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RESEARCH ARTICLE **OPEN ACCESS**

The Study on Innovative Development of the Elderly Care Industry under the Community-based Elderly Care Model based on the SERVQUAL Model

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Abstract:

Background: China's rapidly aging population has highlighted the importance of community-based elderly care, particularly in urban areas like Shanghai, as traditional family-based care declines due to urbanization, smaller families, and shifting dynamics. Community care models provide scalable solutions to address the healthcare and social needs of elderly individuals while fostering innovation in service delivery.

Objective: This study investigates how the quality of community-based elderly care services influences elderly satisfaction and drives innovation within the elderly care industry. Using the SERVQUAL model, it explores the impact of service dimensions—reliability, responsiveness, assurance, empathy, and tangibles—on satisfaction and their role in promoting new care models and technologies.

Methods: The study surveyed 622 residents in Shanghai and analyzed the data with Structural Equation Modeling (SEM). It assessed the relationships between the five service quality dimensions, satisfaction, and innovation in elderly care, offering insights into how these factors interact.

Results: Reliability (β = 0.42), responsiveness (β = 0.35), assurance (β = 0.28), and empathy (β = 0.33) significantly enhance elderly satisfaction, which mediates their impact on innovation. Tangibles (β = 0.09) had minimal influence, suggesting emotional and relational factors are more important than physical care environments. Satisfaction was a key driver of innovation, encouraging the adoption of personalized and technology-driven care models.

Conclusion: High-quality services that improve elderly satisfaction are essential for boosting industry innovative. Smart technology, telemedicine, and remote health monitoring are critical for addressing the challenges of China's aging population, closing service gaps, and creating responsive and efficient care systems.

Keywords: Community-based elderly care, Service quality, Elderly satisfaction, Industrial innovation, SERVQUAL Model, SEM.

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1. INTRODUCTION

China's rapidly aging population has underscored the need for more sustainable and flexible elderly care models. By the end of 2023, the population aged 60 and above had reached 297 million, accounting for 21.1% of the total population [1], This figure is expected to exceed 487 million by 2050 [2]. Traditional family-based care, once a cornerstone of Chinese eldercare, is increasingly strained by urbanization, smaller family sizes, and evolving social dynamics [3, 4]. Against this backdrop, new models have emerged: institutional care (*e.g.*, nursing homes) and community-based care [5]. While institutional

care offers professional services, it often struggles with high costs and limited capacity. Community-based elderly care, emphasizing "aging in place," has become a promising alternative that blends the comfort of the home environment with socially provided services [6, 7]. This model has gained significant traction in urban areas, exemplified by Shanghai's "9073" model, which underscores the importance of community-based care [8-10].

Despite Shanghai's leading role and relatively advanced practices, ongoing challenges persist, including uneven service coverage, variable service quality, and limited professional competencies among community caregivers [11, 12]. Additionally, elderly acceptance and satisfaction vary, reflecting incomplete understanding and integration of community-based services [13]. Exploring these issues in Shanghai—China's largest metropolis and a bellwether for social policy implementation—can yield insights for other rapidly urbanizing regions. While Shanghai's context is unique, its experience can inform other cities facing similar demographic and social transitions, both within China and globally, especially where community-based models are being considered or developed.

To understand and improve community-based elderly care, this study employs the SERVQUAL model, a well-established framework for evaluating service quality across five dimensions: reliability, responsiveness, assurance, empathy, and tangibles. SERVQUAL is particularly relevant for elderly care because it captures both functional quality (*e.g.*, timely and accurate service delivery) and relational aspects (*e.g.*, empathetic communication, professional assurance) crucial in nurturing trust and well-being among older adults. These intangible factors often outweigh physical amenities in determining user satisfaction and can directly influence the adoption of new care approaches or technologies. By focusing on a service-oriented framework, we can better identify where interventions—be they procedural, technological, or organizational innovations—are most needed and most likely to succeed.

Moreover, the concept of "innovation" in elderly care is multifaceted. It includes not only technological advancements, such as telemedicine, wearable health monitors, and smart home devices, but also procedural and organizational innovations, like integrated care pathways, interdisciplinary teams, and community-driven support networks. How satisfaction interacts with these diverse forms of innovation is a key question—high satisfaction may encourage the adoption of cutting-edge technologies, inspire new service delivery models, or lead to the refinement of existing care processes.

This study takes Shanghai's community-based elderly care as a case to address the following questions:

Research Question 1: How does the improvement in community-based elderly care service quality affect elderly satisfaction?

Research Question 2: Does elderly satisfaction mediate the relationship between community-based elderly care service quality and the innovative development of the elderly care industry?

By examining these questions, this research aims to strengthen the theoretical grounding of using SERVQUAL in elderly care contexts, provide insights that extend beyond the Shanghai case, and clarify how improving satisfaction can catalyze innovation. In doing so, the study offers guidance not only for policymakers and service providers in China but also for global stakeholders seeking to enhance community-based elderly care models and foster meaningful innovation in an era of rapid demographic change.

2. LITERATURE REVIEW

2.1. Service Quality in Elderly Care

Service quality in elderly care refers to the degree to which services provided meet or exceed the expectations of elderly individuals. The SERVQUAL model [14] remains a central framework in service quality research, measuring service quality across five key dimensions: reliability, responsiveness, assurance, empathy, and tangibles [14]. While this model has been widely applied in elderly care research, it remains subject to critique for its limitations and study, particularly the assumption that all five dimensions are equally applicable across different service contexts. For example, some scholars argue that the "tangibles" dimension may be less relevant in community-based elderly care compared to institutional care, where physical facilities are more prominent [15]. Moreover, the SERVQUAL model does not fully address how cultural, demographic, or technological factors influence perceptions of service quality in elderly care settings. Thus, there is a need for a more nuanced application of the model, considering the evolving expectations of elderly individuals and the increasing role of technology in care services [16].

In community-based elderly care, the reliability of service refers to the institution's ability to deliver promised services consistently and on time. Responsiveness involves the institution's capacity to react promptly to elderly residents' needs, especially in emergencies. Assurance emphasizes the professional skills and attitude of staff in fostering trust and security among residents. Empathy reflects the ability of service providers to understand and cater to the emotional and physical needs of the elderly. Lastly, tangibles pertain to the physical environment, including the facilities and equipment used to support elderly care.

The literature has highlighted the critical role of service quality in enhancing the quality of life and overall well-being of elderly individuals. However, existing studies largely focus on descriptive analyses, with less attention to potential gaps in the operationalization of service quality dimensions or the impact of external factors such as policy changes and technological advancements.

