

Association Between Intention to Provide Internet Plus Nursing Services, Psychological Resilience and Perceived Professional Benefits Among Chinese Nurses

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Aim: This study seeks to examine the present state of Chinese nurses' intentions to deliver Internet Plus Nursing Services (IPNS), their psychological resilience, and their perceived professional benefits (PPB), in addition to exploring the interrelationships among these variables. IPNS are defined as nursing services performed by registered nurses from medical institutions utilizing internet and other information technologies through an "online application and offline service" model.

Background: Nurses are the primary providers of IPNS, and hence, their willingness is critical to developing IPNS. However, limited research has been conducted to investigate the relationship between nurses' intention to provide IPNS, psychological resilience and PPB.

Methods: A convenience sampling approach was employed to conduct a cross-sectional survey of 611 nurses from three tertiary general hospitals in Shijiazhuang between April and October 2023. The research questionnaires include demographic information, nurses' intention to provide IPNS, psychological resilience and PPB. The statistical analysis included non-parametric testing, Spearman correlation analysis, hierarchical regression analysis, and mediation effect analysis.

Results: The results indicated that nurses' intention to provide IPNS was positively correlated with both psychological resilience ($r=0.566, p<0.001$) and PPB ($r=0.561, p<0.001$). PPB was also positively correlated with psychological resilience ($r=0.631, p<0.001$). Furthermore, the mediating effect of PPB between psychological resilience and nurses' intentions to provide IPNS was 0.127 (95% CI=0.089 to 0.167), accounting for 29.26% of the total effect.

Conclusion: Nurses from tertiary institutions who participated in this study expressed a willingness to provide IPNS, and the research findings imply that PPB modulates psychological resilience and goals.

Implications: Based on the findings of our study, we recommend that nursing managers implement a comprehensive training program aimed at enhancing psychological flexibility and professional practices. This program should encompass advanced nursing techniques, IPNS processes, emergency management, and skills in communication and stress reduction specifically tailored for home healthcare. Such skills may include meditation, deep-breathing workshops, and IPNS experience-sharing sessions. Additionally, it is advisable to offer individual and group counseling whenever feasible and to enhance the welfare of home-visiting nurses to facilitate the progress and implementation of IPNS.

Keywords: internet plus nursing services, psychological resilience, perceived professional benefits, mediation effect

Introduction

Over the past decade, China's population has continued growing, making it one of the most populated countries globally. China's aging population trend has become more noticeable. By the end of 2022, 280 million individuals in our country, accounting for 19.8% of the entire population, were 60 years or older.¹ In China, 150 million elderly individuals, accounting for 65% of the total elderly population, suffer from chronic diseases such as diabetes and hypertension. Additionally, 40 million senior people have a disability or partial disability.² China's national fertility strategy has been continuously optimized to adapt to the increasingly aging population and declining fertility rate. China implemented the "Universal Two-Child Policy" in 2016 and introduced a fertility policy encouraging "one couple could have three children" in 2021.³ While the adjustment of the birth policy should facilitate population growth, it will also impose great pressure on the healthcare system. Additionally, the government continues promoting changes in the payment mechanisms of health insurance, with an emphasis on introducing the Diagnosis-Intervention Packet (DIP) to keep medical expenditure within an acceptable range.⁴ Home care services are becoming increasingly necessary in the aforementioned societal context as the hospital-centred healthcare model can no longer satisfy the general public's need of varied and unique nursing services. Meanwhile, the COVID-19 epidemic in the past three years has also brought opportunities for the developing Internet healthcare in our country.

