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A Study on the Key Factors Affecting the Adoption of Innovative Medical Devices in Healthcare Institutions

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Abstract

This study examines the elements influencing the willingness of medical institutions to adopt innovative medical devices, and the role brand image plays as a mediator in this dynamic. We collected online and email survey data from 230 sample groups in March 2023, working at the medical institutions' purchasing departments in metropolitan cities in the Republic of Korea. First, the purchase decision factors of innovative medical devices, such as performance, warranty service, safety, and technological innovation, significantly positively impacted brand image. Second, the brand image of innovative medical devices showed a marked positive influence on the intention to adopt them. Third, performance, warranty service, safety, and technological innovation positively impacted the adoption intention. Fourth, performance, warranty service, safety, and technological innovation are mediated by brand image to affect adoption intention. This study provides useful information for the field of innovative medical devices.

요 약

본 연구는 의료기관의 혁신의료기기 채택의도에 영향을 미치는 요인을 규명한다. 본 연구는 의료기관의 구매부서에 근무하는 230명의 표본집단을 대상으로 2023년 3월에 온라인과 이메일 설문조사 자료를 수집하였다. 연구 결과는 다음과 같다. 첫째, 혁신의료기기의 구매결정요인인 성능, 보증 서비스, 안전성, 기술적 혁신성은 브랜드 이미지에 유의한 정의 영향을 미쳤다. 둘째, 혁신의료기기의 브랜드 이미지는 채택의도에 유의한 정의 영향을 미쳤다. 셋째, 성능, 보증 서비스, 안전성, 기술 혁신성은 채택의도에 정의 영향을 미쳤다. 넷째, 브랜드 이미지는 성능, 보증서비스, 안전성, 기술혁신성과 채택의도 간의 관계에 유의한 매개 효과를 보였다. 본 연구는 혁신의료기기 분야에 유용한 정보를 제공할 것이다.

Keywords

purchase decision factor; innovative medical devices; adoption intention; brand image

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Ⅰ. Introduction

Essentially, every person wishes to be healthy and enjoy a good quality of life over a prolonged period. To this end, people take actions to prevent, treat, and manage diseases, and these activities are collectively referred to as "healthcare"[1]. Healthcare is at the heart of the current social change. The industry is shifting from a reactive approach to predictive and preventive medicine, providing personalized medicine tailored to individual characteristics and participatory medicine in which patients play an active, participatory role[2]-[4]. The main factors determining such changes are social demand and advancements in science and technology, as information and communication technology-based medical technology is the new paradigm shift with the introduction of big data and artificial intelligence(AI)[5]-[7]. With the medical and healthcare services industry shifting to providing digital solutions, the concept of digital healthcare or smart healthcare has emerged, and biotechnology has been integrated with information and communication technology to mass-produce various digital healthcare products and innovative medical devices[8]-[10].

Innovative medical devices represent a leap forward in healthcare through their potential or realized significant improvements in safety and effectiveness over current treatments or devices[11]-[13]. These advancements are primarily due to integrating advanced technologies like information and communication technology(ICT), biotechnology, and robotics[14][15]. For example, wearable sensors that monitor chronic conditions in real-time, leveraging ICT for data analysis and transmission[16], biotech innovations like lab-on-a-chip devices for rapid diagnostics[17], and robotic surgical assistants that enhance precision in operations illustrate this new wave of innovation[18]. The rationale for the growing interest and intention to adopt these innovative medical devices lies in their potential to offer more personalized, efficient, and less invasive treatment options, ultimately aiming to improve patient outcomes and reduce healthcare costs. By harnessing these technologies, healthcare providers can offer cutting-edge solutions that improve the quality of care and potentially revolutionize patient treatment paradigms.

AI in medicine(medical AI) represents innovative medicine, including machine learning algorithms to process medical data, detect distinct patterns for diagnosing and forecasting diseases, and suggest optimal treatment methods for patients[19]-[21]. Representative applications of this technology include diagnostic imaging devices like computed tomography(CT) and magnetic resonance imaging(MRI) scanners; they learn vast amounts of medical image data using AI-based deep learning technology to recognize specific patterns that improve the accuracy of physicians' interpretations and enables faster disease diagnostics[22]-[24]. Therefore, applying AI technology to medical devices improves existing devices' performance, efficiency, and quality and plays a vital role in creating new value through accurate interpretation, prediction, and prevention of diseases [25][26].