2.2. Community-based Elderly Care Service Quality and Elderly Satisfaction

The reliability of community-based elderly care services, reflected in the timely provision of daily care and medical support, directly impacts the quality of life and sense of security of elderly individuals and is positively correlated with their satisfaction [7]. Responsiveness is equally crucial, especially in emergencies; a service system capable of responding swiftly enhances the trust of the elderly in the institution [17]. Additionally, assurance, demonstrated by the professional skills of service staff, significantly boosts elderly satisfaction [8]. Empathy from service personnel, through warm and considerate attitudes, enhances the happiness of the elderly [18]. Finally, tangible factors, such as improvements in the physical environment and facilities, greatly increase the comfort and sense of security among elderly residents [19].

H1a: The reliability of community-based elderly care service quality positively affects elderly satisfaction.

H1b: The responsiveness of community-based elderly care service quality positively affects elderly satisfaction.

H1c: The assurance of community-based elderly care service quality positively affects elderly satisfaction.

H1d: The empathy of community-based elderly care service quality positively affects elderly satisfaction.

H1e: The tangibles of community-based elderly care service quality positively affect elderly satisfaction.

2.3. Community-based Elderly Care Service Quality and Innovation in the Elderly Care Industry

Research indicates that the reliability of community-based elderly care services provides a stable foundation for innovation within the elderly care industry; improving service standardization and process management contributes to the development of new service models and management tools [6]. For instance, standardized care services and efficient process control reduce error rates, supporting new models such as smart elderly care. Moreover, highly responsive services can quickly adapt to market changes, driving innovations in technology and service models, such as big data and artificial intelligence applications for precise health management [20]. Skilled service providers are better equipped to meet the complex needs of the elderly, facilitating the adoption of telemedicine and smart monitoring and providing a trust foundation for innovation [21]. Empathetic services enhance elderly individuals' dependency on and loyalty to services, creating a user base for personalized elderly care solutions and other human-centered innovations [22]. Lastly, upgrades in tangible facilities, such as smart beds and health monitoring devices, provide essential support for technological innovations in the elderly care industry [23].

H2a: The reliability of community-based elderly care service quality positively affects innovation in the elderly care industry.

H2b: The responsiveness of community-based elderly care service quality positively affects innovation in the elderly care industry.

H2c: The assurance of community-based elderly care service quality positively affects innovation in the elderly care industry.

H2d: The empathy of community-based elderly care service quality positively affects innovation in the elderly care industry.

H2e: The tangibles of community-based elderly care service quality positively affect innovation in the elderly care industry.

2.4. Elderly Satisfaction and Innovation in the Elderly Care Industry

Elderly satisfaction plays a crucial role in driving innovation within the elderly care industry. First, the satisfaction of elderly individuals with community-based elderly care services reflects their recognition of existing services and the degree to which their needs are met. When elderly individuals are satisfied with services, it indicates that service quality has met or exceeded expectations, laying a foundation for introducing new service models such as smart elderly care and telemedicine [24]. Second, elderly satisfaction serves as a market feedback mechanism, encouraging service providers to maintain or improve satisfaction through continuous innovation, with feedback and demand from elderly individuals becoming valuable sources of information for industry innovation [25]. For instance, community elderly care institutions can regularly collect evaluations from elderly residents and their families to identify service deficiencies and continually improve through technological innovation and process optimization, thereby driving service upgrades and enhancement. Moreover, increased satisfaction enhances word-of-mouth effects, attracting more users and expanding market demand, which promotes economic growth and innovation within the industry. Market expansion brings financial support to the elderly care industry, allowing service providers to allocate more resources toward innovation in technology and service models, further elevating industry standards [26]. Lastly, elderly satisfaction provides government and policymakers with a basis for decision-making, as it serves as a key indicator for assessing the quality of elderly care services. Based on satisfaction feedback, the government can adjust policies to encourage industry innovation; for example, satisfaction surveys may reveal that smart elderly care technology enhances the quality of life, prompting increased support for related technologies and fostering technological innovation and development within the industry [27].

H3: Elderly satisfaction positively affects innovation in the elderly care industry.

2.5. The Mediating Role of Elderly Satisfaction

Enhancing the reliability of elderly care services increases elderly satisfaction, making them more receptive

to new technologies and service models, such as the application of smart elderly care systems, thus playing a crucial role in service reliability and industry innovation [28]. Studies show that responsiveness also indirectly promotes innovation by increasing elderly satisfaction; for example, community care services that respond quickly to needs make elderly individuals more inclined to accept smart health monitoring devices and telemedicine services, driving upgrades in service models [29]. Additionally, when elderly individuals are satisfied with the professionalism of service personnel, they are more likely to adopt remote care and health management technologies, supporting industry development [30]. Highly empathetic services enhance elderly individuals' emotional reliance, making them more willing to engage in personalized health plans and use smart care devices, further driving industry innovation [31]. Meanwhile, a modern physical environment and advanced equipment improve the living experience of elderly individuals, boosting their satisfaction with care services and increasing their acceptance of new technologies and devices, providing a solid foundation for industry innovation [3].

H4a: Elderly satisfaction mediates the relationship between the reliability of community-based elderly care service quality and innovation in the elderly care industry.

H4b: Elderly satisfaction mediates the relationship between the responsiveness of community-based elderly care service quality and innovation in the elderly care industry.

H4c: Elderly satisfaction mediates the relationship between the assurance of community-based elderly care service quality and innovation in the elderly care industry.

H4d: Elderly satisfaction mediates the relationship between the empathy of community-based elderly care service quality and innovation in the elderly care industry.

H4e: Elderly satisfaction mediates the relationship between the tangibles of community-based elderly care service quality and innovation in the elderly care industry.

2.6. Research Model

The theory of customer satisfaction originated in the field of marketing and serves as a key framework for assessing whether a company's products and services meet customer expectations [32]. This theory laid the groundwork for subsequent customer satisfaction models. To gain a deeper understanding and measurement of the impact of service quality on customer satisfaction and industry development, integrating the SERVQUAL model becomes essential [14].

This study constructs a comprehensive customer satisfaction impact model based on the ACSI and SERVQUAL models. First, it categorizes community-based elderly care service quality into the five aforementioned dimensions, analyzing their respective impacts on elderly satisfaction and innovation in the elderly care industry. Then, by measuring the gap between customer expectations and actual perceptions of these service dimensions, the study assesses the extent of their impact on satisfaction. Additionally, elderly satisfaction is included as a mediating variable to examine its further influence on innovation in the elderly care industry. The research model expands upon traditional approaches by considering not only service quality but also the dynamic interaction between elderly satisfaction and the continuous innovation needed to meet the complex and changing demands of elderly individuals in community-based care settings. (Fig. **1**).

