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The Behavioral Intention of Hospitals to Promote Sustainable Development of Green Healthcare from the Perspective of Organizational Stakeholders during the COVID-19 Epidemic: A Case Study of Hospitals in Taiwan

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Abstract: When the World Health Organization (WHO) analyzed the culprits of global warming, it was found that in developed countries with relatively few high-polluting heavy industries, the medical sector is one of the sources of high-density carbon emissions. Therefore, the medical industry has a noticeable impact on the environment. Amid the current COVID-19 epidemic, this study adopts the theory of planned behavior (TPB), widely used in decision-making science. We selected a regional teaching hospital with 339 employees in Taiwan to obtain valid questionnaire data. We explore the comparative analysis of different intra-organizational stakeholders' "attitudes," "subjective norms," and "perceived behavioral control" on the hospital's behavioral intention to promote green healthcare. The results show that the TPB model has reliable explanatory power. All three factors have a positive and significant effect on promoting green hospital behavior. Among them, perceived behavioral control was the most notable. A comparative analysis of the differences among stakeholders in the research model shows that "medical administrators" and "nursing staff" have a higher proportion of significant influence effects in various hypotheses, highlighting the critical roles of these two groups in promoting green hospitals. This research policy suggests that the cross-departmental staff in the hospital put forward green innovation ideas, strengthen internal environmental education and management, establish a good incentive system for front-line nursing staff, and implement the sustainable development strategy of the hospital.

Keywords: green hospital; green healthcare; sustainable development; stakeholders; COVID-19 epidemic

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1. Introduction

Since the 1970s, with the rapid industrial development of developing countries and the reform and opening up of the economic system of communist countries, energy and ecological crises have been induced, and people have paid attention to environmental protection. Ecology, environmental conservation, greenness, and sustainable development have become mainstream in the international community. Therefore, the WHO initiated the Millennium Development Goals (Millennium Development Goals, MDGs) as early as 2000: (1) to eradicate extreme poverty and hunger; (2) to achieve universal primary education; (3) to promote gender equality and empower women; (4) to reduce child mortality; (5) to improve maternal health; (6) to combat HIV/AIDS, malaria, and other diseases; (7) to ensure environmental sustainability; (8) to develop a global partnership for development, and eight other goals [1]. In 2016, the WHO further promoted the expansion of the "2030 Sustainable Development Goals" (Sustainable Development Goals; SDGs) to 17 core goals,

covering (1) No Poverty; (2) Zero Hunger; (3) Good Health and Well-Being; (4) Quality Education; (5) Gender Equality, (6) Clean Water and Sanitation; (7) Affordable and Clean Energy; (8) Decent Work and Economic Growth; (9) Industry, Innovation, and Infrastructure; (10) Reduced Inequalities; (11) Sustainable Cities and Communities; (12) Responsible Consumption and Production; (13) Climate Action; (14) Life Below Water; (15) Life on Land; (16) Peace, Justice, and Strong Institutions; and (17) Partnerships for the Goals. Across the three major aspects of economy, society, and environment, it is further divided into 169 sub-items, with the aim of leading global efforts toward sustainability before 2030 [2].

In addition, in the "Who Cares Wins" report proposed by the WHO in 2005 to assess whether enterprises meet sustainable development goals, it is mentioned that global enterprises should integrate three indicators: E—Environmental (environment), S—Social (society), and G—Governance (corporate governance) [3]. SDGs are applicable to all stakeholders such as countries, governments, enterprises, organizations, and citizens, while ESG is mainly applicable to enterprises; in terms of function, SDGs are the goal, and ESG is the means and process to achieve the goal. The means will adapt to different industries and needs, leading to different implementation methods and standards. However, in the medical system, following the wave of sustainable development, the WHO and HCWH jointly promoted a series of green medical sustainable development policies, which will be discussed in depth in the following research.

The motivation to push for green healthcare stems from the impact of climate change on the environment in recent years affecting human health in multiple ways, such as changing the geographical scope of certain infectious diseases and seasonal, short-term temperature fluctuations that result in heatstroke, hypothermia, cardiovascular diseases, and respiratory diseases. According to the World Health Organization (WHO), when analyzing the culprits of warming, it is found that developed countries have much fewer high-polluting heavy industries.

The medical sector is one source of high-density carbon emissions because medical and healthcare institutions provide health care at the cost of significant energy consumption and carbon emission, which indirectly threatens the environment and human health [4]. The WHO and Health Care Without Harm (HCWH, a sustainable health organization) published "Healthy Hospitals—Healthy Planet—Healthy People" in 2008, highlighting the impact of medical institutions on climate change and revealing that the healthcare sector can play an essential role in mitigating climate change [5]. Until 2019, Health Care Without Harm (HCWH) partnered with ARUP to propose that the "Health Care's Climate Footprint Green Paper" is the most comprehensive global analysis of healthcare's contribution to climate change, based on statistics on climate change from 43 countries [6].

The report found that healthcare's climate footprint is equivalent to 4.4 percent of global net emissions, with the top three healthcare emitters accounting for 56 percent of the global footprint, the United States, China, and the European Union. In addition, 71% of these emissions come from the healthcare supply chain. Taiwan is not listed as a country in this competition, so there are no relevant statistical data in this study that support Taiwan's performance in healthcare's climate footprint. According to the statistics of Taiwan's Ministry of Economic Affairs report titled "Energy audit annual report for non-productive industries 2021," there are 155 medical institutions, divided by building type, that are major energy consumers in Taiwan and are responsible for the energy consumption in 2020 [7]. It accounts for 16.09% of the energy consumption of non-productive industries, ranking first in the user category. Thus, we can see the influence of the medical industry on the environmental load. During the current epidemic, according to the WHO report titled "Global analysis of health care waste in the context of COVID-19," it was pointed out that before the epidemic, 30% of medical institutions in the world (60% in the least-developed countries) were not capable of dealing with the existing waste load, the tens of thousands of additional tons of medical waste generated by the COVID-19 pandemic that has put enormous pressure on medical waste management systems around the world, accelerating

threats to human and environmental health, and the urgent need to improve waste property management practice [8].