Meanwhile, procuring expensive medical equipment, such as innovative medical devices, is done by purchasing departments rather than individuals, it is considered a complex decision-making process and not a simple, independent action or event[27], and several factors play a complex role in this decision. Therefore, it would be meaningful to investigate the factors that affect purchase decisions from the perspective of employees of a purchasing department (who are both buyers and service providers) when establishing efficient marketing strategies for the innovative medical device market, which has the potential to grow into a large market in the future.

Previous studies that analyzed purchase decision factors influencing existing medical devices presented

the following attributes: human capability[28][29], price [30], quality and performance[31][32], and corporate image [33]. However, purchase decision factors varied depending on the research subject and perspective, as many were limited studies that did not reflect the characteristics of innovative medical devices. Consequently, this research seeks to empirically determine the factors affecting the intent to adopt innovative medical devices by designing purchase decision factors that consider the characteristics of these devices and the common purchase decision factors of previous studies. These findings integrate and expand the variables mentioned in previous studies to reexamine the size of the causal relationship with adoption intention.

Specifically, as brand image influences buyers' purchase intention, this study focuses on the intermediary role of brand image in the link between factors influencing purchase decisions and the willingness to adopt innovative medical devices. For innovative medical devices that require advanced technologies, brand image affects customers' perception of quality, reliability, and performance. Buyers recognize the value of a product through its brand image and design purchase decisions accordingly. Therefore, brand image mediates between purchase decision factors and the adoption intention of innovative medical devices. Furthermore, as innovative medical devices are equipped with new technologies and characteristics, brand image is a significant source of information until consumers experience the performance and characteristics of the actual products. Understanding the mediating role of the brand image will enable a more accurate grasp of the connection between factors affecting purchase decisions and the intention to adopt innovative medical devices.

II. Literature Review and Hypotheses

In this research, the factors influencing purchase decisions of innovative medical devices were conceptualized as the independent variables. In contrast, the intention to adopt these devices was treated as the dependent variable. Furthermore, the study incorporated brand image to explore its intermediary role in the causal link between these variables. Purchase decision factors comprised the following five sub-factors: performance, convenience, warranty service, safety, and technological innovation. Brand image and adoption intention were composed of a single factor each.

The performance of innovative medical devices is defined as their ability to deliver accurate, quick, and consistent diagnostic results, surpassing existing devices in the same field[34]. This attribute inherently contributes to the perception of a brand as reliable and cutting-edge, which is crucial in the medical device industry[35]. Similarly, convenience, characterized by ease of use, high work efficiency, and compatibility with other medical devices, is vital in enhancing the brand image by aligning with the needs and expectations of medical staff and patients [26][36]. Furthermore, warranty service, including quality post-purchase support and tailored educational resources, is pivotal in establishing trust and reliability in a brand, thereby positively influencing its image [37][38]. Another critical factor is safety, incorporating features to protect patient safety and compliance with international safety standards[39]. It reassures stakeholders of the brand's commitment to patient well-being and risk management[40]. Lastly, technological innovation, demonstrated through the development and application of the latest technology, showcases a brand's leadership in advancing medical care and suggests a forward-thinking and progressive brand image[35][38]. These elements collectively underscore a brand's dedication to quality, safety, and innovation, highly valued in the healthcare sector. Thus, this study proposes the hypotheses above as a natural consequence of the theoretical foundation laid out.

Hypothesis 1. The purchase decision factors of innovative medical devices positively affect brand image.

Hypothesis 1-1. The performance factor positively affects brand image.

Hypothesis 1-2. The convenience factor positively affects brand image.

Hypothesis 1-3. The warranty service factor positively affects brand image.

Hypothesis 1-4. The safety factor positively affects brand image.

Hypothesis 1-5. The technological innovation factor positively affects brand image.

As elucidated by various scholars, brand image is a multifaceted construct reflecting the perceptions and attitudes stakeholders hold towards a brand, influenced by its history, communications, product quality, and overall presence in the market[41][42]. This conceptualization underscores the significant impact brand image can have on the decision-making processes of healthcare institutions, especially concerning the adoption of innovative medical devices [43]. A strong, positive brand image is often associated with reliability, cutting-edge technology, and superior service, elements crucial for healthcare providers when considering integrating new medical technologies into their practice[44]. Consequently, institutions are more likely to adopt devices from brands that are perceived as leaders in innovation and reliability, driven by the expectation that such products will enhance operational efficiency, patient satisfaction, and the quality of care provided. Therefore, this study posits that the abovementioned hypothesis logically follows from the discussed theoretical underpinnings.

