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Exploratory examination of environmental protection behaviors in a hospital setting using the theory of planned behavior and ethical leadership

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Abstract

Most research focused on understanding the general environmental awareness or attitudes around the world, targeting residents, students, or undergraduates. There were limited attempts to understand the environmental protection behaviors in Taiwan healthcare sector. A questionnaire survey was designed with current healthcare personnel in Taiwan as target population. From the theory of planned behavior and ethical leadership, structural equation modelling allowed a better explanation of the social-psychological indicators affecting environmental protection behaviors in the healthcare sector. Attitude, subjective norms and perceived behavioral control are positively impacted by ethical leadership. Environmental protection behavior is significantly influenced by environmental protection intention, while environmental protection intention is strongly affected by perceived behavioral control which is the strongest predictor, followed by attitude. However, there is insignificant correlation of subjective norms to environmental protection intention, due to the weak social connection among healthcare personals, especially with the heavily burdened workload and restrictive measure during the COVID-19 crisis in a hospital environment.

1. Introduction

Within the United Nations Sustainable Development Goals, health and well-being (Goal 3), sustainable cities and communities (Goal 11), as well as sustainable production and consumption (Goal 12), formed the global framework for addressing sustainable healthcare and environmental protection. The healthcare sector worldwide needed to adapt to this new reality of sustainability, increasing its emphasis towards strengthening environmental protection.

Many researches had conducted surveys to understand the perception of different groups in various regions regarding environmental protection, including residents in different parts of mainland China [1–3] and Macau [4, 5], other countries in Asia and Middle East [6–9] as well as America and Europe [10–12]. Other than the general public, middle and high school students were another group of highly surveyed audience, across Asia [13–15], Middle East [16–19] and Europe [20–22]. The next group of targeted respondents was university undergraduates, located in countries from North America, Europe, Middle East and Asia [23–29]. Lastly, the hospitality sector was an interesting area of concern although limited research was performed [30, 31]. However, focus on the healthcare sector was fairly limited.

From the theory of reasoned action [32] and the theory of planned behavior [33] behavioral theories predicted that people’s behavior was determined by their intention, which was in turn influenced by their attitude, subjective norms and perceived behavioral control. Since the development of the above theories, they had been applied to predict and explain various behaviors, from fat intake, weight control, academic integrity to

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consumer behavior. In recent years, the theory of planned behavior had been actively employed in environmental protection \[34, 35\], ranging from choosing green services in the hospitality sector \[36–41\], purchasing green products \[42–48\], recycling behaviors \[49–56\], pollution reduction \[57, 58\], green commuting \[59, 60\] to energy saving \[61, 62\].

From a philosophical viewpoint and the social learning theory, the concept of ethical leadership was formed and defined as ‘the demonstration of normatively appropriate conduct through personal actions and interpersonal relationships, and the promotion of such conduct to followers through two-way communication, reinforcement and decision-making’ \[63, 64\]. In recent years, ethical leadership was defined as ‘having the personal characteristics, behaviors, decision making attitudes that are centered on morality and moral management of others, in an organization’ \[65\]. Ethical leadership played a growing role in incorporating environmental protection \[66, 67\], increasing green innovation \[68\] and strengthening social responsible behaviors \[69–71\].

The combination of other theories and theory of planned behavior \[37–39\] or expanding the theory of planned behavior \[50, 52–54\] in the field of environmental protection was an emerging field of research. At the same time, the field of ethical leadership was broad and developing. Although uncommon, attempts were made to bridge ethical leadership and the theory of planned behavior \[72–74\]. The focus of this research aimed to apply the theory of planned behavior and ethical leadership to determine the factors influencing the adoption of environmental protection behaviors in a hospital setting.

2. Materials and methods

2.1. Research hypothesis

From the literature reviewed, most research focused on understanding the general awareness or attitude toward environmental protection around the world, targeting mostly residents, students or undergraduates. There were limited attempts to understand the factors influencing environmental protection behaviors and the consequences of their actions in Taiwan healthcare sector.

With reference to Fishbein and Ajzen \[32\], Ajzen \[33\] as well as Saxena and Prasad \[74\], the following hypotheses (as shown in figure 1) under the context of environmental protection behaviors in the healthcare sector were proposed:

**Hypothesis 1.** Ethical leadership had a positive correlation to the attitude, subjective norms and perceived behavioral control regarding environmental protection behaviors in a hospital setting.

**Hypothesis 2.** Attitude, subjective norms and perceived behavioral control had a positive correlation to environmental protection intention, which in turn had a positive correlation with environmental protection behaviors in a hospital setting.