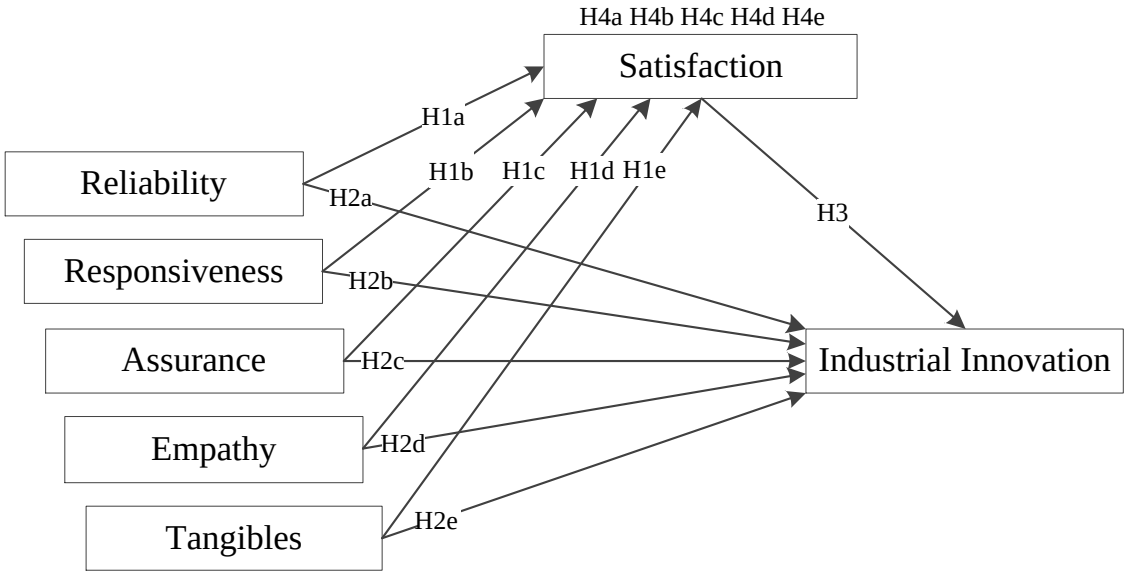

Fig. (1). Research model.

3. RESEARCH METHODOLOGY

3.1. Paradigm and Research Method

Various methods have been employed in studies on community-based elderly care satisfaction, such as the Analytic Hierarchy Process combined with ISM [33], multivariate analysis of variance, principal component analysis [34], regression analysis, and structural equation modeling (SEM), Among these, SEM and regression analysis are the more common. SEM, which integrates regression analysis, path analysis, and factor analysis, is a suitable tool for analyzing complex multivariable relationships and latent constructs.

SEM is a tool based on the covariance matrix of variables, using observed relationships between variables to explore the connections between latent, unobservable variables [35]. This study adopts SEM to examine the relationships between service quality, satisfaction, and innovation development within the context of community-based elderly care. Focusing on community-based care, the study utilizes a survey and statistical analysis to reveal the impact of service quality on satisfaction and innovation development. Drawing on previous research, this study builds a comprehensive theoretical framework based on the PZB model, analyzing the five dimensions of service quality, satisfaction, and innovation development within the context of Shanghai's community-based elderly care industry, thereby providing practical feasibility and guidance for industry application. While SEM offers robust statistical capabilities, it has also limitations in addressing causality, as this study uses cross-sectional data, which constrains its ability to establish causal relationships between service quality, satisfaction, and innovation.

3.2. Research Design

The research focuses on elderly residents in community-based elderly care in Shanghai and their adult children. The study uses an offline questionnaire for data collection, allowing for a thorough examination of community-based care dynamics. However, one limitation is the geographic focus on Shanghai, which may not fully represent the diversity of elderly care needs across China, particularly in rural areas. Rural regions may have distinct service quality perceptions and needs, which could limit the generalizability of the findings.

An analysis of the questionnaire responses provided a statistical overview of sample characteristics. The total sample consisted of 622 individuals, with females making up the majority at 431 participants (69.29%) and males at 191 participants (30.71%). As the study's questions and hypotheses did not involve gender differences, we performed a hypothesis test and found no significant differences between male and female respondents. Thus, the data from both genders were combined for analysis. Regarding age, the study focused primarily on elderly individuals aged 65 and above and their adult children; those aged 65 and above accounted for the vast majority at 70.23%, while those aged 60-64 made up 29.77%.

In terms of educational background, most respondents had a high school education or below, accounting for 57.11%, while the remaining 42.89% had an associate degree or higher. For marital status, the highest proportion was widowed, with 297 respondents (47.75%); married respondents were 211 (33.92%); divorced respondents were 71 (11.41%); and single respondents were the fewest at 43 (6.91%), indicating that widowed elderly individuals have a more urgent need for community-based elderly care services, making them a key focus group.

Among the surveyed groups, elderly individuals constituted 57.23% of the total sample (356, and their children made up 42.77% (266). By covering both elderly individuals and their adult children, this study captures a more comprehensive understanding of the acceptance and need for community-based elderly care services among both groups, providing more reliable data to support innovation in the elderly care industry.

It is important to note that the focus on elderly residents in Shanghai limits the generalizability of the findings. The diversity of elderly care needs, particularly in rural areas, may differ significantly from those in urban centers like Shanghai. Rural populations might have different expectations of service quality, technological adoption, and care innovation, which are not fully represented in this study. Future studies should expand the sample to include rural areas and other regions to enhance the external validity of the findings.

3.3. Measurement

This study involves three variables: service quality, satisfaction, and innovation development. To ensure the validity of the scales, previous research was referenced and adapted to fit the context of community-based elderly care in this study. Details of the specific scale design are shown in Table **1**. For service quality, we referred to the PZB scale, which includes five dimensions—reliability, responsiveness, assurance, empathy, and tangibles—across 22 items. Data analysis revealed that service quality is suitable for a second-order model, so each dimension (reliability, responsiveness, assurance, empathy, tangibles) is discussed separately.

Table 1. Common method bias test model fit indices.

Model	χ^2/df	GFI	AGFI	RMSEA	SRMR
Model without common method bias	2.511	.936	.906	.063	.044
A model with common method bias	2.515	.937	.908	.061	.042

The satisfaction scale was based on the community elderly care supply-demand satisfaction scale developed by Chinese scholars Rong *et al*. [5], comprising three items. The five items for elderly care industry innovation, as an independent construct, were directly drawn from measurement content discussed by den Hertog [36] and Janssen *et al*. [37]: perceived user needs and (technical) options, conceptualization, co-production and coordination, scaling and expansion, and learning and adaptation. These items, developed by den Hertog [36], support community elderly care service organizations in systematically reflecting on and managing new services, especially aspects related to technical capabilities and innovative business models.