Hypothesis 2. The brand image of innovative medical devices positively affects adoption intention.

The performance factor of innovative medical devices is linked to healthcare providers' intentions to adopt such technologies, motivated by the promise of improved patient care and operational excellence[45][46]. Likewise, convenience facilitates a smoother integration into healthcare practices, thus favoring adoption intentions[47]. The ease of use and reduced training requirements make these devices particularly attractive to medical staff, emphasizing their utility in fast-paced healthcare environments[48]. Moreover, warranty service reassures healthcare providers of the manufacturer's commitment to long-term device efficacy and reliability[49]. Safety, involving rigorous design and manufacturing standards to protect patients, further influences adoption intentions by ensuring compliance with regulatory requirements and instilling confidence in the technology's use[50]. Finally, technological innovation is a key driver of adoption intentions[51]. Healthcare providers are keen on adopting devices that enhance treatment outcomes and position them as leaders in medical technology. Thus, this discourse logically deduces the proposed hypotheses from the foundational theories discussed.

Hypothesis 3. The purchase decision factors of innovative medical devices positively affect adoption intention.

Hypothesis 3-1. The performance factor positively affects adoption intention.

Hypothesis 3-2. The convenience factor positively affects adoption intention.

Hypothesis 3-3. The warranty service factor positively affects adoption intention.

Hypothesis 3-4. The safety factor positively affects adoption intention.

Hypothesis 3-5. The technological innovation factor positively affects adoption intention.

III. Methodology

3.1 Subjects and data collection

The sample group consists of employees from the purchasing departments of medical institutions in South Korea's metropolitan areas.

Data collection was carried out through an online survey that lasted roughly three weeks, from the first to the third week of March 2023. After obtaining participants' consent, a self-administered questionnaire was conducted online using Google Docs. Of the 250 distributed copies, 20 were excluded due to the participants' insincere responses, and 230 were used in the final analysis.

3.2 Measurement tool

Purchase decision factors were structured in a way consistent with the studies of Yeo[52], Byun[53], and Hu[54]. The five sub-factors included performance, convenience, warranty service, safety, and technological innovation, each comprising four items, totaling 20. Brand image and adoption intention were grounded on Park[55] and Heo[56], respectively, and each factor is designed with five items.

IV. Research Results

The statistical analyses were conducted utilizing SPSS 28.0 and SPSS Macro 3.4. The research undertook frequency analysis to ascertain frequencies and percentages, thereby elucidating the general attributes of the participants. We adopted exploratory factor analysis(EFA) to assess the validity and reliability of the variables associated with purchase decision factors, brand image, and adoption intention; this included computing Cronbach's alpha to evaluate reliability. Descriptive statistical analysis was then employed to gauge the overall disposition of the purchase decision factors, brand image, and adoption intention. Pearson's correlation analysis was utilized to explore the relationships among purchase decision factors, brand image, and adoption intention, with multiple regression analyses conducted to examine the relationships between these variables. Lastly, bootstrapping analysis, employing SPSS Macro (Model 4), was used to examine the mediating role of the brand image between purchase decision factors and the adoption intention of innovative medical devices. All statistical tests were performed at a .05 level of significance.

4.1 Sample description

Table 1 illustrates the general characteristics of the 230 study participants, detailing the distribution as follows. There were 157 male participants (68.3%) and 73 female participants (31.7%); by age distribution, 45 subjects (19.6%) were in their 30s or younger, 100 subjects (43.5%) were in their 40s, and 85 subjects (37.0%) were in their 50s or older.

Table 1. Demographics of sample

Category		N	%
Gender	Male	157	68.3
	Female	73	31.7
Age	30 years and under	45	19.6
	40s	100	43.5
	50 years and above	85	37.0
Educational attainment	High school graduate	14	6.1
	College graduate	163	70.9
	Graduate school graduate	53	23.0
Medical institution work experience (years)	Under 3	36	15.7
	3 - 5	39	17.0
	5 - 7	41	17.8
	7 - 9	43	18.7
	9 and above	71	30.9
Hospital type	Hospital	55	23.9
	General hospital	74	32.2
	Tertiary general hospital	101	43.9
Total		230	100.0

4.2 Reliability and validity of measurement tool

To test the hypotheses, this study conducted EFA and reliability analysis. Initially, factor analysis was carried out on the questionnaire items for each variable utilizing the varimax rotation method.