Internet Plus Nursing Services (IPNS) are primarily services where registered nurses from medical institutions use Internet technology to offer nursing services to discharged patients or special groups with diseases or limited mobility. This approach follows an "online application and offline service" model. The nurses who perform this service are called "shared nurses". The National Health Commission first proposed this policy in February 2019, selecting six provinces or cities – Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang and Guangdong – as pilot areas.⁵ In December 2020, China issued the "Notice on Further Promoting the Pilot Project of IPNS", requiring that in addition to the existing six pilots, at least one city in each province should implement this.⁶ The Health Commission of Shijiazhuang, Hebei Province, identified six pilot hospitals in April 2021.⁷ Despite nearly three years of IPNS implementation in Shijiazhuang, the capital of Hebei Province, medical institutions' active participation has not increased much. The primary restriction is the shortage of nurses. Additionally, the implementation of IPNS faces limitations owing to the home setting, introducing a degree of unpredictability and risk that demands higher professional competence and adaptability from nurses. Nurses in tertiary healthcare facilities have a high level of general competence, but finding the time and energy to engage in this work owing to their heavy clinical nursing tasks is challenging for them.⁸ Given its nascent stage, numerous challenges persist, including insufficient platform monitoring, the absence of a robust quality control system, and deficient regulations.⁹ Furthermore, several factors constrain nurses' ability to deliver Internet Plus Nursing Services (IPNS), such as unpredictable home environments, nurses' limited emergency response capabilities, shortages of medical equipment, and others.¹⁰ These issues may pose risks to nurses' medical and personal safety. Consequently, it is crucial to comprehend the factors influencing nurses' intention to participate in IPNS within tertiary hospitals before implementing effective measures to promote its practice. In various countries, service models akin to the Internet Plus Nursing Services (IPNS) are commonly referred to as telemedicine, e-health, mobile health, telehealth, and tele-nursing. In nations such as the United States, this model was initiated early, experienced rapid development, and has utilized a wide array of network technologies, including telephones, video technology, emails, and mobile applications.¹¹ Internationally, telemedicine has demonstrated a positive impact on alleviating symptoms in cancer patients, facilitating the rehabilitation of individuals with chronic diseases, and reducing hospital readmission rates, thereby indicating significant potential for future development.^{12–14}

Psychological resilience refers to the capacity to persistently overcome challenges in various life situations and to restore or maintain one's equilibrium.¹⁵ It helps nurses to cope with work stress, promote professional development and ultimately improve the quality of healthcare services.¹⁶ Research has indicated a positive relationship between job development and psychological resilience.^{17,18} IPNS is a new option for nurses' career development. At present, IPNS is still in the early stage, and the lack of legislation and occupation standards may make nurses feel insecure and expose them to some uncertain risks.¹⁹ The concept of risk perception was proposed by Bauer in 1960, and it has since been shown to have a substantial impact on both patients' and healthcare professionals' use of mobile health.^{20,21}

Psychological resilience is an important factor affecting nurses' risk perception.²² Thus, we hypothesize that psychological resilience may play an important role in influencing nurses' intention to provide IPNS.

Nurses' Perceived Professional Benefits (PPB) encompass the advantages and rewards nurses perceive from their profession, recognizing the role of nursing in personal growth.²³ Nurses with higher level of PPB exhibit greater professional identity, work engagement and satisfaction.²⁴ In the Value-based Adoption Model, perceived benefits play a role in the adoption of M-Internet through perceived value.²⁵ Perceived value is the most important determinant of Internet health care technology adoption intention by health care professionals.²⁶ PPB has an intrinsic incentive effect on nurses' career growth and acts as a mediator between psychological resilience and motivation to stay in the workforce.²⁷ Accordingly, we hypothesize that nurses' PPB influences their desire to offer IPNS and acts as a mediator between this intention and psychological resilience.

In summary, the complex interplay among Chinese nurses' willingness to deliver IPNS, their psychological resilience, and their PPB necessitates further elucidation. While previous research has investigated the impact of demographic characteristics, perceived value, and perceived risk on this willingness, the effects of psychological resilience and PPB remain underexplored.^{26,28} This study pioneers an examination of the influence of nurses' psychological resilience and perceived professional benefits on their willingness to provide IPNS, adding a new dimension to existing research. The objectives of this study were (1) to examine the present state of psychological resilience, perceived professional benefits and nurses' intention to offer IPNS; (2) to analyse the relationship between the three variables; and (3) to verify the mediating effect of perceived professional benefits between psychological resilience and nurses' intention to provide IPNS. Our study would enrich the research on the relationship between the three variables and also help to comprehensively understand the influencing factors of nurses' intention to provide IPNS. Furthermore, it offers novel perspectives for further intervention studies, which might start with enhancing psychological resilience and perceived professional benefits to boost nurses' motivation to enroll in IPNS and promote its development.