All respondents were asked to express their level of agreement or disagreement on a 5-point Likert scale, where 1 represented “strongly disagree” and 5 represented “strongly agree.” Before the official distribution of the questionnaire, three doctoral students and two experts in the management field reviewed the preliminary questionnaire to ensure that the items were reasonable and scientifically sound.

4. RESULTS

4.1. Common-method Bias

To assess the potential for common-method bias, this study conducted Harman’s single-factor test, performing the principal component analysis (PCA) on the measurement data for the seven constructs: reliability, responsiveness, assurance, empathy, tangibles, satisfaction, and industry innovation. The results revealed seven factors with eigenvalues greater than 1, explaining a cumulative variance of 69.558%, with the first factor accounting for 22.403%. This indicates that common-method bias is unlikely to affect the data [38] significantly. Additionally, the Unmeasured Latent Method Construct (ULMC) approach was employed (Table **1**), with no improvement in model fit when the common-method bias latent variable was added, further confirming that common-method bias does not significantly impact the findings [39].

4.2. Analysis of the Measurement Model

Confirmatory factor analysis (CFA) was conducted to assess the reliability and validity of the scales using AMOS and Cronbach's α *via* SPSS. As shown in Table **2**, all standardized factor loadings for the observed variables exceeded the 0.7 threshold, indicating strong correlations with their respective latent variable. The composite Reliability (CR) and Average Variance Extracted (AVE) values exceeded the acceptable thresholds, ensuring the reliability and validity of the measurement model. The Cronbach’s α values were also above 0.7 for all constructs, confirming the model’s reliability [40, 41].

Table 2. Confirm factor analysis.

Factor	λ	CR	AVE	α
Reliability (REL)	-	.90	.65	.90
REL1. The community elderly care service can provide care services within the promised time.	.88	-	-	-
REL2. When an elderly person encounters a problem, community care staff can offer sincere concern and timely assistance.	.69	-	-	-
REL3. The community elderly care service consistently provides reliable services.	.82	-	-	-
REL4. Community elderly care staff exhibit attention to detail and accuracy in their services.	.86	-	-	-
REL5. The community care center can properly record and maintain service files for the elderly.	.75	-	-	-
Responsiveness (RES)	-	.82	.54	082
RES1. The community elderly care service can respond promptly to the needs of elderly people.	.71	-	-	-
RES2. Community elderly care staff are always ready to assist the elderly and their families.	.76	-	-	-
RES3. The community elderly care service can quickly handle urgent needs of the elderly and their family members.	.70	-	-	-
RES4. Community elderly care staff are always willing to provide assistance and support.	.77	-	-	-
Assurance (A)	-	.88	.65	.88
A1. The behavior of community elderly care staff instills trust and reassurance in elderly people and their families.	.89	-	-	-
A2. Elderly people and their families feel confident in the professional knowledge and skills of the community care staff.	.83	-	-	-
A3. Community elderly care staff show respect and politeness toward elderly people and their families.	.77	-	-	-
A4. Community elderly care staff can accurately answer questions from the elderly and their families.	.70	-	-	-
Empathy (E)	-	.90	.64	.90
E1. Community elderly care staff can give sufficient attention and care to the elderly.	.71	-	-	-
E2. Community elderly care staff demonstrate personal concern for the elderly and their family members.	.88	-	-	-
E3. The community care service can understand and respect the unique needs of elderly people and their families.	.83	-	-	-
E4. The community care service schedule is reasonable, considering the elderly’s daily routines and the convenience of their families.	.82	-	-	-
E5. Community care staff prioritize the interests and needs of elderly people and their families.	.74	-	-	-
Tangibles (T)	-	.88	.65	.88
T1. Community elderly care facilities are modernized and meet the daily needs of elderly residents.	.87	-	-	-
T2. The community care center facilities are tidy and cozy, creating a comfortable living environment.	.72	-	-	-
T3. Community elderly care staff maintain a neat appearance, leaving a good impression on the elderly and their families.	.87	-	-	-

(Table 2) contd.....

Factor	λ	CR	AVE	α
T4. The promotional materials and information provided by the community care center are clear and easy to understand.	.75	-	-	-
Satisfaction (S)	-	.84	.65	.84
S1: My overall satisfaction with current community-based senior care services is high.	.77	-	-	-
S2: Compared to what I expected, my overall satisfaction with current community-based senior care services is high.	.85	-	-	-
S3: Compared to my ideal level, my overall satisfaction with current community-based senior care services is high.	.79	-	-	-
Industrial Innovation (II)	-	.91	.66	.90
II1: Keeping up with promising innovative care services and technologies is very important for the care experience of elderly people.	.77	-	-	-
II2: Care services integrated with current business and processes can meet the needs of elderly people.	.88	-	-	-
II3: Collaboration with other partners helps improve or introduce new care services.	.73	-	-	-
II4: The care facility is able to implement successful innovative care services throughout the entire facility.	.88	-	-	-
II5: The care facility actively learns and adapts innovative strategies to enhance service quality.	.79	-	-	-

Table 3. Correlations between constructs.

Variable	REL	RES	A	E	T	S	II
REL	**.80**	-	-	-	-	-	-
RES	.62**	**.74**	-	-	-	-	-
A	.58**	.66**	**.80**	-	-	-	-
E	.54**	.60**	.57**	**.80**	-	-	-
T	.50**	.44**	.63**	.59**	**.81**	-	-
S	.42**	.55**	.33**	.40**	.24**	**.80**	-
II	.39**	.40**	.28**	.42**	.37**	.51**	**.81**
X	3.71	3.65	3.67	3.67	40.4	3.92	3.73
SD	.75	.84	.61	.64	.75	.67	.65

Note: $^{**}p<0.01$.

For discriminant validity, the square root of the Average Variance Extracted (AVE) for each variable exceeded the correlation coefficients with other constructs, further supporting discriminant validity [40] as shown in Table **3**.

4.3. Structural Model

The Structural Equation Modeling (SEM) analysis was conducted using AMOS 26.0, with a maximum likelihood estimation method. The model fit indicated a good fit: $X^2/df=2.511<3$, GFI = 0.936 > 0.9, AGFI = 0.905 > 0.9, NFI = 0.939 > 0.9, CFI = 0.965 > 0.9, and RMSEA = 0.063 < 0.08, indicating a good fit [41].