The eigenvalue, serving as the criterion for extracting factors, was established at 1.0 or higher. Factor loading values were required to be 0.5 or higher, and items failing to surpass the 0.5 threshold in repeated factor analyses were omitted. Furthermore, reliability analysis was executed on the items categorized under each factor, with verification achieved by calculating Cronbach's α coefficient.

4.2.1 Decision factors

Upon conducting multiple rounds of exploratory factor analysis on the 20 items related to purchase decision factors, several key findings emerged: the Kaiser-Meyer-Olkin(KMO) measure, assessing the adequacy of sampling, reached .942; Bartlett's test of sphericity, evaluating the appropriateness for factor analysis, yielded a chi-square value of 3905.872 with 190 degrees of freedom and a significance level of $p<.001$. These outcomes affirmed the suitability of factor analysis, demonstrating the presence of common factors among the items. Five factors were extracted From the factor analysis results, with all item factor loadings exceeding the 0.5 threshold, thereby establishing adequate validity. The reliability analysis revealed Cronbach's alpha values for the safety factor at .904, the convenience factor at .913, the performance factor at .917, the warranty service factor at .890, and the technological innovation factor at .915. Each of these values surpasses the recommended minimum of 0.6, indicating a high level of internal consistency within the measurement data.

4.2.2 Brand image

Upon conducting iterative exploratory factor analysis on the five items related to brand image, it was found that the Kaiser-Meyer-Olkin(KMO) measure, which assesses the adequacy of sampling, stood at .834; Bartlett's test of sphericity, which tests the appropriateness for factor analysis, showed a chi-square value of 539.025 with 10 degrees of freedom and a significance level of $p<.001$. These results verified the appropriateness of utilizing factor analysis and confirmed the existence of common factors among the items. From the factor analysis, a single factor emerged, with all item factor loadings surpassing the 0.5 mark, thus deeming the validity as adequate. Additionally, the results from the reliability analysis revealed a Cronbach's alpha value of .861 for the brand image factor, exceeding the benchmark value of 0.6. This indicates that the measurement data possess a high level of internal consistency.

4.2.3 Adoption intention

Through iterative exploratory factor analysis conducted on the five items concerning adoption intention, several key findings emerged: the Kaiser-Meyer-Olkin(KMO) measure, assessing sampling adequacy, registered at .853; Bartlett's test of sphericity, evaluating the appropriateness for factor analysis, yielded a chi-square value of 784.668 with 10 degrees of freedom and a p-value of less than .001. These outcomes validated the applicability of factor analysis and identified the existence of common factors among the items. A singular factor was extracted from the factor analysis result, with all item factor loadings being 0.5 or greater, thus affirming adequate validity. Additionally, reliability analysis revealed that the Cronbach's alpha value for the adoption intention factor was .908, surpassing the accepted minimum of 0.6. This indicates a high level of internal consistency within the measurement data.

4.3 Descriptive statistics and correlation

In order to assess the overall tendencies of the primary variables, measures such as the mean, standard deviation, and range were computed; skewness and kurtosis values were also calculated to verify the fulfillment of the normality assumption.

Generally, if the absolute skewness exceeds 3.0 or if the absolute kurtosis surpasses 10.0, it is interpreted that the data do not adhere to the normality assumption[57]. Nevertheless, in this investigation, the data satisfied the normality criterion, as illustrated in Table 2.

Table 2. Descriptive statistics of key variables

Variable	M	SD	Range	Skewness	Kurtosis
Performance	3.37	0.90	1-5	-.296	-.318
Convenience	3.30	0.84	1-5	-.186	-.159
Warranty service	3.29	0.92	1-5	-.379	-.275
Safety	3.77	0.81	1-5	-.399	-.206
Technological innovation	3.48	0.82	1-5	-.183	-.339
Brand image	3.59	0.81	1-5	-.320	-.431
Adoption intention	3.47	0.83	1-5	-.208	-.336

Before examining the influential relationships between the variables of purchase decision factors, brand image, and adoption intention, this study performed a correlation analysis to examine the relationship between the variables, as the findings presented in Table 3.