Given the above factors, the construction industry uses almost half of the world's energy [9]. Since the 1990s, developed countries such as Canada, Japan, the Netherlands, the United Kingdom, and the United States have successively proposed green building evaluation systems to regulate the consumption and pollution caused by buildings and energy. Among them, the Leadership in Energy and Environmental Design (LEED) and Green Guide for Health Care (GGHC) are currently the complete evaluation systems in the world [10]. LEED, developed by the United States Green Building Council in 1998, is the global benchmark for green building design and operation. It provides quantitative tools that directly measure a building's performance. Revised in 2003, based on LEED evaluation indicators, GGHC is the world's first quantifiable sustainable design, construction, and operation toolkit customized for the healthcare industry, as well as a transformational tool for building healthy hospitals for people and the environment [11].

However, the biggest revolution in green medicine was the establishment of HCWH in the United States in 1996, which was founded to transform the global health sector into an ecologically sustainable industry without compromising patient safety or care. It became a leading advocate for environmental health and justice. HCWH strongly promotes international green and healthy hospitals, and currently, the HCWH network has more than 1500 members in 75 countries, representing the interests of more than 60,000 hospitals and health centers. HCWH mainly calls on global healthcare institutions to refer to the framework entitled "Global Green and Healthy Hospitals: A Comprehensive Environmental Health Agenda for Hospitals and Health Systems Around the World [12]", which promotes ten aspects of green hospitals: buildings, chemicals, energy, food, leadership, pharmaceuticals, purchasing, transportation, waste, and water.

This document provides a series of action items for each dimension and tools and resources that can be used to achieve these goals. In 2010, to encourage Taiwan's medical institutions to join the environmental sustainability initiative, the National Health Bureau of the Ministry of Health and Welfare, together with the Environmental Protection Agency and the Energy Bureau of the Ministry of Economic Affairs, jointly established an information exchange platform to assist and guide domestic hospitals in promoting energy conservation and carbon reduction. Known as the "Carbon Reduction, Save the Earth, and the Medical Community are launched as a Pioneer" campaign, it involved 9 medical societies, 18 medical systems, and 128 hospitals, covering more than 64% of the country's general hospital beds.

Carbon emissions are expected to be reduced by 13%, or about 164,648 metric tons, in 2020 compared to 2007. Since 2010, the National Health Bureau of the Ministry of Health and Welfare has measured whether a hospital can be regarded as a green hospital using eight major indices: alternative energy, energy efficiency, environmental education, food, green buildings, transportation, waste, and water. Chang referred to the "Green Guide for Health Care" in the United States and the "Building Green Hospital Checklist" in Canada for the construction and investigation of green hospital indicators among Taiwanese people [13]. The hospital implemented a green hospital policy and developed seven green hospital indicators suitable for Taiwan. These seven indicators are "Facility Management," "Transportation," "Sustainable Site Management," "Chemical Substance Management," "Waste Management," "Food Supply," and "Environmentally Friendly Purchase" [14,15]. These seven indicators are also consistent with the 6th, 7th, 9th, and 11th objectives of the SDGs' 17 indicators of the WHO related to environmental sustainable development.

In 2012, the National Health Bureau of the Ministry of Health and Welfare and HCWH cooperated in holding the "Pre-Conference on HPH and Environment" at the Taipei International Convention Center. At the same time, the Global Green and Healthy Hospital Network were also held to announce the ceremony of representatives of 13 Southeast Asian countries; in 2013, the National Health Department organized the "International Environment-Friendly Hospital Team Work Best Practice Award". The same event contin-

ued from 2014 to 2015 until the rotation of Taiwan's ruling party in 2016. The competent authority for health promotion of the Taiwan government is the Health Promotion Administration of the Ministry of Health and Welfare, which promotes and practices green health care in the private and public health sectors (including pharmaceutical and medical device producers, care providers, etc.).

There is no clear specification on it, nor has it built an integrated green procurement and supply chain system that is perfect for the exclusive medical system, and even a cross-departmental green hospital management system has not been established. At present, the business related to energy conservation policies is still controlled by the Ministry of Economic Affairs of Executive Yuan to hold energy conservation benchmarking awards every year. Waste environmental management is managed by the Environmental Protection Administration of Executive Yuan, which organizes the "Green Procurement Excellence Unit Selection Award" every year. The policy of green hospitals was in a period of stagnation. This, coupled with the COVID-19 pandemic, has worsened the push for green healthcare. Research on green hospitals in Taiwan is scarce. Therefore, the motivation of this research can restart Taiwan's emphasis on green hospital issues.

The levels of medical institutions in Taiwan are categorized as medical centers, regional hospitals, district hospitals, and clinics. This study uses eight indicators developed by the National Health Bureau of the Ministry of Health and Welfare (2010). It uses the theory of planned behavior that has been widely used in recent years for green technology, environmental behavior, and healthcare behavior decision-making as a research method. The studied regional hospital is one of the 174 domestic member hospitals (low-carbon hospitals) of the International Committee on Health Promotion Hospitals and Environment. Amid the epidemic situation, different intra-organizational stakeholders intend to promote green medical care in the hospital to find the help and resistance points to promoting green hospitals and hope that hospitals can quickly improve and achieve the standard green hospital indicators. The good ecological condition of the Earth is a significant responsibility and obligation. Moreover, the results of this study can be used as a reference for hospitals in Taiwan and other countries to promote green hospital indicators and hospital-sustainable education policies, especially for hospitals that adopt the GGHH indicators promoted by HCWH.

2. Theoretical Background

The TPB has been widely used in behavioral decision-making research in various fields in recent years. The research scope of TPB includes all kinds of planned consumption behaviors, scientific and technological information, leisure and recreation, social behaviors, environmental behaviors, medical care, and other related research at all levels. The TPB posits that "behavioral intention" is one of the best variables to predict the rational behavior of individuals, as proposed by Ajzen [16]. The origin of the TPB can be traced back to the theory of multi-attribute attitude (TMA) proposed by Fishbein [17]. The TMA believes that behavioral attitudes can determine behavioral intentions and that expected behavioral outcomes and outcome evaluations can determine behavioral attitudes. Ajzen and Fishbein later developed the multi-attribute attitude theory into the theory of reasoned action (TRA) [18,19]. In 1985, Ajzen's research found that an individual's behavior was not completely driven by their "attitude" or "subjective norm" but was also subject to the control of external factors, thus the TRA was expanded to a "perceived behavior control" model, and thus developed into a new TPB model [16]. Yuriev et al. [20] compiled 143 international journals related to environmental behavior and analyzed 126 of 905 academic articles using TPB empirical research, showing that TPB has considerable explanatory power in environmental behavior issues. Therefore, this study adopts Ajzen's research methods to explore the behavioral intention of hospitals to promote green medical care from the perspectives of different intra-organizational stakeholders amid the COVID-19 epidemic with attitudes, subjective norms, perceived behavioral control, and behavioral intentions [16,21–23]. This study believes that the promotion of green hospitals should

involve integrating multiple technologies, such as alternative energy, energy efficiency, environmental protection, green buildings, transportation, waste treatment, and water recycling [24]. Therefore, this study will affect the concept of "attitude" in the promotion of green hospitals by hospitals, which refers to the positive or negative feelings an individual has about the behavior; more specifically, it is conceptualized by the individual's evaluation of the specific behavior.