Methods

Study Design and Samples

This study utilized a cross-sectional survey design. From April to October 2023, clinical nurses at three tertiary general hospitals in Shijiazhuang were recruited using a convenience sampling method. Eligible participants were registered nurses with at least one year of clinical experience, who provided informed consent, volunteered to participate and could comprehend the survey. Exclusion criteria included nurses who were retired or rehired, in training or study, absent for reasons such as sick leave or pregnancy leave and in non-nursing roles. The minimum sample size for studies investigating influencing factors should be 5–10 times greater than that of the independent variables.²⁹ A total of 16 variables were involved, including 14 variables in general demographic and job characteristics, as well as two primary independent variables: psychological resilience and PPB. Accounting for a 20% rate of invalid questionnaires, the required sample size was estimated to be 96–192.

Investigation Tools

Questionnaire of General Information

General demographic information included age, gender, degree of education, marital status, fertility status, the age of children, monthly income, department of work, professional title, position, work seniority, employment relationship, whether clinical nurse specialist or not and the number of night shifts per month.

Chinese Version of the Connor-Davidson Resilience Scale

The Connor-Davidson Resilience Scale (CD-RISC) is a widely used instrument designed to measure resilience, which is the ability to cope with adversity.³⁰ Developed by Connor and Davidson, the scale has been adapted into various languages and cultural contexts to ensure its applicability across different populations. In this study, the Chinese version of the CD-RISC, translated by Xiaonan Yu and Jianxin Zhang, was employed to assess resilience among participants.³¹ This version has demonstrated reliability and validity in assessing resilience within Chinese-speaking populations, making it a valuable tool for both research and clinical applications. The scale includes 25 items in three dimensions:

resilience (13 items), strength (8 items) and optimism (4 items). Each item was rated using a 5-point Likert scale, with 1 to 5 indicating “never”, “seldom”, “sometimes”, “often” and “always”, respectively. Scores range from 25 to 125, with higher scores indicating greater psychological resilience. The Cronbach’s α coefficient for the Chinese version of the CD-RISC was reported to be 0.91. Confirmatory factor analysis of the Chinese data failed to verify the original 5-factor structure of CD-RISC obtained in the USA, while exploratory factor analysis resulted in a 3-factor structure of resilience. This suggests that the three-factor model is more capable of reflecting various dimensions of psychological resilience and is more suitable for the Chinese cultural context. The total score of the Chinese version of the CD-RISC scale demonstrated good correlations with self-esteem and life satisfaction providing compelling evidence for the validity of the Chinese version of the CD-RISC among the Chinese population.

Questionnaire of Nurses’ PPB

The questionnaire, developed by Chinese scholar Hu Jing, comprises 33 items across five dimensions: positive professional perception (7 items), good patient-nurse relationship (6 items), recognition from families and friends (6 items), a sense of belonging to work team (6 items) and personal growth (8 items).²³ The questionnaire utilized a 5-point Likert scale, with ratings from 1 to 5 corresponding to “completely disagree”, “disagree”, “neutral”, “agree” and “completely agree”, respectively. The total score varies between 33 and 165. In general, nurses with higher overall scores have a higher PPB than those with lower total scores. This questionnaire has been widely used to assess Chinese nurses’ professional benefits.^{32–34} The total Cronbach’s α coefficient of the scale was 0.958, and the split-half reliability coefficient was 0.938. The content validity index at the item level was 0.83–1.00; the content validity index at the scale level was 0.97.

Questionnaire of Nurses’ Intention to Provide IPNS

This questionnaire, developed by Chinese scholars to assess nurses’ intention to provide IPNS, consists of 17 items across three subscales: participating behaviour attitude (5 items), subjective norms of behaviour (5 items), and perceived behavioral control (7 items).³⁵ Data were collected using a 5-point Likert scale ranging from 1 (“Completely disagree”) to 5 (“Completely agree”). A higher score indicates a stronger intention to participate in the IPNS. The Cronbach’s α coefficient of the total scale was 0.927, and the test-retest reliability coefficient was 0.805, indicating good internal consistency and stability of the scale. The construct validity was confirmed through exploratory factor analysis, which extracted eight factors with a cumulative variance contribution rate of 72.33%. The criterion-related validity was further supported by a significant positive correlation ($r=0.743$, $p<0.01$) between the nurses’ participation intention and their actual participation behavior, indicating that the scale effectively measures what it is intended to measure.