Table 3. Correlation matrix

Variable	Purchase decision factor					Bra.	Ado.
	Per.	Con.	War.	Saf.	Ino.		
Performance	1						
Convenience	.460**	1					
Warranty service	.743**	.468**	1				
Safety	.654**	.293**	.666**	1			
Technological innovation	.716**	.363**	.752**	.757**	1		
Brand image	.744**	.402**	.768**	.755**	.793**	1	
Adoption intention	.825**	.394**	.750**	.721**	.750**	.794**	1

*Note: Per., Con., War., Saf., Ino., Bra., and Ado. stand for performance, convenience, warranty service, safety, technological innovation, brand image, and adoption intention, respectively

The following sub-factors of the purchase decision variable shows a positive correlation with brand image: performance (r=.744, p<.01), convenience (r=.402, p<.01), warranty service (r=.768, p<.01), safety (r=.755, p<.01), and technological innovation (r=.793, p<.01). Furthermore, the following sub-factors of the purchase decision variable were positively(+) correlated with adoption intention: performance (r=.825, p<.01), convenience (r=.394, p<.01), warranty service (r=.750, p<.01), safety (r=.721, p<.01), and technological innovation (r=.750, p<.01). Lastly, brand image (r=794, p<.01) showed a positive association with adoption intention.

4.4 Hypothesis testing

Table 4 presents the results of validating purchase decision factors on innovative medical devices and brand image. Prior to the analysis, this study determined if any multicollinearity problem existed between the independent variables; the variance inflation factor(VIF) was found to be 1.340~3.342, and as this was less than 10, any issue was found on multicollinearity among the independent variables. Furthermore, the Durbin-Watson(D/W) statistic, with a value of 1.933 near 2, suggested an absence of autocorrelation in the residuals.

The degree of explanatory power about how well the purchase decision factors of innovative medical devices explained brand image was R2=.746, with an explanatory power of 74.6% and F=131.793, indicating that the regression model was appropriately fitted at a specified level of significance of α=.001. Among the sub-factors of the purchase decision variable, performance (β=.193, p<.01), warranty service (β =.235, p<.001), safety (β=.259, p<.001), and technological innovation (β=.271, p<.001) had a significant positive effect on brand image. The relative influence of the sub-factors was in the following decreasing order: technological innovation, safety, warranty service, and performance. In conclusion, regarding the impact of purchase decision factors on brand image, Hypothesis 1-1, Hypothesis 1-3, Hypothesis 1-4, and Hypothesis 1-5 were accepted; Hypothesis 1-2 was not supported.

Table 5 displays the findings from examining brand image's influence on the intention to adopt innovative medical devices.

The measure of how effectively the brand image explained adoption intention was an R2 value of .630, translating to an explanatory power of 63.0%, and an F-statistic of 387.635, demonstrating the regression model was fitted at a significance level of α=.001. The innovative medical devices' brand image (β=.794, p<.001) significantly positively influenced adoption intention. Thus, Hypothesis 2, regarding the impact of brand image on adoption intention, was supported.

Table 6 showcases the analysis outcomes that assess the effect of purchase decision factors on the intention to adopt innovative medical devices. Initially, to ascertain the presence of multicollinearity among independent variables, the study calculated the VIF, which ranged between 1.340 and 3.342.

Given that these values are below the threshold of 10, it was concluded that multicollinearity did not pose a concern.

Additionally, the Durbin-Watson(D/W) statistic was observed at 2.007, closely approximating 2, indicating no correlation among the residuals.

The model's explanatory capability regarding how effectively the purchase decision factors accounted for adoption intention was determined by an R^2 value of .760, which signifies an explanatory power of 76.0%, and an F-statistic of 141.831, suggesting the regression model was well-fitted at a significance level of α =.001. Within the spectrum of purchase decision factors, performance (β=.481, p<.001), warranty service (β=.164, p<.01), safety (β=.195, p<.001), and technological innovation (β=.139, p<.05) each significantly and positively influenced adoption intention. The factors impacted adoption intention in decreasing influence: performance, safety, warranty service, and technological innovation. Therefore, Hypotheses 3-1, 3-3, 3-4, and 3-5 were supported, affirming their positive impact on adoption intention, whereas Hypothesis 3-2 was not supported, indicating no significant effect of convenience on adoption intention.