Attitudes are often viewed as a function of an individual's salient beliefs regarding the outcome of an action. This study uses the technology acceptance model (TAM) developed from the TRA theory as the basis of the two attitude dimensions, "perceived ease of use (PEOU)" and "perceived usefulness (PU)" [25–27]. PEOU adopts the eight major projects of the National Health Bureau of the Department of Health to promote green hospitals, including "Enhancing Energy Efficiency," "Enhancing Green Building Design," "Using Alternative Energy," "Using Public Transportation and Cycling," "Promoting the Use of Green Food," "Promoting Environmentally Friendly Waste Disposal Systems," "Effective Water Resource Utilization System," "Implementation of Environmental Protection Education" [28]. Detecting the approval and feasibility willingness of different intra-organizational stakeholders to cooperate with the hospital to promote green hospital-related indicators PU is based on six benefits that may be brought about by the hospital's promotion of green hospitals to test the attitude of different intra-organizational stakeholders to the hospital's goal of promoting green hospitals: "helps to enhance environmental awareness and be a good citizen of the world," "helps to improve the quality of medical care," "helps to be friendly to work and medical environment," "contributes to the image of a friendly hospital," "contributes to the hospital's business performance and sustainable development," and "conforms to the world trend and development trend".

The term "subjective norm" refers to the social pressure that an individual feels about whether to enact a certain behavior; that is, when predicting an individual's behavior, referring to those individuals or groups that influence an individual's behavioral decisions (salient individuals or groups), the effect on whether an individual takes a particular action. Therefore, the design of this study divides the factors that affect "subjective norm" into the "primary group (PG)" and "secondary group (SG)". The PG includes the administrative department of the hospital in charge of promoting green hospitals and relevant government authorities (health and environmental protection units) that mainly affect the hospital's promotion of green hospital policy. The SG refers to the relevant institutions that affect the hospital's promotion of green hospital policy, including civil environmental groups, mass media, religious groups, and other social groups.

In addition, "perceived behavioral control (PBC)" reflects an individual's past experiences and expected obstacles. The greater the perceived behavioral control over behavior, the more resources and opportunities individuals believe and the fewer obstacles they anticipate. Taylor and Todd deconstructed perceptual behavioral control into Bandura's self-efficacy and Triandis's notion of facilitating conditions [21,27,29–32]. Notani [33] believes that PBC includes "internal control factors (ICFs)", such as personal abilities, emotions, shortcomings, or skills, as well as "external control factors (ECFs)" such as barriers to others, and dependencies, information, or opportunities. This study adopts Notani in that the cooperation of hospital staff to implement green hospital policy is assumed to be affected by their ICFs, including whether they have sufficient green hospital expertise, environmental protection concepts and behaviors, sufficient ability, time factors, and external control. Such ECFs include adequate education and training provided by the hospital, promotional funds, supporting measures, and reward and punishment mechanisms.

3. Aim and Scope

The structure of this research is shown in Figure 1.

Based on the above theoretical basis, this study takes a regional teaching hospital in Taiwan as the research object and adopts a cross-sectional study to target five different intra-organizational stakeholders in a hospital: medical administrators, doctors, nursing

staff, medical examination, medical personnel (pharmacists, laboratory technicians, radiologists, etc.), and other outsourced personnel (waste disposal, catering services, security personnel, etc.).

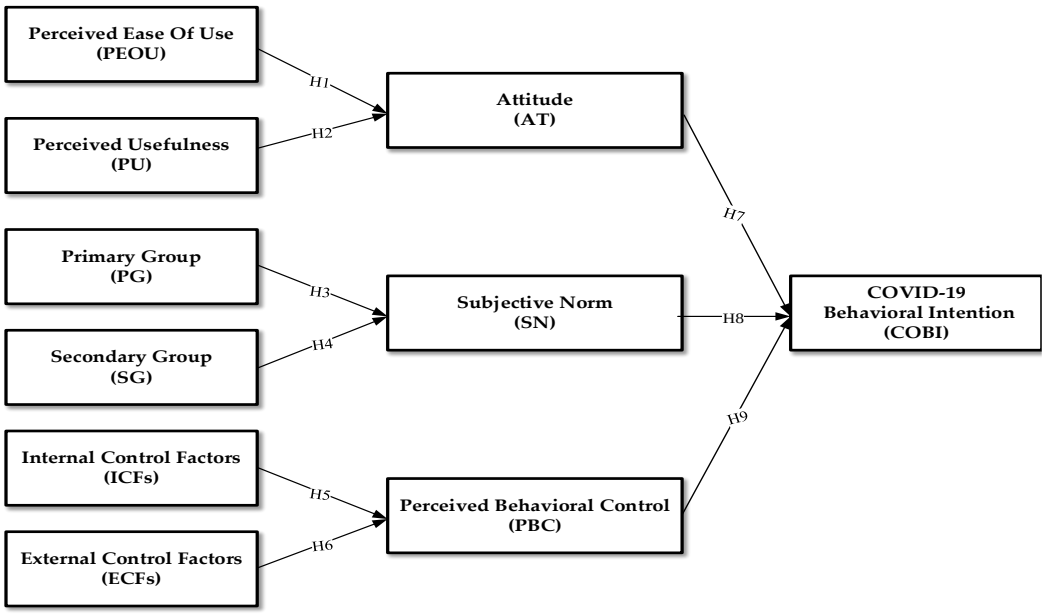

Figure 1. The schema of research structure model and hypotheses.