Data Collection

The data was collected via an online survey tool, the Questionnaire Star Platform. Initially, the researcher communicated with the nursing directors and the head nurses at the target hospitals. Then, after obtaining their consent, the head nurses disseminated the questionnaire link via WeChat groups to various departments, encouraging eligible nurses to participate. The questionnaire introduction used standardized language to detail the study’s purpose, importance and instructions, requiring completion for submission. To prevent duplicate responses, the system only allowed one submission per unique IP address. Out of 651 questionnaires distributed, 40 were considered invalid owing to a response time of less than three minutes or identical answers across all items, resulting in 611 valid responses. The questionnaire achieved an effective response rate of 93.86%.

Statistical Analysis of the Datasets

Data were analyzed using SPSS Version 26.0, with a significance threshold set at $p<0.05$. The participating nurses’ demographic and occupational characteristics were presented as frequencies. The Kolmogorov–Smirnov test was utilized to evaluate the normality of the data. Psychological resilience, PPB and nurses’ intention to provide IPNS were not normally distributed and were described by the median and interquartile range. This study employed Harman’s single-factor test to assess common method bias. Non-parametric tests were utilized to investigate the demographic and employment factors that impact nurses’ intention to offer IPNS. Spearman correlation analysis was employed to quantify the correlations among the key variables. We utilized hierarchical regression analysis to examine the impact of

psychological resilience and PPB on nurses' intention to provide IPNS. Model 4 of PROCESS in SPSS, a statistical framework based on path analysis, was employed to investigate mediation effects between variables. This model was utilized to examine the mediating role of PPB in the relationship between psychological resilience and IPNS intention. The bootstrap method, with a 95% confidence interval, tested the significance of the mediation effect.

Ethical Considerations

We confirm that this study was conducted in accordance with the Declaration of Helsinki. The ethics approval was obtained from the Research Ethics Committee of the Second Hospital of Hebei Medical University (Approval number: 2023-R115). All participants had the right to terminate and withdraw at any time during the investigation, and they completed the questionnaires anonymously.

Results

Common Method Bias Test results

Harman's single-factor test was used to assess common method bias in this study. The results showed that the variance explanation rate of the first common factor was 39.077%, which indicates less serious common method bias.

Differences in the Inclination of Nurses with Diverse Demographic Characteristics to Offer IPNS

As shown in Table 1, nurses' willingness to offer IPNS differed in terms of fertility status, number of night shifts per month and whether they were specialist nurses or not, while other demographic characteristics showed no difference.

Table 1 Comparison of the Intention of Nurses with Different Sociodemographic Characteristics to Provide IPNS (n = 611)

Sociodemographic Characteristics	Number	Total Score of the Intention [$M(P_{25}, P_{75})$]	Z/χ^2	P
Gender			-0.406	0.685
Male	40	63.00 (53.00,68.75)		
Female	571	62.00 (53.00,68.00)	0.5389	0.145
Age (years)				
≤30	108	63.50 (55.00,68.00)		
31–39	402	61.00 (52.75,67.00)		
40–49	89	62.00 (56.00,71.50)		
50–60	12	57.00 (51.75,63.75)	0.300	0.861
Education				
Junior college and below	32	64.00 (51.25,68.75)		
Bachelor	565	62.00 (53.00,68.00)		
Master and above	14	60.00 (54.75,68.75)	2.745	0.433
Marital status				
Single	70	61.50 (51.00,67.00)		
Married	536	62.00 (53.00,68.00)		
Divorced	4	61.50 (59.50,65.00)		
Widowed	1		1.486	0.829
Children's age				
Infancy	138	60.00 (53.00,67.00)		
Early childhood	98	62.00 (53.75,71.25)		
Preschool period	128	62.00 (54.00,68.00)		
School period	202	62.00 (52.00,68.00)		
Adult	45	62.00 (55.50,67.00)		

(Continued)

Table 1 (Continued).