Table 4. Impact of purchase decision factors on the brand image of innovative medical devices

factor	Unstandardized coefficient		Standardized coefficient	t	p	VIF
	B	SE	β			
(Constant)	.309	.151		2.038	.043	
Performance	.174	.050	.193	3.460**	.001	2.750
Convenience	.028	.037	.029	.744	.457	1.340
Warranty service	.207	.052	.235	3.981***	.000	3.070
Safety	.260	.054	.259	4.811***	.000	2.554
Technological innovation	.270	.061	.271	4.411***	.000	3.342
Dependent variable: Brand image						
R2=.746, Adjusted R2 =.741, F=131.793***, p=.000, D/W=1.933						

Table 5. Impact of brand image on adoption intention

factor	Unstandardized coefficient		Standardized coefficient	t	p
	B	SE	β		
(Constant)	.555	.152		3.657	.000
Brand image	.811	.041	.794	19.688***	.000
Dependent variable: Adoption intention					
R2=.630, Adjusted R2=.628, F=387.635***, p=.000, D/W=1.715					

Table 6. Impact of purchase decision factors on adoption intention of innovative medical devices

factor	Unstandardized coefficient		Standardized coefficient	t	p	VIF
	B	SE	β			
(Constant)	.276	.151		1.833	.068	
Performance	.443	.050	.481	8.866***	.000	2.750
Convenience	-.011	.037	-.011	-.293	.770	1.340
Warranty service	.148	.052	.164	2.851**	.005	3.070
Safety	.201	.054	.195	3.733***	.000	2.554
Technological innovation	.141	.061	.139	2.316*	.021	3.342
Dependent variable: Adoption intention						
=.760, Adjusted =.755, F=141.831***, p=.000, D/W=2.007						

Table 7. Mediating effect of brand image between purchase decision factors and adoption intention

Path	Effect	Boot SE	95% Confidence interval	
			LLCI	ULCI
Performance→Brand image→Adoption intention	.0397	.0196	.0084	.0849
Convenience→Brand image→Adoption intention	.0064	.0096	-.0146	.0245
Warranty service→Brand image→Adoption intention	.0474	.0221	.0097	.0943
Safety→Brand image→Adoption intention	.0594	.0264	.0129	.1159
Technological innovation→Brand image→Adoption intention	.0616	.0300	.0140	.1319

This research applied bootstrapping analysis using SPSS Macro (Model 4) to assess the mediating role of brand image in the relationship between purchase decision factors and innovative medical devices' adoption intention, as depicted in Table 7.

The bootstrapping approach generates a 95% confidence interval for the indirect effect coefficient. According to Preacher and Hayes[58], the mediating effect is deemed statistically significant at the .05 level if zero is not contained within the confidence interval. For this analysis, the number of bootstrap samples was set to 5,000, and the 95% confidence interval's upper and lower bounds for the indirect effect coefficient were calculated.

Firstly, the indirect effect coefficient for the pathway from performance to brand image to adoption intention was calculated as .0397, with confidence interval bounds of .0084 (lower) and .0849 (upper). The absence of zero in this interval confirms a significant mediating effect, leading to the acceptance of Hypothesis 4-1.

Secondly, the indirect effect coefficient for the pathway from convenience to brand image to adoption intention was .0064, with confidence interval bounds of -.0146 (lower) and .0245 (upper). This interval includes zero, indicating no significant mediating effect; thus, Hypothesis 4-2 was rejected.

Thirdly, the pathway from warranty service through the brand image to adoption intention yielded an indirect effect coefficient of .0474, with confidence interval bounds of .0097 (lower) and .0943 (upper). The exclusion of zero from this interval signifies a significant mediating effect, supporting the acceptance of Hypothesis 4-3.

Fourthly, the indirect effect coefficient for the safety of brand image in the adoption intention pathway was .0594, with confidence interval bounds of .0129 (lower) and .1159 (upper). With zero not included in this interval, a significant mediating effect is confirmed, and Hypothesis 4-4 was accepted.

Lastly, the pathway from technological innovation through the brand image to adoption intention had an indirect effect coefficient of .0616, with confidence interval bounds of .0140 (lower) and .1319 (upper).

The absence of zero in this interval indicates a significant mediating effect, leading to the acceptance of Hypothesis 4-5.