2.2. Questionnaire survey and data collection

Data were collected from a questionnaire survey conducted in order to test the hypotheses. The target population of the survey was current healthcare personnel in Taiwan, which would include medical doctors, nurses, other medical staffs and administrative staff. As of Year 2020, there were about 338,000 medical
personnel in Taiwan according to the Ministry of Health and Welfare [75]. Assuming that the non-medical personnel within the healthcare sector made up a quarter of all working personnel, the size of the target population should be around 450,000.

The questionnaire survey was performed online using SurveyCake, which was commonly used as a survey platform in Taiwan. This online survey platform was easy to use to the healthcare sector with enabled 'required questions', ensuring no missing answers. The design of the survey underwent a pre-test of 20 personnel to assess its validity and identify unresolved ambiguities. The content of the survey was later modified based on feedback obtained. The survey was widely distributed among the healthcare sectors using social media and instant communications app, from August to October 2021. Data screening were conducted and duplicated or invalid responses were deleted to ensure data quality.

Due to the Covid-19 pandemic leading to a huge increase in workload of personnel in the healthcare sector, in total 202 completed answer forms were collected, yielding a 5.8% margin of error at 90% confidence level, using equation (1),

\[
n = \frac{z^2p(1 - p)N}{e^2N + z^2p(1 - p)}
\]

where \( n \) was the sample size, \( N \) was the population size, \( e \) was the margin of error, \( z \) was \( z \)-score according to desired confidence level, while \( p \) was the population proportion related to the survey and was usually given a value of 0.5. Furthermore, the sample size satisfied the \( n/q \) rule of the analytic method of Structural equation Modelling having a value within 5 to 20 [76], where \( n \) was the sample size and \( q \) was the number of parameters to be estimated.

The survey used in this study consisted of two sections, with a total of 32 questions. The first section had a total of five questions, collecting basic demographic data (as shown in table 1) which included gender, age, education level, monthly income level and nature of job. The second section had a total of twenty-seven questions regarding ethical leadership, attitude, subjective norms, perceived behavioral control, intention and behavior of respondents.

| Table 1. Characteristics of sample. |
| Variables | \( n = 202 \) | Percentage |
| Gender | | |
| Male | 48 | 23.8% |
| Female | 152 | 75.2% |
| Declined to disclose | 2 | 1.0% |
| Age | | |
| \( \leq 20 \) | 0 | 0% |
| 21–30 | 32 | 15.8% |
| 31–40 | 52 | 25.7% |
| 41–50 | 62 | 30.7% |
| 51–60 | 40 | 19.8% |
| > 60 | 16 | 7.9% |
| Education level | | |
| High school and below | 9 | 4.5% |
| Bachelor’s degree | 140 | 69.3% |
| Masters and PhD | 53 | 26.2% |
| Monthly income level | | |
| \( \leq \) NTD50,000 | 109 | 54.0% |
| NTD50,001 to 80,000 | 68 | 33.7% |
| NTD80,001 to 120,000 | 7 | 3.5% |
| > NTD120,000 | 18 | 8.9% |
| Nature of job | | |
| Doctors | 21 | 10.4% |
| Nurses | 85 | 42.1% |
| Other Medical Staffs | 24 | 11.9% |
| Admin Staffs | 72 | 35.6% |
Each construct consisted of four to seven items, as shown in Table 2, where all items were rated based on a five-point Likert scale, where 1 referred to ‘strongly disagree’ or ‘never’ and 5 referred to ‘strongly agree’ or ‘always’. Measures of subjective norms, perceived behavioral control and intentions were modified from previous studies [36, 41, 43, 44, 54] while measures of environmental awareness, ethical leadership, attitude and environmental protection behaviors were created based on previous studies [36, 43, 54, 61, 62] and discussion with personnel involved with environment protection policies in hospitals. For example, ‘EA8 Environment protection is everyone’s duty’ under the environmental awareness construct, attempted to understand whether respondents were aware of the above item. ‘AT2 I will protect our Earth’s environment’ was the next step under the environmental attitude construct, to understand if respondents agreed with this item; respondents might be aware of this item but disagreed with it. This was further followed by ‘INT3 I intend to protect the environment’ under the environmental protection intention construct, to understand respondents’ intention to practice this item; respondents might be aware and agreed with this item, but with no intention to practice it. Finally, the intention and behavior of environmental protection explored the link between the intention to spend money to protect the environment (INT1) and eat a plant-based diet instead of meat and plant-based diet (EPB7); in Taiwan, plant-based diet was more expensive. Similarly, the link between the intention to spend time to protect the environment (INT2) and taking the stairs instead of using the elevator when walking up/down three floors (EPB3), sorting my rubbish according to regulations (EPB5), walking or cycling for distances less than a kilometer (EPB6) were explored.