Sociodemographic Characteristics	Number	Total Score of the Intention [<i>M</i> (<i>P</i> ₂₅ , <i>P</i> ₇₅)]	<i>Z</i> / <i>x</i> ²	<i>P</i>
Children in the family			8.189	0.042
No child	118	61.00 (52.00,67.00)		
One boy	164	61.00 (54.00,67.00)		
One girl	140	60.00 (51.00,68.00)		
Two or more children	189	63.00 (55.50,69.00)		
Monthly income (RMB)			3.028	0.387
<3,000	10	64.00 (55.75,67.25)		
3,001–4,999	64	61.00 (52.00,67.75)		
5,000–10,000	481	61.00 (53.00,68.00)		
>10,001	56	64.00 (56.25,74.00)		
Professional title			8.321	0.081
Nurse	35	63.00 (56.00,69.00)		
Senior Nurse	100	63.00 (54.25,69.00)		
Supervisor Nurse	440	61.00 (52.00,67.00)		
Co-chief nurse	29	63.00 (56.50,71.50)		
Chief nurse	7	65.00 (61.00,67.00)		
Professional Position			3.630	0.163
Nurse	572	61.00 (53.00,68.00)		
Ward head nurse	35	63.00 (59.00,71.00)		
Head nurse	4	65.00 (58.25,65.00)		
Working years			1.882	0.597
≤5	25	61.00 (54.00,67.00)		
5–10	267	62.00 (54.00,68.00)		
11–20	249	62.00 (52.00,67.00)		
>20	70	60.50 (54.75,66.00)		
Employment relationship			5.577	0.062
Public institution	102	64.00 (56.00,72.00)		
Contract employment	497	61.00 (53.00,67.00)		
Others	12	61.00 (51.25,70.00)		
Department or wards			5.554	0.475
Internal Medicine	166	63.00 (54.00,70.50)		
Surgery	225	60.00 (53.50,66.00)		
G & O	33	62.00 (52.50,70.00)		
Paediatric	40	60.50 (51.25,67.00)		
Emergency	12	64.00 (57.75,67.75)		
ICU	31	61.00 (53.00,68.00)		
Others	104	61.00 (51.00,67.00)		
Clinical nurse specialist			−2.003	0.045
Yes	295	62.00 (54.00,68.00)		
No	316	61.00 (52.00,67.00)		
Night shifts per month			11.159	0.011
0	177	63.00 (55.50,71.00)		
1–3	81	63.00 (53.50,68.00)		
4–6	259	60.00 (52.00,66.00)		
>6	94	62.00 (54.50,68.00)		

Abbreviation: G&O, Gynaecology & Obstetrics.

Scores of Nurses' Intention to Provide IPNS, Psychological Resilience and PPB

As shown in [Table 2](#), the median total scores for nurses' intention to provide IPNS, psychological resilience and PPB were 62 (IQR:53–68), 85 (IQR:76–97) and 133 (IQR:126–153), respectively.

Table 2 Descriptive Analyses of Nurses' Intention to Provide IPNS, Psychological Resilience and Perceived Professional Benefits (n = 611)

Variables	Number of Items	Score Range	Total Score	Average Score of Items
Intention to provide IPNS	17	17–85	62 (53,68)	3.65 (3.12,4.00)
Psychological resilience	25	25–125	85 (76,97)	3.40 (3.04,3.88)
Perceived professional benefits	33	33–165	133 (126,153)	4.03 (3.81,4.63)

Correlation Analyses Between Nurses' Intention to Provide IPNS and Their Psychological Resilience and PPB

As shown in Table 3, nurses' intention to provide IPNS had a positive correlation with psychological resilience ($r=0.566$, $p<0.001$) and PPB ($r=0.561$, $p<0.001$). Psychological resilience also correlated positively with PPB, with an r value of 0.631 ($p<0.001$).

The Predictive Effects of Psychological Resilience and PPB on Nurses' Intention to Provide IPNS

Hierarchical regression analysis was used, where the demographic variables with statistically significant differences ($p<0.05$), including fertility status, number of night shifts per month and whether a specialist nurse or not, were regarded as the control variables, and nurses' willingness to provide IPNS was regarded as the dependent variable. The control variables were input into the first layer. Additionally, PPB and psychological resilience were regarded as separate variables. They were put into the second layer. Results show that even after the influence of demographic variables was removed, psychological resilience and PPB accounted for 41.0% of the variations in nurses' intention to provide IPNS (Table 4).

Table 3 Correlation Analyses Between Nurses' Intention to Provide IPNS, Psychological Resilience and Perceived Professional Benefits (n = 611)

Variables	Intention to Provide IPNS	Psychological Resilience	Perceived Professional Benefits
Intention to provide IPNS	1		
Psychological resilience	0.566***	1	
Perceived professional benefits	0.561***	0.631***	1

Notes: *** $P<0.001$.