Ⅴ. Discussion

First, performance is a key attribute of medical devices and affects the product's brand image. The performance of medical devices is directly related to patient treatment outcomes. If the performance of a medical device is outstanding, it will directly improve patient outcomes. As a result, this will enable medical institutions to provide services to a larger patient population, thus improving the brand image. Chung, Hwang[33] and Kwon and Cho[59] examined the impact of purchase decision factors on brand image in the clothing sector. They determined a significant, influential relationship consistent with this study. Although these studies did not deal with the medical field, their findings reaffirm that purchase decision factors on brand image.

Second, the brand image of innovative medical devices positively affects the intention to adopt them. This result indicates that brand image serves as an indispensable antecedent of the purchase decision process of medical institutions. Brand image is customers' perception of a brand, encompassing product quality, value, and reliability. In the case of innovative medical devices, factors such as technical stability, performance, and service comprise the critical elements of a brand image. According to Lee, Kim[60], if the brand image is positive, medical institutions will be inclined to adopt the medical devices of that brand because a positive brand image guarantees both the quality and reliability of a product. As a result, medical institutions anticipate delivering superior patient care and elevating the quality of their medical services by adopting these devices. Previous studies have confirmed that brand image is an antecedent variable that affects the purchase or adoption intentions of a brand. Haryanto[61] determined that corporate image affects the purchase intention of products. Kim[62] also found that an eco-friendly brand image affects purchase intentions, and these findings are consistent with this study. This study shows that emphasizing the performance, safety, and technological innovation of innovative medical devices can build a sustainable brand image and encourage medical institutions to adopt innovative medical devices. In addition, a positive brand image not only improves sales but also contributes toward fostering long-term customer relationships. Therefore, strategically managing and improving brand image enhances brand awareness and loyalty.

Third, among the components influencing purchase decisions, performance, warranty service, safety, and technological innovation significantly affected the intention to adopt. The impact of these factors on adoption intention was ranked in descending order: performance, safety, warranty service, and technological innovation. Notably, the performance of innovative medical devices had the most significant impact because the performance of medical devices is directly related to the efficiency of medical staff using such devices to treat patients. In other words, medical devices with excellent performance enable accurate and quick diagnosis, leading to improved treatment outcomes. The performance of medical devices influences medical institutions' intention to adopt a device. These findings indicate that performance excellence is a significant factor in deciding the market competitiveness of manufacturers of innovative medical devices. The orientation that medical institutions favor products that offer outstanding performance suggests that manufacturers should invest in research and development to improve product performance. Safety was highly influential because the safety of medical devices directly influences treatment outcomes.

As medical devices are used to manage or treat patients, safety is essential for the intended purpose. If a medical device is unsafe, the resulting side effects and problems can threaten patients' health. Accordingly, medical institutions must be confident about the safety of the medical devices they adopt. These findings suggest that manufacturers of innovative medical devices must invest in technology development to ensure device safety and gain market competitiveness.

Furthermore, manufacturers must ensure testing and verification of products and convince consumers about the safety of their devices. Warranty service influences adoption intention. It is incumbent on manufacturers to ensure that medical devices remain safe and provide stable performance throughout the product's intended life cycle. Brands that guarantee these features gain customer trust, ultimately increasing consumers' intention to adopt the product. In addition, warranty services that respond quickly and effectively to problems increase customer satisfaction, improving brand image and adoption intention in the long run. These findings suggest that it is essential for manufacturers of innovative medical devices to provide optimal product performance and safety and complete warranty services through the duration of the product's intended life cycle to strengthen medical institutions' adoption intention. This will reduce customer anxiety, increase confidence in the product, and ultimately adoption intention. Technological innovation also affects adoption intention as it can enhance product performance and safety and support new treatment methods. Notably, innovations can improve the standard of medical services and the results of treatments, as medical institutions focus on technological innovations when adopting devices. These findings emphasize the importance of technological innovation in developing and improving innovative medical devices and suggest a strategy to gain market competitiveness to improve brand image. Reportedly, purchase decision factors significantly impact the intention to adopt medical equipment. The following studies determined that various factors had a marked influential relationship with purchase or repurchase intentions: Yeo[52] study shows the factors as quality and profitability of expensive medical equipment; in Byun[53] study, the factors were corporate image and reliability; and in Lee, Kim[60] study, the factors were identified as quality, reliability, and corporate image. These findings support this study.