4. Hypotheses Development

Based on the collection and review of literature data from Ajzen and related environmental behavioral intentions and green hospitals, the following hypotheses were established and verified by statistical analysis in this study (H1 through H9 are amid the circumstances of the COVID-19 pandemic) [16,20,22,23,27,34–36].

This study covers a wide range of projects based on the promotion indicators of green hospitals and even involves the use of related green technology (such as innovation and equipment, such as renewable energy technology, alternative energy technology, circular economy technology, green building, etc.) equipment [37–39], so it refers to "green information technology" [27,40,41], "environmental science and technology" [20,34,35,42,43], and "medical technology" [36] applied related research; introducing Davis et al.'s proposed TAM (Technology Accept Model) sets two important factors influencing attitudes as cognitive ease of use "Perceived Ease of Use (PEOU)" and cognitive usefulness "Perceived Usefulness (PU)", so this study established research H1 and H2 [26].

H1. *The hospital staff's belief in the PEOU in promoting green hospitals has a positive and significant correlation toward the "attitude".*

H2. *The hospital staff's belief in the PU in promoting green hospitals has a positive and significant correlation toward the "attitude".*

This study adapted Taylor and Todd's [27] widely cited study combining TPB with TAM, which distinguishes "subjective norm" from the concepts of "peer influence" and "superior's influence". The "subjective norm" of this study was divided into objects with a relatively high contact frequency with the subject of the test as the "primary group (PG)" and the object with a relatively minor contact frequency with the subject is called "secondary group (SG)". H3 and H4 are therefore set in this study.

H3. *The hospital staff's belief in the PG approach of promoting green hospitals has a positive and significant correlation toward the "subjective norm".*

H4. *The hospital staff's belief in the SG approach of promoting green hospitals has a positive and significant correlation toward the "subjective norm".*

Notani [33] believed that perceived behavioral control (PBC) mainly contains internal control factors (ICF), such as the individual's technology, abilities, or emotions, as well as the individual's external control factors (ECF), such as information, opportunities, dependence on others or obstacles. This study argues that employees in promoting green hospital PBCs mainly influence ICFs and ECFs. H5 and H6 are therefore set in this study.

H5. *The hospital staff's belief in ICFs that promote green hospitals has a positive and significant correlation toward the "perceived behavioral control".*

H6. *The hospital staff's belief in ECFs that promote green hospitals has a positive and significant correlation toward the "perceived behavioral control".*

In the research by Yuriev et al. [20], in 143 international journals related to environmental behavior, 905 articles using TPB were collected, and finally, through two-stage screening and comparison, 126 representative articles were selected for analysis. It was found that TPB is quite explanatory in exploring environmental behavior decision-making, and accounts for 72% of the explanatory power of expanded variable optimization TPB. This research topic mainly explores the differences in the influencing factors of employees with different stakeholders on green hospitals, so the basic theoretical framework of TPB is adopted [16,22,23,27] to explore the relationship between attitudes, subjective norms, and perceptual behavior control on the behavioral intentions of different intra-organizational stakeholders to promote green hospitals. H7–H10 is therefore set in this study.

H7. *The hospital staff's "behavioral intention" to promote green hospitals is positively and significantly affected by the "attitude". That is, the stronger the attitude, the stronger the behavioral intention.*

H8. *The hospital staff's "behavioral intention" in promoting green hospitals is positively and significantly influenced by the "subjective norms". That is, the stronger the subjective norm, the stronger the behavioral intention.*

H9. *The hospital staff's "behavioral intention" in promoting green hospitals is positively and significantly affected by the "perceived behavioral control". The stronger the perceived behavioral control, the stronger the behavioral intention.*

H10. *There are significant differences in the behavioral intention patterns of different intra-organizational stakeholders in promoting the TPB in green hospitals.*

5. Materials and Methods

5.1. Variables and Measurements

Studies in this field typically measure items in the TPB models using a 7-point Likert's scale, from strongly agree to strongly disagree which were measured on a +3–−3 scale (+3: strongly agree, −3: strongly disagree). (Note that one weakness of the Likert scale is that participants may avoid extreme response categories, leading to a central tendency bias.) The dependent variable was the behavioral intention to promote green healthcare, measured by four-item questions on a +3–−3 scale (+3: very appropriate, −3: not appropriate at all). In Figure 1, the independent variables of TPB predictor variables were: (1) attitude (included 5 items) which was constructed by PES (included 8 items) and PU (included 6 items); (2) subjective norms (included 4 items) which constructed by MSN (included 4 items) and SSN (included 4 items); (3) perceived behavioral control (included 4 items) which constructed by ICF (included 4 items) and ECF (included 4 items).

The hospital staff was divided into five stakeholder groups to compare the research structure model: Mode 1 (M1) represents "medical administrators" (n = 45), Mode 2 (M2) represents "doctors" (n = 32), Mode 3 (M3) represents "nursing staff" (n = 196), Mode 4 (M4) represents "medical examination and medical personnel" (n = 35), and mode 5 (M5) represents "other outsourced personnel" (n = 31).

5.2. Samples and Procedures

We conducted a cross-sectional anonymous questionnaire survey by purposeful sampling. The survey was conducted between 1 March and 15 May 2022. There were 1756 people in this hospital, and a total of 450 people voluntarily registered to participate in the study. A total of 450 questionnaires were distributed, and the recovery rate of the 339 valid questionnaires was 75.33%. Among them, 77.3% were female; 91.7% had obtained at least a college degree; 56.8% had worked in this hospital for more than 7 years; non-supervisors accounted for 91.2% of the proportion of supervisory positions; and 54.9% have religious beliefs (including Buddhism, Taoism, Christianity, etc.).

5.3. Statistical Analyses

The data from the questionnaire were imported into the SPSS 28 software and were identified by code alone. Data processing and analysis were done by using SPSS 28 software and partial least squares (PLS) for structural equation modeling data analysis. A comparison of the structural equations consistent with the research framework of this study targeting a small sample of different intra-organizational stakeholders. The statistical software SmartPLS 3.3.7 was used to carry out various statistical analyses. According to the purpose and hypothesis of this study, the structural equation model was used for data analysis.