Reliability (β = 0.42, p < 0.001), supporting H1a. Reliability is critical because elderly individuals and their families need to trust that the services they receive will be timely, consistent, and accurate. Reliable service builds trust, which directly impacts satisfaction. If a senior care facility consistently provides planned check-ups, medications, and meals on time every time, the older residents and their families will feel confident in the service, leading to better satisfaction levels..

Responsiveness (β = 0.35, p < 0.001), supporting H1b. Responsiveness in elderly care involves the ability to react promptly and effectively to the needs and concerns of elderly residents. When care providers are responsive, elderly individuals feel valued, which leads to greater satisfaction with the service. If an elderly resident needs assistance adjusting a medical device and the staff responds immediately, this responsiveness will be highly appreciated, leading to greater overall satisfaction.

Assurance (β = 0.28, p < 0.01), supporting H1c. Assurance refers to the confidence that care providers instill in elderly residents and their families through their professionalism, competence, and trustworthiness. For instance, a caregiver providing clear, confident communication about a resident's health status can significantly enhance the family's satisfaction.

Empathy (β = 0.33, p < 0.001), supporting H1d. When care providers show empathy, residents feel more cared for and valued, leading to increased satisfaction with the service. A caregiver might spend extra time with a resident who is feeling isolated, engaging in conversation, or offering reassurance, which can greatly enhance overall satisfaction.

Tangibles (β = 0.09, p > 0.05), not supporting H1e: While tangibles can contribute to satisfaction in some service sectors, their impact may be less significant in elderly care, where interpersonal factors like reliability and empathy are more critical to overall satisfaction. Resident may prioritize the quality of care they receive (*e.g.*, timely assistance, friendly interaction) over the aesthetics of the room they stay in. This suggests that tangibles, though relevant, may not have the same weight as other service quality dimensions in determining satisfaction.

Reliability (β = 0.37, p < 0.001), supporting H2a. A reliable service provides a strong foundation for continuous improvement and innovation because

consistent service delivery allows for the identification of areas in need of improvement or technological advancements. For instance, a reliable service might identify the need for smart home technologies to monitor elderly residents' health remotely, which could lead to the development of new innovative solutions.

Responsiveness (β = 0.41, p < 0.001), supporting H2b. Care providers who are responsive to both residents' needs and industry trends are more likely to implement innovative solutions that improve care quality. If a care facility quickly responds to a rise in demand for dementia care by developing specialized programs or introducing new treatments, this responsiveness can lead to innovations that enhance care services. For example, after noticing an increase in elderly residents with cognitive impairments, the facility might introduce virtual reality therapies, representing an innovative response to this growing need.

Empathy (β = 0.39, p < 0.001), supporting H2d. Empathy helps care providers understand the emotional and personal needs of residents, which can inspire innovative approaches to service delivery. By listening to residents' concerns and experiences, caregivers can identify new ways to improve care. A caregiver who empathizes with a resident's feelings of isolation may suggest implementing social programs or technology solutions, such as virtual social networks, to combat loneliness. This empathy-driven innovation can lead to new approaches in elderly care that enhance residents' well-being.

Tangibles (β = 0.30, p < 0.01), supporting H2e. The physical aspects of care facilities, such as well-maintained buildings and updated equipment, play a role in fostering innovation. A modern, well-equipped care facility may introduce cutting-edge assistive technologies, such as robotic caregivers or automated health-monitoring systems, as part of its innovation efforts.

Satisfaction (β = 0.47, p < 0.001), supporting H3. Satisfied residents and their families are more likely to advocate for and support the implementation of innovative practices in care services. Satisfaction acts as a feedback mechanism that encourages service providers to innovate to meet and exceed expectations continuously (Fig. **2**).

According to the recommendations by Fritz and MacKinnon [42], a sample size of 558 is required for the percentile bootstrap method and 462 for the bias-corrected bootstrap method when testing for mediation effects. With 622 valid questionnaires, this study can use the bootstrap method to test for mediation effects. Based on the bootstrap calculation results, the path from Reliability to Industrial Innovation through Satisfaction is significant (β = 0.20, p < 0.001, CI = [0.05, 0.20]), supporting H4a. The path from Responsiveness to Industrial Innovation through Satisfaction is also significant (β = 0.16, p < 0.01, CI = [0.03, 0.14]), supporting H4b. The path from Assurance to Industrial Innovation through Satisfaction is significant (β = 0.13, p < 0.01, CI = [0.01, 0.09]), supporting H4c. The path from Empathy to Industrial Innovation through Satisfaction is significant (β = 0.15, p < 0.01, CI = [0.03, 0.11]), supporting H4d. However, the path from Tangibles to Industrial Innovation through Satisfaction is not significant (β = 0.04, p > 0.05, CI = [-0.04, 0.07]), so H4e is not supported.

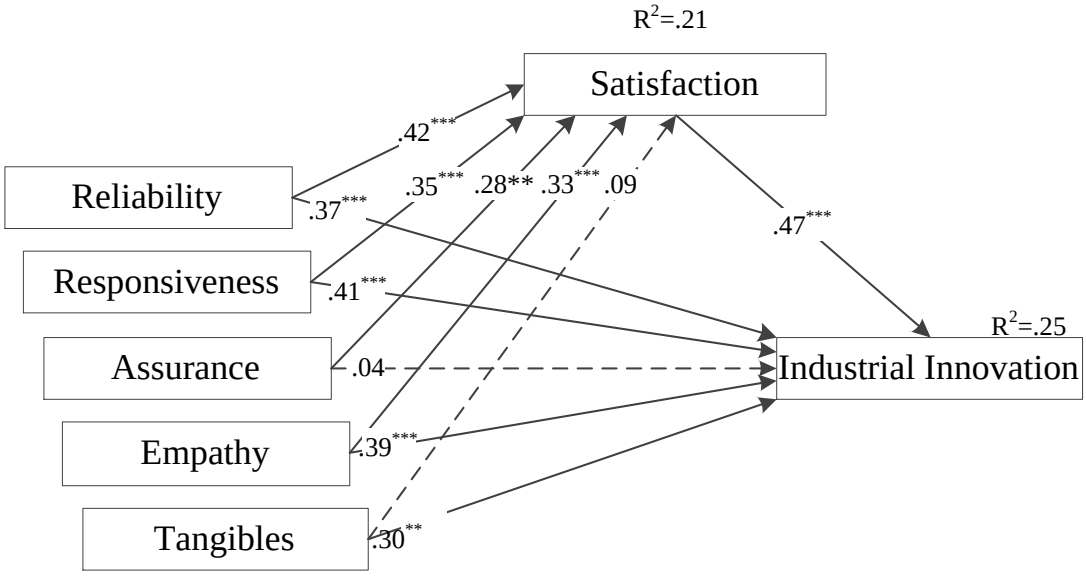

Fig. (2). Results of the structural model.
Note: *p<0.05, **p<0.01, ***p<0.001.

