	0.206	0.190	**0.443**	0.135	0.178	
QoL1Psy	0.305	0.306	0.309	0.159	0.419	0.341	0.588	0.470	**0.683**	0.485	
QoL2Psy	0.144	0.170	0.244	0.108	0.278	0.236	0.544	0.444	**0.687**	0.466	
QoL3Psy	0.293	0.235	0.315	0.208	0.376	0.385	0.588	0.502	**0.805**	0.440	
QoL4Psy	0.354	0.286	0.272	0.350	0.306	0.381	0.503	0.485	**0.630**	0.341	
QoL5Psy	0.270	0.229	0.321	0.278	0.383	0.517	0.743	0.680	**0.801**	0.506	
QoL6Psy	0.445	0.352	0.448	0.357	0.505	0.556	0.739	0.666	**0.847**	0.566	
QoL1Soc	0.221	0.238	0.253	0.165	0.342	0.354	0.596	0.528	0.519	**0.831**	
QoL2Soc	0.245	0.261	0.163	0.212	0.226	0.287	0.494	0.469	0.397	**0.663**	
QoL3Soc	0.399	0.391	0.414	0.335	0.546	0.476	0.665	0.567	0.578	**0.895**	
LV-Env	0.379	0.342	0.425	0.334	0.517	0.560					**0.948**
LV-Phy	0.387	0.380	0.393	0.380	0.475	0.635					**0.908**
LV-Psy	0.422	0.359	0.439	0.347	0.518	0.569					**0.901**
LV-Soc	0.372	0.379	0.366	0.306	0.490	0.477					**0.824**