6. Results

6.1. Reliability and Validity of the Research Model

This study uses SmartPLS software for Confirmatory Factor Analysis. Factor loading, reliability analysis, discriminant validity, and convergent validity were used to confirm the reliability and validity of the research model. The analysis steps of the test measurement model are briefly described as follows (Tables 1 and 2). (1) The loading of individual (variable) factors must be greater than 0.5. All the questions in this study had the lowest factor load of 0.786 and the highest of 0.978, all of which meet the required standard, indicating that this research model has good reliability [44]. (2) This study used Jöreskog, Dijkstra, and Henseler's [45] "rho_A," "composite reliability," and "Cronbach's alpha," which must be greater than 0.7 to evaluate internal consistency reliability. "rho_A" is between 0.908 and 0.985, "composite reliability" is between 0.932 and 0.988, and all "Cronbach's alpha" values are between 0.903 and 0.985, indicating that the research model has good reliability performance. (3) The average variance extracted (AVE) must be greater than 0.5; the minimum AVE of each aspect of this study was 0.775, indicating that each aspect of this study has certain convergent validity [46]. (4) The square root of AVE of each aspect must be greater than the correlation coefficient with other aspects [46–48], the square root of AVE of each aspect in this study is greater than that with other potential variables. According to Table 2, each aspect of this study has a certain discriminant validity (discriminant validity). (5) This study also tested that the factor loading was greater than other factor loadings, showing that own-loadings were greater than cross-loadings, which indicated that the measurement had good convergent validity and discriminant validity.

Table 1. The reliability and validity of this study (n = 339).

Construct	Item	Loading	Mean	STDEV	T Statistics
	PEOU 1	0.889	0.889	0.017	51.301
Perceived Ease of Use (PEOU)	PEOU 2	0.92	0.919	0.01	88.538
VIF = 4.736	PEOU 3	0.908	0.908	0.013	67.641
rho A = 0.963	PEOU 4	0.786	0.786	0.03	26.492
Cronbach's α = 0.960	PEOU 5	0.83	0.83	0.024	34.125
Composite Reliability = 0.967	PEOU 6	0.902	0.902	0.015	59.272
AVE = 0.784	PEOU 7	0.915	0.915	0.013	69.804
	PEOU 8	0.924	0.924	0.01	89.806
Perceived Usefulness (PU)	PU 1	0.922	0.921	0.015	61.628
VIF = 4.736	PU 2	0.953	0.953	0.007	131.382
rho A = 0.978	PU 3	0.964	0.963	0.006	166.442
Cronbach's α = 0.978	PU 4	0.962	0.961	0.007	135.293
Composite Reliability = 0.982	PU 5	0.958	0.957	0.009	109.21
AVE = 0.902	PU 6	0.94	0.94	0.012	76.011
Primary Group (PG)					
VIF = 2.185	PG 1	0.938	0.939	0.009	103.016
rho A = 0.953					
Cronbach's α = 0.952	PG 2	0.94	0.94	0.011	87.472
Composite Reliability = 0.968	PG 3	0.96	0.96	0.007	140.256
AVE = 0.875	PG 4	0.902	0.902	0.029	31.054
Secondary Group (SG)					
VIF = 2.185	SG 1	0.925	0.926	0.022	41.969
rho A = 0.962					
Cronbach's α = 0.956	SG 2	0.947	0.947	0.009	107.966
Composite Reliability = 0.968	SG 3	0.94	0.939	0.013	70.381
AVE = 0.882	SG 4	0.946	0.946	0.01	91.023
Internal Control Factors (ICFs)					
VIF = 3.012	ICFs 1	0.913	0.912	0.037	24.709
rho A = 0.950					
Cronbach's α = 0.948	ICFs 2	0.948	0.949	0.009	105.111
Composite Reliability = 0.963	ICFs 3	0.941	0.941	0.012	81.116
AVE = 0.866	ICFs 4	0.919	0.919	0.014	63.682
External Control Factors (ECFs)					
VIF = 3.012	ECFs 1	0.945	0.945	0.013	72.53
rho A = 0.968					
Cronbach's α = 0.967	ECFs 2	0.956	0.955	0.014	66.937
Composite Reliability = 0.976	ECFs 3	0.969	0.969	0.007	138.246
AVE = 0.911	ECFs 4	0.948	0.948	0.011	86.715
Attitude (AT)					
VIF = 1.436	AT1	0.973	0.972	0.007	148.466
rho A = 0.985	AT2	0.967	0.967	0.007	141.058
Cronbach's α = 0.985	AT3	0.968	0.968	0.008	114.208
Composite Reliability = 0.988	AT4	0.974	0.974	0.006	149.867
AVE = 0.942	AT5	0.97	0.969	0.007	129.35
Subjective Norm (SN)					
VIF = 1.436	SN1	0.945	0.945	0.009	106.95
rho A = 0.965					
Cronbach's α = 0.965	SN2	0.949	0.949	0.009	108.48
Composite Reliability = 0.974	SN3	0.954	0.954	0.008	117.896
AVE = 0.904	SN4	0.955	0.955	0.009	106.552
Perceived Behavioral Control (PBC)					
VIF = 1.257	PBC1	0.858	0.858	0.021	41.55
rho A = 0.908					
Cronbach's α = 0.903	PBC2	0.92	0.92	0.011	82.342
Composite Reliability = 0.932	PBC3	0.884	0.884	0.022	40.776
AVE = 0.775	PBC4	0.858	0.856	0.029	30.055
COVID-19 Behavioral Intention (COBI)					
Cronbach's α = 0.976	COBI 1	0.96	0.96	0.011	85.304
rho A = 0.976	COBI 2	0.95	0.95	0.018	52.486
Composite Reliability = 0.982	COBI 3	0.978	0.978	0.006	171.683
AVE = 0.932	COBI 4	0.974	0.974	0.006	165.842

Note: Both standard deviation and t-values are for loadings, VIF < 5; AVE: Average variance extracted.

Table 2. Correlation among constructs and the square root of the AVE (n = 339).