5. DISCUSSION

The study confirms that the timeliness and accuracy of services, underpinned by reliability, significantly enhance elderly satisfaction, aligning with previous research by Shan *et al*. [7], which highlights reliability as a critical factor in improving quality of life and security among elderly individuals. In Shanghai, where urban living conditions and service expectations are higher, consistent and reliable services are crucial. For instance, ensuring prompt and accurate emergency medical responses can substantially contribute to a sense of safety and trust, forming the backbone of a positive care experience. The study also finds that responsiveness is a key driver of satisfaction, particularly in fast-paced urban environments like Shanghai, where elderly individuals have heightened expectations for quick action. This is consistent with Hu *et al*. [17], who emphasize the importance of responsive care, especially during emergencies.

An example would be the swift response of care staff to a fall or sudden illness, where an immediate, professional reaction alleviates the crisis and builds trust, thus increasing satisfaction. Furthermore, assurance—reflecting the professionalism and competence of staff—positively impacts satisfaction, consistent with Ye [8]. However, its effect is somewhat less pronounced than responsiveness and empathy, possibly due to the high expectations for swift professional care in major cities. While elderly residents in Shanghai value professional competence, they may prioritize the speed and immediacy of care over qualifications. Empathy also plays a critical role in enhancing satisfaction, in line with Wei *et al*. [18], as it fosters emotional connections and increases feelings of belonging. Personalized care that acknowledges the unique needs of elderly individuals can significantly boost satisfaction, as demonstrated by Sandholdt *et al*. [22], who suggest empathy fosters customer loyalty. For example, a caregiver's simple act of engaging with an elderly resident feeling lonely can significantly enhance their sense of satisfaction. However, the study also finds that elderly individuals in Shanghai show relatively low concern for the physical environment (tangibles), suggesting that emotional and psychological needs take precedence over the physical conditions of the care setting. This finding contrasts with other industries, where tangibles (such as facility quality) are often emphasized, but in elderly care, emotional connections, and personal service matter more.

The study highlights the significant role of service quality in driving innovation within the elderly care sector. High-quality service forms a stable foundation for innovation, supporting new technologies and care models. Consistent service reliability, as pointed out by Zhang *et al*. [6], creates a solid platform for introducing innovations like remote health monitoring or AI-driven care solutions. In this regard, responsiveness not only influences satisfaction but also plays a pivotal role in fostering innovation, particularly in the development of smart elderly care technologies. This finding supports Flessa and Huebner [20], who emphasize that responsiveness to emerging needs drives the adoption of new technologies. For example, quick adaptation to the rising demand for digital health tools can spur the development of telemedicine services, offering remote consultations, medication management, and health monitoring for elderly residents.

In contrast, the study finds that assurance does not significantly influence innovation, which may be attributed to the already high trust levels in Shanghai's elderly care sector. Once a certain level of trust is established, further improvements in professional competence may not drive innovation as much as responsiveness does. Empathy, on the other hand, proves to be a key driver of innovation by promoting personalized care models. Care providers who empathize with the specific challenges faced by elderly individuals can stimulate the development of innovative services tailored to those needs, such as memory care programs for Alzheimer's patients or personalized rehabilitation services. Lastly, tangibles—while contributing to innovation—have a more limited impact compared to other dimensions. The physical infrastructure of care facilities, such as assistive devices or smart home technologies, may encourage the adoption of new solutions. Still, these innovations are less influential than the relational aspects of service quality. For instance, a facility equipped with smart home technologies might serve as a testing ground for the development of new devices designed to enhance the elderly care experience. Yet, this aspect remains secondary to the emotional and relational components of care.

A key contribution of this study is its exploration of elderly satisfaction as a mediator between service quality and innovation. The results support findings from Cui *et al*. [24], who suggest that satisfaction is a key driver of innovation in community-based elderly care models. Satisfied elderly residents are more likely to embrace new care models, such as smart elderly care and telemedicine, which in turn drives further innovation in the industry. Ko and Chou [25] argue that improved satisfaction can amplify word-of-mouth effects, leading to greater demand for innovative care solutions. This study aligns with that perspective, showing that satisfaction not only directly impacts innovation but also promotes market demand, influencing both the development of new services and the flow of funding into the sector. While this study underscores the importance of service quality in enhancing elderly satisfaction and driving innovation, it also highlights several avenues for further exploration. The relationship between family dynamics and satisfaction, for example, is an area that could benefit from the deeper investigation, particularly in how family involvement affects perceptions of care quality.

Additionally, the practical challenges in implementing innovations, such as cost, accessibility, and digital literacy, should be considered. Policymakers and practitioners should focus on addressing these barriers to ensure that the elderly can fully benefit from innovative care solutions. Finally, the study's findings could serve as a foundation for developing more targeted strategies that balance the need for high-quality service with the drive for technological advancements in the elderly care sector.

CONCLUSION

This research, focusing on community-based elderly care in Shanghai, China, explores the complex relationships between service quality, elderly satisfaction, and innovation within the elderly care industry. The study reveals that service dimensions such as reliability, responsiveness, assurance, and empathy significantly enhance elderly satisfaction, while tangible factors (physical aspects of the care environment) play a relatively minor role. Moreover, elderly satisfaction is identified as a key mediator between service quality and innovation in the industry, demonstrating that enhancing satisfaction not only improves service quality but also acts as a catalyst for driving innovation. This finding underscores the importance of a holistic approach to service design, where both the emotional and practical needs of elderly individuals are addressed, thus fostering a culture of continuous improvement and technological advancement.

Despite the promising implications of the study, several challenges persist. For example, there are issues of uneven service coverage and professional skill gaps within the elderly care sector. To address these, the integration of smart technologies and AI-driven solutions could provide more precise and personalized care, enabling more efficient resource allocation and reducing disparities in service quality. Additionally, while the findings offer valuable insights to Shanghai, they may have limited generalizability to other regions with different demographic and cultural contexts. Future research could explore the application of these insights in a broader range of urban and rural settings, taking into account local variations in elderly care needs, family dynamics, and infrastructure capabilities.

Furthermore, the innovation process in elderly care could benefit from a more detailed examination of how service quality improvements translate into specific technological or service model innovations. For example, the development of smart home systems, remote health monitoring, and telemedicine services could be explored as concrete examples of how elderly satisfaction and responsiveness to care needs drive innovation in the sector. Policymakers and service providers could use these findings to inform their strategies for integrating technology into elderly care, ensuring that innovation aligns with the real needs of elderly individuals.