Table 4 Hierarchical Regression Analysis of Nurses' Intention to Provide IPNS (n = 611)

Model	Variables	β	SE	β^*	t	P
Model 1	(Constant)	64.342	1.309		49.142	<0.001
	Clinical nurse specialist (using "non-specialist nurse" as reference)					
	Clinical nurse specialist	1.383	0.855	0.065	1.618	0.106
	Fertility status (using "2 or more children" as reference)					
	No child	-2.618	1.249	-0.098	-2.096	0.036
	1 boy	-2.334	1.115	-0.098	-2.094	0.037
	1 girl	-2.744	1.165	-0.109	-2.355	0.019

(Continued)

Table 4 (Continued).

Model	Variables	β	SE	β^*	t	P
	Number of night shifts per month (using “≥7” as reference)					
	0	0.174	1.337	0.007	0.130	0.897
	1–3	–0.239	1.593	–0.008	–0.150	0.881
	4–6	–2.689	1.259	–0.126	–2.136	0.033
Model 2	(Constant)	12.771	2.806		4.552	<0.001
	Clinical nurse specialist (using “non-specialist nurse” as reference)					
	Clinical nurse specialist	1.278	0.649	0.060	1.968	0.049
	Fertility status (using “2 or more children” as reference)					
	No child	–0.735	0.955	–0.027	–0.769	0.442
	1 boy	–1.109	0.848	–0.047	–1.307	0.192
	1 girl	–0.719	0.891	–0.029	–0.807	0.420
	Number of night shifts per month (using “≥7” as reference)					
	0	–1.255	1.018	–0.054	–1.233	0.218
	1–3	–1.155	1.211	–0.037	–0.954	0.341
	4–6	–1.219	0.959	–0.057	–1.271	0.204
	Perceived professional benefits	0.173	0.024	0.288	7.212	<0.001
	Psychological resilience	0.307	0.028	0.434	10.922	<0.001

Notes: Model 1, $R^2 = 0.036$, Adjusted $R^2 = 0.025$, $\Delta R^2 = 0.036$, $F = 3.241$, $P = 0.002$; Model 2, $R^2 = 0.446$, Adjusted $R^2 = 0.438$, $\Delta R^2 = 0.410$, $F = 53.852$, $P < 0.001$.

Abbreviations: β , non-standardized coefficients; SE, standard error; β^* , standardized coefficients.

The Mediating Effect of Perceived Professional Benefits Between Psychological Resilience and Nurses’ Intention to Provide IPNS

In this study, significant variables in univariate analysis were taken as control variables, and mediation analysis was used to explore whether perceived professional benefits played a mediating role in the relationship between psychological resilience and nurses’ intention to provide IPNS. As shown in Table 5, psychological resilience had a significant predictive effect on nurses’ intention to provide IPNS ($c=0.434$, $t=19.041$, $p<0.05$). After the inclusion of PPB as a mediating variable, psychological resilience still had a significant predictive effect on nurses’ intention to provide IPNS ($c'=0.307$, $t=10.922$, $p<0.05$). Moreover, psychological resilience had a significant predictive effect on PPB ($a=0.737$, $t=19.759$, $p<0.05$), and PPB had a significant predictive effect on nurses’ intention to provide IPNS ($b=0.173$, $t=7.212$, $p<0.05$). Bootstrap testing revealed that confidence intervals for both direct and indirect effects excluded 0, which

Table 5 Mediation Effect of Perceived Professional Benefits Between Psychological Resilience and Nurses’ Intention to Provide IPNS (n = 611)

Effect	Path	Effect	SE	t	p	95% CI
Direct effect	Psychological resilience → Intention to provide IPNS (c')	0.307	0.028	10.922	<0.001	0.252,0.362
Indirect effect	Psychological resilience → perceived professional benefits (a)	0.737	0.037	19.759	<0.001	0.663,0.810
	perceived professional benefits → Intention to provide IPNS (b)	0.173	0.024	7.212	<0.001	0.126,0.220
	Psychological resilience → perceived professional benefits → Intention to provide IPNS (a*b)	0.127	0.020	–	–	0.089,0.167
Total Effect	Psychological resilience → Intention to provide IPNS (c)	0.434	0.023	19.041	<0.001	0.390,0.479

indicated that PPB acted as a partial mediator. In general, the mediating effect ($a*b/c$) accounted for 29.26% of the total effect.