	PEOU	PU	PG	SG	ICFs	ECFs	AT	SN	PBC	COBI
Perceived Ease of Use (PEOU)	0.888									
Perceived Usefulness (PU)	0.888	0.95								
Primary Group (PG)	0.581	0.613	0.935							
Secondary Group (SG)	0.486	0.571	0.736	0.939						
Internal Control Factors (ICFs)	0.562	0.535	0.506	0.452	0.93					
External Control Factors (ECFs)	0.496	0.464	0.423	0.401	0.817	0.954				
Attitude (AT)	0.586	0.61	0.515	0.46	0.361	0.296	0.97			
Subjective Norm (SN)	0.55	0.513	0.555	0.508	0.495	0.449	0.472	0.951		
Perceived Behavioral Control (PBC)	0.382	0.378	0.395	0.4	0.498	0.468	0.335	0.426	0.88	
COVID-19 Behavioral Intention (COBI)	0.445	0.498	0.404	0.452	0.473	0.45	0.372	0.465	0.536	0.966

Note: S.D.: standard deviation; the shaded numbers in the diagonal row are square roots of the average variance extracted (AVE).

6.2. Structural Model Analysis of Research Framework

The statistical analysis results of all samples of 339 employees in the structural formula of this research show that hypotheses H1 to H9 are true (refer to Figure 2 and Table 3). The research results show that the beliefs of the PEOU (H1) and the PU (H2) of hospital staff are positively and significantly correlated with "attitude," and the belief of the PU has a greater impact on "attitude" than the PEOU (PEOUβ = 0.423 *** > Puβ = 0.21 **). Both the PG (H3) and SG (H4) beliefs of hospital staff have a positive and significant correlation with the "subjective norm," and the influence of PG on "subjective norm" is greater than that of SG (PGβ = 0.396 *** > SGβ = 0.217 **). Hospital staff's ICFs (H5) and ECFs (H6) beliefs both showed a positive and significant correlation with "perceived behavioral control," and the influence of ICFs on "perceived behavioral control" is greater than that of ECFs (ICFsβ = 0.347 *** > ECFsβ = 0.184 *). In addition, the "attitude" (H7), "subjective norm" (H8), and "perceived behavioral control" (H9) of hospital staff are all important to the "behavioral intention" and showed a positive significant correlation, and the influence of "perceived behavioral control" on "behavioral intention" in promoting green hospital is greater than those of "subjective norm" or "attitude" (PBCβ = 0.392 *** > SNβ = 0.238 *** > ATβ = 0.129 **). Therefore, it could be inferred that the hospital should initially overcome the control barrier of the "perceived behavioral control" factor in promoting green hospital policy; particularly in promoting the ICFs of hospital employees, then establish publicity and supervision based on the PG of the "subjective norm" (the green hospital promotion department of the hospital and related business government departments). Lastly, hospitals should often promote the "perceived usefulness" benefits that the promotion of green hospitals can be expected to bring.

Table 3. Research model assumptions established by different intra-organizational stakeholders.

Hypotheses		All	Result	M1_ADM	M2_DOC	M3_NUR	M4_MED	M5_OTH
H1	PEOU → AT	0.210 (*2.095*) *	Support	0.491 ***	0.304 $^{n.s.}$	−0.072 $^{n.s.}$	0.268 $^{n.s.}$	0.449 $^{n.s.}$
H2	PU → AT	0.423 (*4.309*) ***	Support	0.167 $^{n.s.}$	0.350 $^{n.s.}$	0.709 ***	0.308 $^{n.s.}$	0.173 $^{n.s.}$
H3	PG → SN	0.396 (*5.936*) ***	Support	0.211 $^{n.s.}$	0.620 ***	0.453 ***	0.067 $^{n.s.}$	0.563 **
H4	SG → SN	0.217 (*3.401*) **	Support	0.441 ***	0.155 $^{n.s.}$	0.137 $^{n.s.}$	0.448 *	0.110 $^{n.s.}$
H5	ICF → PBC	0.347 (*4.269*) ***	Support	0.318 *	0.318 $^{n.s.}$	0.271 $^{n.s.}$	0.374 $^{n.s.}$	0.537 $^{n.s.}$
H6	ECF → PBC	0.184 (2.339) *	Support	0.071 $^{n.s.}$	0.368 $^{n.s.}$	0.258 $^{n.s.}$	0.198 $^{n.s.}$	−0.052 $^{n.s.}$
H7	AT → COBI	0.129 (*2.638*) **	Support	0.251 $^{n.s.}$	0.289 $^{n.s.}$	0.055 $^{n.s.}$	0.406 $^{n.s.}$	0.163 $^{n.s.}$
H8	SN → COBI	0.238 (*3.680*) ***	Support	0.221 $^{n.s.}$	0.025 $^{n.s.}$	0.299 ***	−0.261 $^{n.s.}$	0.421 $^{n.s.}$
H9	PBC → COBI	0.392 (*6.518*) ***	Support	0.394 *	0.489 $^{n.s.}$	0.460 ***	−0.063 $^{n.s.}$	0.251 $^{n.s.}$

Notes: (1) n.s. = not significant. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. The italic numbers inside the ( ) are the t value. (2) Perceived Ease of Use (PEOU); Perceived Usefulness (PU); Primary Group (PG); Secondary Group (SG); Internal Control Factors (ICFs); External Control Factors (ECFs); Attitude (AT); Subjective Norm (SN); Perceived Behavioral Control (PBC); COVID-19 Behavioral Intention (COBI). (3) M1_ADM: medical administrators, M2 DOC doctors, M3_NUR nursing staff, M4-MED medical examination, and medical personnel (pharmacists, laboratory technicians, radiologists, etc.), and M5_OTH other outsourced personnel (waste disposal, catering services, security personnel, etc.)