In summary, this study offers valuable contributions to understanding the drivers of elderly satisfaction and innovation in community-based care. By addressing the identified challenges—such as skill gaps and uneven service coverage—and further exploring the integration of technology and innovation, the research lays the groundwork for optimizing elderly care models not only in China but also in other aging societies globally. These insights provide a roadmap for enhancing care quality, increasing satisfaction, and fostering the innovation necessary to meet the growing demands of an aging population.

RESEARCH SHORTCOMINGS AND FUTURE RESEARCH SUGGESTIONS

The study relies on self-reported data from elderly residents and their families, which may introduce response bias. Respondents may overstate their satisfaction due to social desirability, or they may underreport dissatisfaction out of fear of repercussions or concerns about service provision. While the study attempted to mitigate this bias by using multiple sources (elderly individuals and their adult children), the subjective nature of self-reported data means that the findings should be interpreted with caution. To address this, future research could include objective measures of service quality and satisfaction, such as third-party evaluations or observational data.

The use of cross-sectional data limits the ability to draw conclusions about causal relationships between service quality, satisfaction, and innovation. While SEM can identify correlations and paths between variables, it cannot establish directionality or causality without longitudinal data. Future studies should consider collecting data over time to explore how changes in service quality affect satisfaction and innovation and whether innovations in care services lead to long-term improvements in elderly care outcomes.

AUTHORS' CONTRIBUTION

G.F.: Study conception and design; G.F.: Data collection; Q.L.: Analysis and interpretation of results; G.F.: Draft manuscript.

All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

REL	=	Reliability
RES	=	Responsiveness
A	=	Assurance
E	=	Empathy
T	=	Tangibles
S	=	Satisfaction
II	=	Industrial Innovation

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study has been approved by the Ethics Council of Krirk University, Iran, with the code of ethics (IC. KRIRK. IRB. No. 2563-07-009).

HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from the participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available from the corresponding author [G.F] upon reasonable request.

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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REFERENCES

[1] Zhu Y. Quantitative Analysis on the Eldercare Labor Demand in China. Eldercare Labor Demand in China and Coping Strategies. Singapore: Springer Nature Singapore 2024; pp. 79-112. http://dx.doi.org/10.1007/978-981-97-5153-2_5

[2] Xu S, Zhang T, Fukuda H, He J, Bao X. Comprehensive study of residential environment preferences and characteristics among older adults: Empirical evidence from China. Buildings 2024; 14(7): 2175. http://dx.doi.org/10.3390/buildings14072175

[3] Feng Z, Glinskaya E, Chen H, *et al*. Long-term care system for older adults in China: policy landscape, challenges, and future prospects. Lancet 2020; 396(10259): 1362-72. http://dx.doi.org/10.1016/S0140-6736(20)32136-X PMID: 34338215

[4] Fang EF, Xie C, Schenkel JA, *et al*. A research agenda for ageing in China in the 21st century (2nd edition): Focusing on basic and translational research, long-term care, policy and social networks. Ageing Res Rev 2020; 64: 101174. http://dx.doi.org/10.1016/j.arr.2020.101174 PMID: 32971255

[5] Rong X, Zhou Z, Su Y. Factors affecting the job satisfaction of caregivers in a home-based elderly care program. Int J Environ Res Publ Heal 2022; 19(15): 9332. http://dx.doi.org/10.3390/ijerph19159332 PMID: 35954687

[6] Zhang Q, Li M, Wu Y. Smart home for elderly care: development and challenges in China. BMC Geriatr 2020; 20(1): 318. http://dx.doi.org/10.1186/s12877-020-01737-y PMID: 32883224

[7] Shan S, Sun Z, Zhang F, Zhang R, Yang B. Have elderly individuals in urban China been satisfied with nursing services during the COVID-19 pandemic? Int J Environ Res Publ Heal 2021; 18(20): 10624. http://dx.doi.org/10.3390/ijerph182010624 PMID: 34682371

[8] Ye J. Research on the Quality Enhancement of Community Home-Based Elderly Care Services: Dimensional Differences and Realistic Approaches Proceedings of the 2023 8th International Conference on Modern Management and Education Technology (MMET 2023). Atlantis Press, 29 Nov 2023, pp. 66-78. http://dx.doi.org/10.2991/978-2-38476-146-3_10

[9] Zhou X, Cao K. Spatial multi-objective optimization of institutional elderly-care facilities: A case study in Shanghai. Int J Appl Earth Obs Geoinf 2023; 122: 103436. http://dx.doi.org/10.1016/j.jag.2023.103436

[10] Yang S, Liu L, Wang C, Lo K, Wang D. Elderly people's preferences for healthcare facilities in Shanghai: gender features and influencing factor analysis. BMC Publ Heal 2023; 23(1): 356. http://dx.doi.org/10.1186/s12889-023-15279-6 PMID: 36800949

[11] Huang X, Gong P, White M. Study on spatial distribution equilibrium of elderly care facilities in downtown Shanghai. Int J Environ Res Publ Heal 2022; 19(13): 7929. http://dx.doi.org/10.3390/ijerph19137929 PMID: 35805586

[12] Chen L, Han WJ. Shanghai: Front-runner of community-based eldercare in China. J Aging Soc Policy 2016; 28(4): 292-307. http://dx.doi.org/10.1080/08959420.2016.1151310 PMID: 26909666

[13] Chen L, Ye M, Chen L, Ye M. The development of community eldercare in Shanghai. Commun Elderca Ecol China 2020; 6: 55-83. http://dx.doi.org/10.1007/978-981-15-4960-1_3 PMID: 37312870

[14] Parasuraman A, Zeithaml VA, Berry LL. SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. J Retail 1988; 64(1): 12-40.