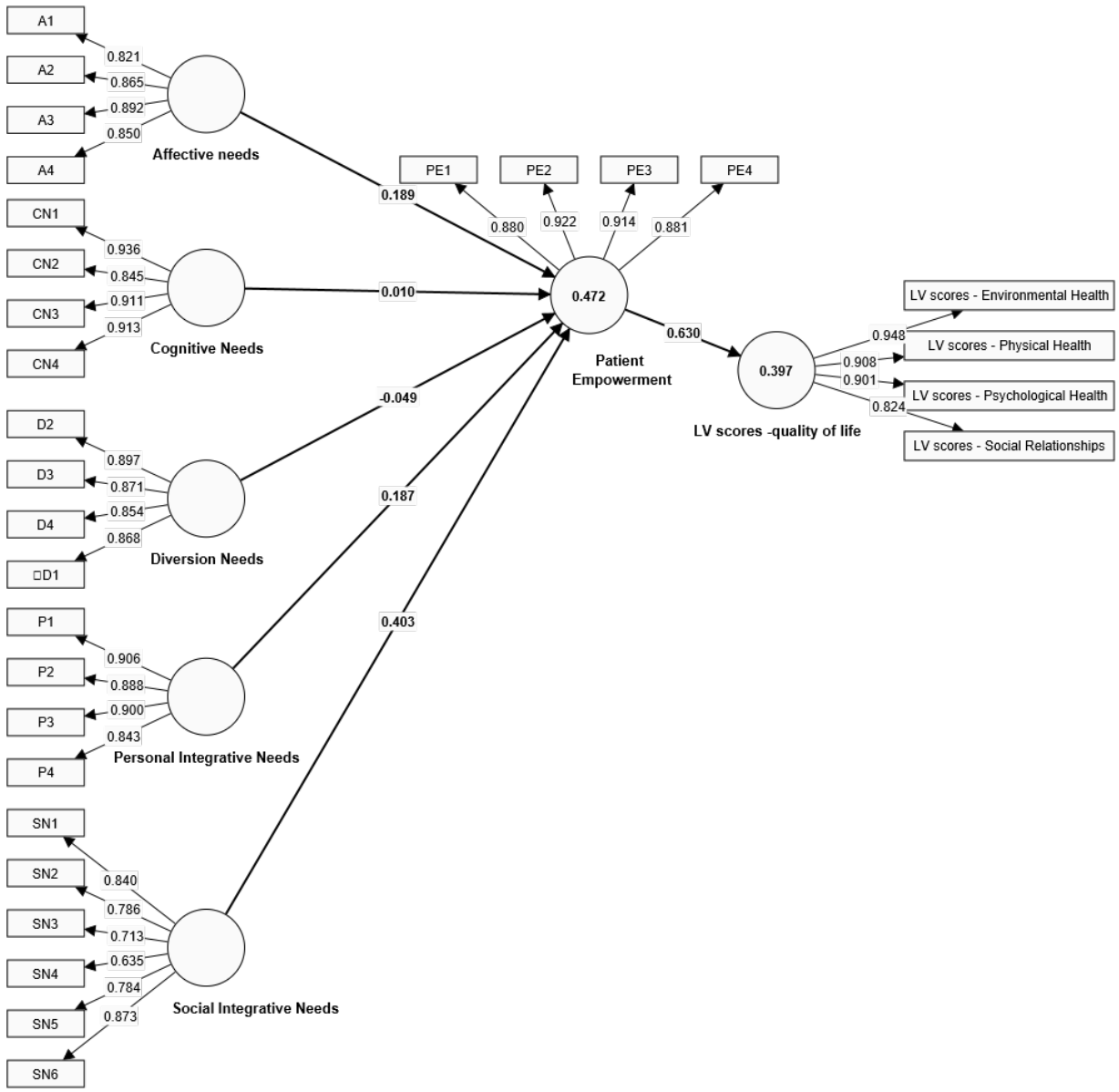

Figure 4 Evaluation of Measurement Model Through PLS Algorithm

Table 4 The Results of HTMT

	Affective Needs	Cognitive Needs	Diversion Needs	Quality of Life	Patient Empowerment	Personal Integrative Needs	Social Integrative Needs
Affective Needs							
Cognitive Needs	0.860						
Diversion Needs	0.856	0.681					
Quality of Life	0.475	0.443	0.489				
Patient Empowerment	0.678	0.516	0.573	0.675			
Personal Integrative Needs	0.875	0.689	0.760	0.412	0.643		
Social Integrative Needs	0.905	0.647	0.841	0.591	0.714	0.812	

Table 5 Bootstrap HTMT (10,000-sample re-sampling)

	Original sample (O)	Sample mean (M)	5.00 %	95.00 %
Cognitive Needs <-> Affective Needs	0.860	0.861	0.751	0.950
Diversion Needs <-> Affective Needs	0.856	0.857	0.784	0.920
Diversion Needs <-> Cognitive Needs	0.681	0.684	0.534	0.815
Patient Empowerment <-> Affective Needs	0.678	0.678	0.564	0.777
Patient Empowerment <-> Cognitive Needs	0.516	0.517	0.376	0.650
Patient Empowerment <-> Diversion Needs	0.573	0.571	0.410	0.714
Personal Integrative Needs <-> Affective Needs	0.875	0.876	0.755	0.974
Personal Integrative Needs <-> Cognitive Needs	0.689	0.691	0.559	0.803
Personal Integrative Needs <-> Diversion Needs	0.760	0.759	0.682	0.828
Personal Integrative Needs <-> Patient Empowerment	0.643	0.642	0.521	0.754
Quality of Life <-> Affective Needs	0.475	0.476	0.325	0.619
Quality of Life <-> Cognitive Needs	0.443	0.444	0.301	0.582
Quality of Life <-> Diversion Needs	0.489	0.491	0.337	0.628
Quality of Life <-> Patient Empowerment	0.675	0.675	0.575	0.764
Quality of Life <-> Personal Integrative Needs	0.415	0.412	0.263	0.552
Social Integrative Needs <-> Affective Needs	0.905	0.906	0.828	0.973
Social Integrative Needs <-> Cognitive Needs	0.647	0.651	0.500	0.788
Social Integrative Needs <-> Diversion Needs	0.841	0.841	0.763	0.911
Social Integrative Needs <-> Patient Empowerment	0.714	0.713	0.605	0.806
Social Integrative Needs <-> Personal Integrative	0.812	0.812	0.708	0.898
Social Integrative Needs <-> Quality of Life	0.591	0.597	0.492	0.694

CONCLUSIONS

This study advances our understanding of how social media needs and patient empowerment can be measured reliably and validly among chronic patients in Malaysian primary care settings. The findings provide a strong foundation for future research and practical application by confirming that the adapted measurement model demonstrates sound psychometric properties. The validated instrument can assist healthcare providers, researchers, and policymakers in assessing how fulfilling diverse social media needs and strengthening patient empowerment may improve the quality of life among chronic patients.

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Conflict of Interest
The authors have no competing interests to declare.

Ethics Approval
Ethical approval for the study was sought from the National Medical Research Register (NMRR) of the Ministry of Health Malaysia [ID-25-00312-GWZ], the Ethical Committee of Universiti Malaysia Sarawak [FME/25/66], the Clinical Research Centre of the Sarawak State Health Department, the divisional health office, and the respective health clinics.

Consent to Participate
Informed consent was obtained from all participants before the interviews, and individuals who did not consent were excluded from the study.

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