Discussion

The median total score for nurses' intention to provide IPNS was 62 (53,68), and the average item score was 3.65 (3.12,4.00), which was above the medium level; this suggests that nurses were willing to participate. This result is consistent with the one from a previous study in Hebei Province³⁶ but lower than the result of the study by Qiao and Jing from Shandong Province.^{37,38} This is likely caused by the fact Shandong Province has tried to provide home care for patients through the "shared nurse" application before the announcement of the national IPNS pilot policy was announced in 2019, and thus, their nurses have a high degree of cognition.³⁹ Conversely, Hebei Province is not included in the earliest pilot provinces; thus, home care services started later in 2021, leading to a relatively lower degree of cognition. Moreover, the study conducted by Li Jingjian revealed that nurses in non-pilot provinces had a limited understanding of IPNS, which subsequently affected their willingness to participate.⁴⁰

Presently, investigating the current situation and influencing factors of nurses' intention to provide IPNS is particularly important. A survey of nurses' job preferences for IPNS found that personal safety and salary were the two most discussed aspects.⁴¹ Measures have been taken to ensure nurses' professional and personal safety, such as purchasing liability insurance and personal accident insurance for nurses and providing a mobile APP locating system.⁴² The cost of IPNS is an important factor affecting nurses' enthusiasm and patients' acceptance.⁴³ Considering nurses' salaries, IPNS can be included in the medical insurance reimbursement catalogue to alleviate the financial conflict between patients and nurses.⁴⁴ In China, IPNS means that nurses provide online nursing consultation and home care services for patients with the help of information technology. IPNS include different work content and forms in different countries. Studies in other countries have found that interpersonal relationships and support among colleagues, including doctors, nurses and other healthcare workers, are associated with the retention intention of home care nurses.^{45–48} A systematic review from Finland researchers concerning the barriers for nurses using telehealth applications identified that insufficient resources were organizational factors.⁴⁹ Strengthening the cooperation between hospitals and communities is necessary. In China, a good approach could be to have hospital nursing experts train community nurses, who would then provide on-site services.

The median total score for psychological resilience in this study was 85 (76,97), and the average item score was 3.40 (3.04,3.88). Han Binru investigated 71,477 nurses from different types of hospitals in China, and the average score of their psychological resilience was 90.49 ± 15.71 ,¹⁷ which is higher than the result of this study. The following are possible reasons: (a) Only nurses from tertiary hospitals were included in this study, while nurses from other grade hospitals were not investigated; therefore, the sample may not be representative. Most patients treated in tertiary hospitals in China are critically sick and complex, which leads to heavy workloads and high psychological pressure for clinical nurses. (b) During the COVID-19 epidemic over the past three years, nurses in third-level designated hospitals have faced a higher risk of infection and heavier nursing tasks, which might have diminished their psychological resilience. Based on our results, nursing managers at tertiary institutions should place greater focus on developing nurses' psychological resilience.

In this study, the PPB score was 133 (126,153), and the average item score was 4.03 (3.81, 4.63), which was high. This result is consistent with the research conducted by Chinese scholar Wang Xiaomin.⁵⁰ Nurses' professional abilities have significantly improved after the experience of COVID-19 epidemic, which has led to an increased perception of their professional value and social status, thereby enhancing their perceived professional benefits.

A positive correlation was found between nurses' intention to provide IPNS and psychological resilience. Psychological resilience is essentially the ability to cope with stress and adversity, and it is a positive resource. A previous study has found that nurses' psychological resilience influences their career development.¹⁷ Nurses with higher psychological resilience can more effectively cope with work pressure, which results in a reduced perception of stress. Therefore, they feel more confident and enthusiastic about their nursing duties, which eventually contributes to achieving outstanding work performance and promoting career development. Nurses with strong psychological resilience are prepared to handle various challenges and emergencies, which makes them more likely to offer IPNS. Sun Ling et al

conducted a meta-analysis examining the correlation between resilience and work fatigue among Chinese nurses and found a moderate negative correlation between them;⁵¹ further, they found significant differences across different regions. Additionally, a study from New Zealand found that nurses with a high level of psychological resilience could reduce their burnout and increase their work engagement, which helped them achieve personal career development.⁵²