[15] Shie AJ, Wu WF, Yang M, Wan X, Li H. Design and process optimization of combined medical and elderly care services: An integrated service blueprint–TRIZ model. Front Publ Heal 2022; 10: 965443. http://dx.doi.org/10.3389/fpubh.2022.965443 PMID: 36311585

[16] Kalideen L, Govender P, van Wyk JM. Standards and quality of care for older persons in long term care facilities: a scoping review. BMC Geriatr 2022; 22(1): 226. http://dx.doi.org/10.1186/s12877-022-02892-0 PMID: 35303830

[17] Hu W, Qutayan SMSB, Othman MDDNB. Influence of digital health technologies among healthcare providers on long-term care services implementation for elderly with disabilities. J Ecohuman 2024; 3(6): 1412-21. http://dx.doi.org/10.62754/joe.v3i6.4119

[18] Wei SP, Shih SC, Lin SC, Liu CJ, Lu YW, Chang WL. Primary caregivers satisfaction and its related factors in home health care services. Int J Gerontol 2011; 5(2): 107-11. http://dx.doi.org/10.1016/j.ijge.2011.05.001

[19] Deng H, Zhang J. An Empirical Research on Evaluation of Service Quality of Nursing Homes in Tianjin. Proceedings of the 2018 2nd International Conference on Education, Economics and Management Research (ICEEMR 2018). Atlantis Press, 06 June 2018, pp. 19-25. http://dx.doi.org/10.2991/iceemr-18.2018.5

[20] Flessa S, Huebner C. Innovations in health care: A conceptual framework. Int J Environ Res Publ Heal 2021; 18(19): 10026. http://dx.doi.org/10.3390/ijerph181910026 PMID: 34639328

[21] Rubeis G. The disruptive power of Artificial Intelligence. Ethical aspects of gerontechnology in elderly care. Arch Gerontol Geriatr 2020; 91: 104186. http://dx.doi.org/10.1016/j.archger.2020.104186 PMID: 32688106

[22] Sandholdt CT, Cunningham J, Westendorp RGJ, Kristiansen M. Towards inclusive healthcare delivery: Potentials and challenges of human-centred design in health innovation processes to increase healthy aging. Int J Environ Res Publ Heal 2020; 17(12): 4551. http://dx.doi.org/10.3390/ijerph17124551 PMID: 32599806

[23] Arun Sampaul Thomas G, Harold Robinson Y. Real-Time Health System (RTHS) Centered Internet of Things (IoT) in Healthcare Industry: Benefits, Use Cases and Advancements in 2020. Multimedia Technologies in the Internet of Things Environment. Singapore: Springer 2021; pp. 83-93. http://dx.doi.org/10.1007/978-981-15-7965-3_6

[24] Cui F, Ma L, Hou G, Pang Z, Hou Y, Li L. Development of smart nursing homes using systems engineering methodologies in industry 4.0. Enterprise Inf Syst 2020; 14(4): 463-79. http://dx.doi.org/10.1080/17517575.2018.1536929

[25] Ko CH, Chou CM. Apply the SERVQUAL instrument to measure service quality for the adaptation of ICT technologies: A case study of nursing homes in Taiwan. Healthcare 2020; 8(2): 108.

http://dx.doi.org/10.3390/healthcare8020108
[26] Bunn F, Goodman C, Corazzini K, *et al*. Setting priorities to inform assessment of care homes' readiness to participate in healthcare innovation: A systematic mapping review and consensus process. Int J Environ Res Publ Heal 2020; 17(3): 987. http://dx.doi.org/10.3390/ijerph17030987 PMID: 32033293
[27] Melkas H, Hennala L, Pekkarinen S, Kyrki V. Impacts of robot implementation on care personnel and clients in elderly-care institutions. Int J Med Inform 2020; 134: 104041. http://dx.doi.org/10.1016/j.ijmedinf.2019.104041 PMID: 31838291
[28] Hamiduzzaman M, Kuot A, Greenhill J, Strivens E, Isaac V. Towards personalized care: Factors associated with the quality of life of residents with dementia in Australian rural aged care homes. PLoS One 2020; 15(5): e0233450. http://dx.doi.org/10.1371/journal.pone.0233450 PMID: 32437455
[29] Padikkapparambil J, Ncube C, Singh KK, Singh A. Internet of Things technologies for elderly health-care applications. Emergence of pharmaceutical industry growth with industrial IoT approach. New York: Academic Press 2020; pp. 217-43. http://dx.doi.org/10.1016/B978-0-12-819593-2.00008-X
[30] Moldovan F, Blaga P, Moldovan L, Bataga T. An innovative framework for sustainable development in healthcare: The human rights assessment. Int J Environ Res Publ Heal 2022; 19(4): 2222. http://dx.doi.org/10.3390/ijerph19042222 PMID: 35206410
[31] Łukasik S, Tobis S, Kropińska S, Suwalska A. Role of assistive robots in the care of older people: Survey study among medical and nursing students. J Med Internet Res 2020; 22(8): e18003. http://dx.doi.org/10.2196/18003 PMID: 32784187
[32] Oliver RL. A cognitive model of the antecedents and consequences of satisfaction decisions. J Mark Res 1980; 17(4): 460-9. http://dx.doi.org/10.1177/002224378001700405
[33] Sheykhangafshe F. Predicting psychological needs of elderly based on psychological and social wellbeing. Proceedings of the First National Social Health Conference with Disabled and Elderly Approach. London, UK, Oct 2017, pp. 1-6.
[34] Honarvar B, Gheibi Z, Asadollahi A, *et al*. The impact of abuse on the quality of life of the elderly: A population-based survey in Iran. J Prev Med Publ Heal 2020; 53(2): 89-97. http://dx.doi.org/10.3961/jpmph.19.210 PMID: 32268463
[35] Tabri N, Elliott CM. Principles and practice of structural equation modeling. Canad Gradu J Sociol Criminol 2012; 1(1): 59-60. http://dx.doi.org/10.15353/cgjsc.v1i1.3787
[36] Den Hertog P. Managing service innovation: firm-level dynamic capabilities and policy options. Utrecht: Dialogic Innovatie & Interactie 2010; p. 46.
[37] Janssen MJ, Castaldi C, Alexiev A. Dynamic capabilities for service innovation: conceptualization and measurement. R & D Manag 2016; 46(4): 797-811. http://dx.doi.org/10.1111/radm.12147
[38] Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP. Common method biases in behavioral research: A critical review of the literature and recommended remedies. J Appl Psychol 2003; 88(5): 879-903. http://dx.doi.org/10.1037/0021-9010.88.5.879 PMID: 14516251
[39] Belschak F, Verbeke W, Bagozzi RP. Coping with sales call anxiety: The role of sale perseverance and task concentration strategies. J Acad Mark Sci 2006; 34(3): 403-18. http://dx.doi.org/10.1177/0092070306286535
[40] Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. J Mark Res 1981; 18(1): 39-50. http://dx.doi.org/10.1177/002224378101800104
[41] Hair JF, Risher JJ, Sarstedt M, Ringle CM. When to use and how to report the results of PLS-SEM. Eur Bus Rev 2019; 31(1): 2-24. http://dx.doi.org/10.1108/EBR-11-2018-0203
[42] Fritz MS, MacKinnon DP. Required sample size to detect the mediated effect. Psychol Sci 2007; 18(3): 233-9. http://dx.doi.org/10.1111/j.1467-9280.2007.01882.x PMID: 17444920