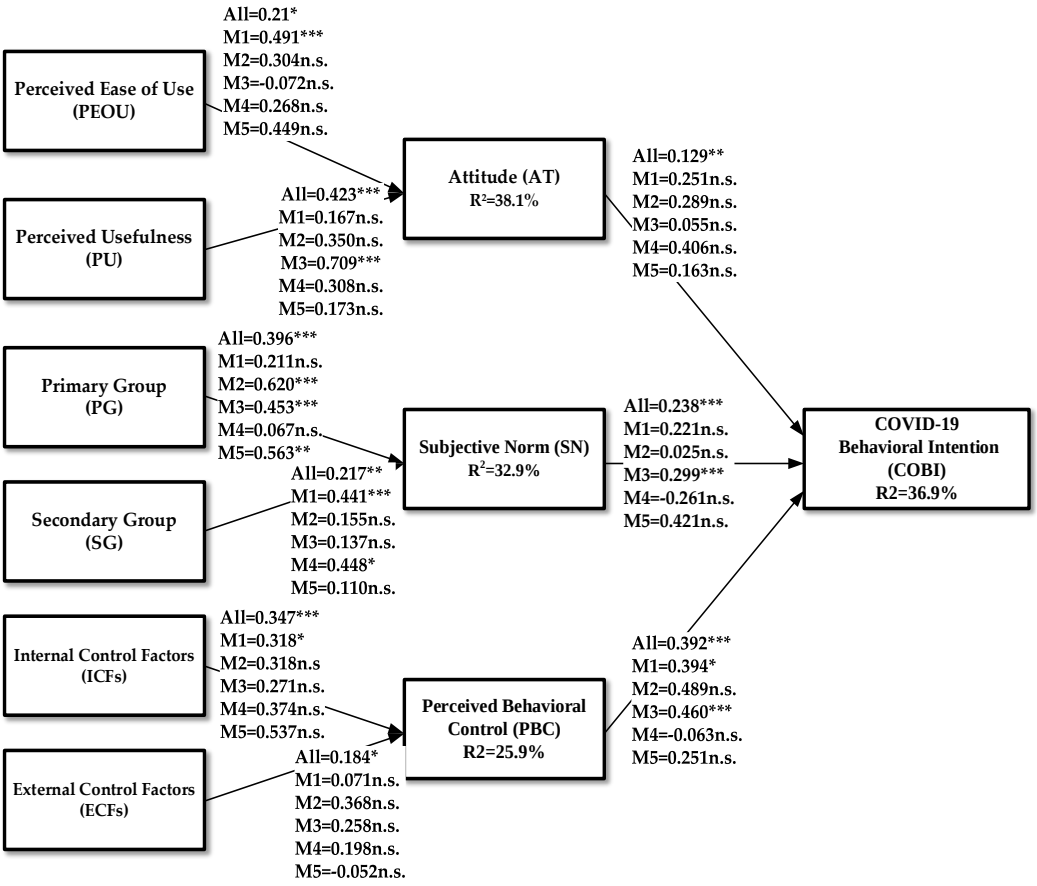

Figure 2. The SEM of research model. Notes: n.s. = not significant. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

6.3. Comparative Analysis of Structural Models of Different Intra-Organizational Stakeholders

Hypothesis 10 of this study was postulated to explore the significant differences in the behavioral intention patterns of different intra-organizational stakeholders for promoting green healthcare by the TPB. Therefore, this study divided hospital staff into five stakeholder groups to compare the research structure model: Mode 1 (M1) represents "medical administrators" (n = 45), Mode 2 (M2) represents "doctors" (n = 32), Mode 3 (M3) represents "nursing staff" (n = 196), Mode 4 (M4) represents "medical examination and medical personnel" (n = 35), and mode 5 (M5) represents "other outsourced personnel" (n = 31). According to Figure 2 and Table 3, the following nine pathways were identified (all pathways are assumed amid COVID-19 pandemic conditions):

1. Pathway H1 (PEOU → AT): Among the different intra-organizational stakeholders, only "medical administrators" (M1 = 0.491 ***) believed in the PEOU for promoting green hospitals; there was a positive and significant correlation with "attitude (AT)" and the rest were not significant.
2. Pathway H2 (PU → AT): Among the different intra-organizational stakeholders, only "nursing staff" (M3 = 0.709 ***) believed in PU for promoting green hospitals through AT showed a positive and significant correlation, and the rest were not significant.
3. Pathway H3 (PG → SN): Among the different intra-organizational stakeholders, "doctors" (M2 = 0.620 ***), "nursing staff" (M3 = 0.453 ***), and "other outsourced personnel" (M5 = 0.563 **) showed a positive and significant correlation with the "subjective norm (SN)" for the PG belief in promoting green hospitals, among which "physician" (M2 = 0.620 ***) had the most significant effect.
4. Pathway H4 (SG → SN): Among the different intra-organizational stakeholders, "medical administrators" (M1 = 0.441 ***) and "medical examinations and medical personnel" (M4 = 0.448 *) were the most important in promoting green hospitals' SG

beliefs and showed a positive and significant correlation with the SN among which "medical administrators" (M1 = 0.441 ***) had the most significant effect.

5. Pathway H5 (ICFs → PBC): Among the different intra-organizational stakeholders, only "medical administrators" (M1 = 0.318 *) believe in ICFs promoting green hospitals through "perception behavioral control (PBC)" showed a positive and significant correlation, while the rest had no significant correlation.
6. Pathway H6 (ECFs → PBC): Any group of employees among the different intra-organizational stakeholders has a strong impact on the beliefs of ECFs that promote green hospitals, and PBC showed a positive correlation; however, the correlation was not significant.
7. Pathway H7 (AT → COBI): The "COVID-19 behavioral intention (COBI)" of any group of employees in promoting green hospitals is positively affected by AT, but the effect was not significant for any group.
8. Pathway H8 (SN → COBI): Among the different intra-organizational stakeholders, only "nursing staff" (M3 = 0.299 ***) had the COBI for promoting green hospitals, which was positively and significantly affected by the SN and the rest were not significant.
9. Pathway H9 (PBC → COBI): Among the different intra-organizational stakeholders, "medical administrators" (M1 = 0.394 *) and "nursing staff" (M3 = 0.460 ***) were the most important in promoting green hospitals. Their COBI was positively and significantly affected by PBC among which "nursing staff" (M3 = 0.460 ***) was more significant.

Overall, we found that "medical administrators" (M1) and "nursing staff" (M3) had a higher proportion of each hypothesized significant effect, with four significant effects each. Therefore, we conclude that these two groups play a key role in determining the success or failure of the hospital's promotion of the green hospital policy. "Medical administrators" (M1) are the implementers of the hospital's green hospital policy, and "nursing staff" (M3) account for the largest proportion of hospital staff and are the first-line green hospital policy implementers.

7. Discussion

The results of this study are similar to those of Shen (2015 and 2019) and Widianto et al. (2021) in applying TPB theory to healthcare-related research [14,15,49]. The studies on the application of TPB theory to environmental behavior are related to Yuryev et al., Taylor and Todd, Li et al., Banjarnahor et al., AlQudah et al., Akman and Mishra, Anser et al., Chen et al., Tsaur and Lin, and Yoon, which disclosed the same results [20,27,34–36,40–43,50], confirming that the TPB hypothetical model in this study has explanatory power. The contributions of this study to promoting green hospital policies are as follows.