Fourth, this study confirmed the mediating effect of the sub-factors of purchase decision (i.e., performance, warranty service, safety, and technological innovation) within the nexus connecting purchase decision factors to the intent to adopt innovative medical devices; these elements signify the devices' quality and worth. Amplifying these factors bolsters the inclination of medical institutions to adopt such devices. Performance represents a product's functional value, a robust warranty service denotes the reliability of post-sales product management, safety represents factors that reduce risks to patients. Technological innovation represents the differentiation and advancement of the product. Accordingly, these factors create the brand image of medical devices and directly affect adoption intention. These findings suggest that innovative medical device manufacturers require strategies to understand the relationship between brand image and adoption intention, thereby improving the purchase decision factors of their products. Manufacturers should focus on improving these factors because improving product performance, strengthening warranty services, and ensuring product safety can enhance brand awareness and improve adoption intentions.

Ⅵ. Conclusion

This research explored the influence of factors in purchasing decisions on the willingness to adopt innovative medical devices, focusing on the staff of purchasing departments within medical institutions in metropolitan areas of Korea, such as Seoul.

Additionally, it investigated how the perception of brand image mediates this relationship. The findings from the empirical tests conducted to evaluate the stated hypotheses include. Initially, it was discovered that performance, warranty service, safety, and technological innovation significantly and positively impacted the brand image among the various elements constituting the purchase decision aspect. The impact of these elements on brand image ranked in descending order as follows: technological innovation, safety, warranty service, and performance, with technological innovation exerting the most substantial influence. In medical devices, technological advancements are pivotal in enhancing products' functionality and overall performance, increasing convenience of use, and developing new treatment methods. The technological superiority of such products provides an attractive value to medical institutions, and brands that provide this gain a positive image. Furthermore, technological innovations impact patient treatment outcomes and safety. Therefore, employees entrusted with purchasing-related responsibilities depend on brands that provide safe and effective treatment methods through technological innovations. These research findings provide implications for brands manufacturing medical devices, indicating that investing in technological innovation and actively marketing solutions are critical for improving brand image and market competitiveness. This is attributed to the vital role of technological innovation in improving the quality of medical services, patient safety, and functionality of products.

Next, the safety factor was found to affect brand image significantly. Innovative medical devices can directly affect patients' health. As a result, purchasing departments recognize the safety of innovative medical devices as an essential requirement, which is as important as product performance and technological innovation. If a problem occurs while using a medical device, the consequences are not simple material loss; they can directly threaten a patient's health and life. These findings suggest that safety is a key factor that medical device manufacturers should consider foremost, specifically in technology development and product improvement.

Moreover, the warranty service factor was also found to influence the brand image. Medical devices are complex and precise products; even a small problem can interfere with their use and impact treatment outcomes. Therefore, purchasing departments consider warranty service necessary, and manufacturers take responsibility and respond quickly and effectively when a product has a problem. As warranty service is provided, purchasing departments are confident about the stability and quality of a product, which positively affects brand image.

Finally, this study substantially contributes to the field by empirically validating assumptions that are often taken for granted in the context of healthcare technology adoption. By quantitatively demonstrating how factors directly enhance brand image and influence adoption decisions, the research provides actionable insights for manufacturers and healthcare institutions. These findings not only confirm the theoretical relationships within the adoption framework but also offer a strategic foundation for enhancing market competitiveness and patient outcomes through focused improvements in product quality and branding strategies.

Ⅶ. Limitations and Future Research Directions

This study acknowledges certain limitations that suggest directions for future research. Primarily, the focus solely on the perspective of purchasing department staff within medical institutions may not capture the complete dynamics affecting the adoption of innovative medical devices. Future studies should incorporate the viewpoints of other key stakeholders such as physicians, nurses, and technical staff who interact directly with these devices, providing a more comprehensive analysis of adoption factors.

Moreover, the research was confined to employees of medical institutions in metropolitan areas of Korea, which might limit the generalizability of the findings across different geographical and institutional contexts. Subsequent research should extend to a broader array of regions and include varied healthcare settings to enhance the applicability and relevance of the results.

Additionally, while the study examined internal factors like performance and brand image, it did not fully explore external influences such as economic conditions, government regulations, or competitive actions, which can significantly impact adoption rates. Future research should aim to integrate these external variables to provide a more holistic understanding of the factors driving the adoption of medical technologies.

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