Additionally, demographic variables were selected as control variables to analyse the impact of PPB and psychological resilience on nurses' intention to provide IPNS. The results showed that the above two factors could explain 41.0% of the variance, indicating a strong predictive effect. Psychological resilience influences nurses' intentions to deliver IPNS both directly and indirectly through PPB, with the indirect effect of PPB accounting for 29.26% of the total impact. Nurses exhibiting higher levels of psychological resilience are more adept at managing work-related stress and emotional challenges, thereby addressing problems in a more constructive manner. This capability results in increased recognition from colleagues and patients, which in turn fosters harmonious professional relationships. Furthermore, the positive experiences derived from their professional roles contribute to the enhancement of their PPB. One study found that resilience was positively correlated with the five dimensions of perceived professional benefits.⁵³ Liu, a Chinese scholar, also discovered a positive correlation ($r=0.553$) between nurses' psychological resilience and their PPB.⁵⁴ Having a high level of PPB enables nurses to feel satisfied at work and motivates them to make extra efforts, which helps improve their personal professional skills and overall quality. Nurses with higher levels of professionalism and enthusiasm can provide better nursing services, which makes it easier for them to gain approval from patients and colleagues. These will strengthen nurses' professional identities, enabling them to plan and develop their career more actively. The IPNS model is the inevitable product of the aging society in China, and the market demand for it is high. For nurses, it is both a challenge and an opportunity, as well as a new option for their career development prospects. In this sense, nurses with a high level of PPB are more likely to participate in IPNS. Additionally, nurses' relatives and friends have easier access to professional medical guidance and advice in their daily lives. As a result, nurses experience a heightened PPB, and their family members and friends are more inclined to support their work. In IPNS mode, nurses are expected to provide home care services to patients during their off-duty hours. With the full understanding and support of their family, nurses will be more willing to participate.

Nurse retention in home healthcare and telemedicine has become a critical focus due to rising healthcare demands and a nursing shortage. Studies highlight factors affecting retention, such as shared decision-making and organizational commitment, which boost job satisfaction and retention. Enhancing these can improve patient outcomes and agency performance, underscoring the need for supportive work environments.⁵⁵ A study explores how cross-sector collaboration boosts participant retention in nurse-home-visiting programs, emphasizing the benefits of relational coordination and structural integration among community providers like substance use treatment and child welfare services.⁵⁶ It highlights the potential of bridging healthcare and social services to improve retention rates. Additionally, integrating telehealth in home-based palliative care enhances access to quality resources. A systematic review finds that telehealth empowers nurses, strengthens their professional identity, and fosters leadership, leading to improved patient outcomes.⁵⁷

Nursing managers should evaluate the psychological resilience of shared nurses and prioritize assigning nurses with high psychological resilience level to provide IPNS for patients, especially those nursing operations with high technical difficulty. To augment the competencies of nurses exhibiting low psychological resilience, it is recommended to implement a comprehensive series of training sessions. These sessions should encompass advanced nursing methodologies, IPNS processes, emergency management, and skills in communication and stress alleviation pertinent to home healthcare services. Furthermore, workshops focusing on meditation, deep-breathing exercises, and the exchange of experiences related to IPNS are likely to be advantageous. It is also advisable to offer individual or group psychological counseling whenever feasible. Finally, enhancing the welfare of home-visiting nurses is recommended to facilitate the advancement of IPNS.

Conclusions

This study found that nurses' intention to provide IPNS was positively correlated with their psychological resilience and perceived professional benefits. Psychological resilience not only directly predicted nurses' intention to provide IPNS, but it also indirectly predicted intention through the mediating variable of perceived professional benefits. This lays

a theoretical framework for future intervention research to improve nurses' psychological resilience and perceived professional benefits, so as to improve their willingness to engage in this work and promote its development.

The innovation of this study is to focus on the effect of nurses' internal psychological factors on the intention to provide IPNS. This is an advantage of this study, but it also has some limits, such as whether intrinsic and organizational factors other than these two variables are at play. In the future, we may further improve nurses' specialized ability, strengthen vocational training, optimize salary and safety procedures and strengthen communication between nursing managers and nurses, so as to enhance nurses' willingness to participate. Lastly, this study only included nurses from one city in North China, which may limit the generalizability of the results. Future longitudinal studies will need to be conducted in multiple regions.

Data Sharing Statement

The data that support the findings of this study are available from the corresponding authors upon reasonable request.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no conflicts of interest in this work.

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