First of all, the three dimensions of AT, SN, and PBC had significant impacts on the behavioral intention of employees in the hospital to promote green hospitals. PBC (β = 0.392 ***) was greater than SN (β = 0.238 ***) and SN was greater than AT (β = 0.129 **). Therefore, in order to improve the green behavior willingness of employees, the hospital must first overcome the control obstacles of employees' PBC factors. The stronger the influence of PBC, the stronger the promotion behavior of green hospital policy. Among factors of PBC, ICFs (β = 0.347 ***) had a greater indirect impact on the behavioral intention of green hospitals than ECFs (β = 0.184 *). This study suggested that hospital-policy makers should "strengthen the environmental protection expertise of green hospital employees", "reward and publicize hospital employees to develop environmental protection concepts and behaviors", "enhance employees' willingness and execution ability to cooperate with green hospital policy promotion", and "enhance employees' personal professional knowledge, ability, time, environmental protection concepts, and behaviors", etc.

Second, among the SN factors that promote green hospital employees, PG (β = 0.396 ***) was greater than SG (β = 0.217 **). This demonstrated the importance of the hospital's green hospital policy promotion department and relevant government departments' business

management. In this study, the hospital employees recognized that PG establishing a closely linked green hospital management system was a key and important factor for the implementation of green hospital policies.

Third, from the attitude factors of the hospital employee, PU (β = 0.423 ***) was greater than PEOU (β = 0.21 **) in the promotion of green hospital policy. This study suggests that hospital management units should be more active in publicizing the concept of the perceived usefulness of green hospitals. For example, propagating green hospital policies is "in line with world trends and development trends", "helps enhance environmental protection awareness and be a global citizen", "friendly work and medical environment", "improve medical quality and hospital image", and "help hospitals' business performance and sustainable development".

Fourth, the study disclosed that medical administrators (M1) and nursing staff (M3) accounted for a higher proportion of each hypothetical significant effect. Each M1 and M2 had four significant effects, indicating that these two groups had significant effects in promoting green hospitals. This meant that the M1 group, which was the promotion and management unit of the green hospital, and the M3 group, which was the front-line hospital with the largest number of people implementing the green hospital policy, were the key roles in determining the success or failure of the hospital's promotion of the green hospital policy. However, due to their different roles, the two groups focused on different sub-facets. In AT dimension, the M1 group emphasized sub-facet PEOU (β = 0.491 ***) and the M3 group emphasized sub-facet PU (β = 0.709 ***). In terms of SN dimension, the M1 group emphasized sub-facet SG (β = 0.441 ***) and the M3 group emphasized PG (β = 0.453 ***). In the PBC part, the M1 group emphasized ICFs (β = 0.318 ***), while the M3 group showed no significance on ICFs and ECFs. In order to improve the behavioral intention of employees to promote green hospitals in the hospital, and to promote the consensus between the M1 group and the M3 group, it is the primary task to promote the green hospital policy, and then extend it to all hospital employees, in addition to exploring green behavioral intentions based on these five major groups within the hospital: avoid harm, protect, work sustainability, influence others, and take initiative [51]. More influences from organizational development and organizational sustainability education could be discussed in depth in the future.

8. Conclusions and Policy

The first contribution of this study was to compare and analyze differences in behavioral decision-making among hospital employees of different job attributes in promoting a green hospital TPB integration model from the perspective of stakeholders within different organizations during the COVID-19 epidemic. The second contribution was to re-verify that TPB applied to behavioral decision science can be widely applied to behavioral decision-making in different fields, especially in the field of environmental decision-making behavior, and has reliable explanatory power. The following is an explanation of the macroscopic aspect of policy and the microscopic aspect of organizational implementation based on the results of this study.

From a macro perspective, since 2016, the promotion of Taiwan's green hospital policy has been stagnant, and the COVID-19 pandemic has made the promotion of green medical care even worse, and research on green hospitals in Taiwan is even more scarce. The implementation of this research once again calls on the Taiwanese government to pay more attention to the implementation of the green hospital policy. Through this finding, we could more actively establish a green hospital environmental management system platform based on green hospital evaluation indicators and cross-ministerial committees, establish an integrated green medical human resource management system, implement green medical-education, and formulate an assessment and reward system, as well as regularly conduct green performance assessments for each hospital. In addition, Taiwan's medical industry needs to expand the medical climate footprint control systems in line with international standards (for example, linking with the United Nations Sustainable

Development Goals SDGs). Taiwan's medical industry can promote the research and development of green technology (such as recycling, water purification, sewage treatment, environmental remediation, management of flue gas, the technology of pollutant emission control, and alternative clean and renewable energy). To ensure ecological sustainability, policymakers should also consider the moderating effects of imposing environmental taxes (green taxes) on other key factors such as energy use behavior, energy consumption sources, and green technologies [37–39]. Make Taiwan's entire medical industry supply chain gradually decarbonize to achieve the best goal of sustainable development of the healthcare industry [52–54].

From a microscopic perspective, Xu et al. [55] disclosed that when hospital leaders formulate environmental leadership strategies, they can enhance the awareness of green organizations and strengthen employees' green innovation behaviors. A green organizational atmosphere can strengthen the intermediary relationship. Dreyer et al. emphasized that the development of sustainable organizational culture through organizational change will effectively improve employees' individual and collective green behaviors [56]. Therefore, strengthening the organization's green innovation through the transformation of the hospital's environmental leadership can bring about a new green organizational culture and create higher green management performance. Hospitals can reduce electricity consumption for equipment such as air conditioners, encourage different organizational stakeholders to commute to get off work by low-carbon transport (e.g., MRT) or on foot, use local ingredients, reduce food transportation, achieve carbon reduction, resource recycling, and other specific measures, supplemented by the establishment of a reward and punishment system in the hospital. In the future, there will be more research and development space to make up for the relative lack of green hospital research.

9. Limitations

Although TPB is widely used in different academic fields, there is currently no single theoretical framework that can explain all behavioral changes. The TPB behavioral theory framework focuses on rational reasoning, and excluding effects may limit its interpretation of whether hospital employees are responsible for green hospital performance. In addition, this study only focuses on one regional hospital, and the study should be extended to all hospitals in Taiwan, and even hospitals at different levels will be restricted.

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