### Table 2. List of constructs.

| Item | Question | References |
|------|----------|------------|
| **Ethical Leadership** | | [43] |
| EL1 | My supervisor believed that environmental protection is very important. | |
| EL2 | My supervisor believed that environmental protection is an ethical issue. | |
| EL3 | The actions of my supervisor affect me. | |
| EL4 | My supervisor supported me in concerning about environmental protection. | |
| **Attitude** | | [48, 54] |
| AT1 | I believe that environmental protection is very important. | |
| AT2 | I will protect our Earth’s environment. | |
| AT3 | Environmental protection gives plants a better environment to grow. | |
| AT4 | Green products benefit the environment. | |
| **Subjective Norms** | | [41, 43, 54] |
| SN1 | My friends and family supported me in concerning about environmental protection. | |
| SN2 | My friends and family are concerned about environmental protection. | |
| SN3 | My friends and family supported me in adopting environmental protection behaviors. | |
| SN4 | My friends and family’s ethical behaviors are important to me. | |
| **Perceived Behavioral Control** | | [36, 44, 54] |
| PBC1 | I have limitless potential in protecting the environment. | |
| PBC2 | I have sufficient time to protect the environment. | |
| PBC3 | I am confident that if I want, I can protect the environment. | |
| PBC4 | It is mostly up to me whether I adopt environmental protection behaviors. | |
| **Environmental Protection Intention** | | [36, 50, 76] |
| INT1 | I am willing to spend my money to protect the environment. | |
| INT2 | I am willing to use my time to protect the environment. | |
| INT3 | I intend to protect the environment. | |
| INT4 | I am glad to adopt environmental protection behaviors. | |
| **Environmental Protection Behavior** | | [54, 61, 62] |
| EPB1 | I switch off lights and other electrical appliances when not in use. | |
| EPB2 | I use reusable bags instead of disposable bags. | |
| EPB3 | I take the stairs instead of using the elevator when walking up/down less than three floors. | |
| EPB4 | I use reusable eating utensils instead of disposable eating utensils. | |
| EPB5 | I sort my rubbish according to regulations. | |
| EPB6 | I walk or cycle for distances less than a kilometer. | |
| EPB7 | I eat a plant-based diet instead of meat and plant-based diet. | |
2.3. Statistical processing

To analyze the collected data, descriptive statistics and structural equation modelling were carried out. Structural equation modelling was a statistical methodology used in an attempt to establish causal relationships among constructs, allowing a simple visualization of the influences of social psychological factors on environmental protection behaviors in a hospital setting.

The two major software used were SPSS 25.0 and Amos 20.0. Firstly, the internal consistency reliability and construct validity were examined. Secondly, a confirmatory factor analysis model was performed in order to determine an adequate measurement model. The Maximum Likelihood method were used to estimate the models while covariances were determined among all exogenous variables and control variables as well as tested with the bootstrap approach [77]. The overall model fit was measured by commonly used fit indices in literature: the model chi-square ($\chi^2$) [54, 59–62, 69, 70, 72], the standardized root mean square residual (SRMR) [54, 59, 70, 72, 73], the root mean square error of approximation (RMSEA) [54, 59–62, 69, 70, 72, 73], the goodness of fit (GFI) [54, 61, 62, 69], the Tucker and Lewis index (TLI) [54, 59, 62, 70] and the comparative fit index (CFI) [54, 59, 62, 69, 70, 72, 73].

### Table 3. Mean, standard deviation, skewness and kurtosis.

| Item | Mean | S.D. | Skewness | Kurtosis |
|------|------|------|----------|----------|
| EL1  | 3.78 | 0.812| −0.032   | −0.436   |
| EL2  | 3.58 | 0.879| 0.089    | −0.330   |
| EL3  | 3.72 | 0.968| −0.647   | 0.302    |
| EL4  | 3.71 | 0.791| 0.145    | −0.403   |
| AT1  | 4.68 | 0.489| −1.024   | 4.416    |
| AT2  | 4.57 | 0.534| −0.696   | −0.719   |
| AT3  | 4.66 | 0.474| −0.697   | −1.530   |
| AT4  | 4.55 | 0.654| −1.714   | 4.416    |
| SN1  | 3.86 | 0.727| −0.096   | −0.441   |
| SN2  | 3.78 | 0.799| −0.590   | 0.731    |
| SN3  | 3.98 | 0.729| −0.117   | −0.694   |
| SN4  | 4.08 | 0.725| −0.683   | 1.190    |
| PBC1 | 4.03 | 0.785| −0.302   | −0.684   |
| PBC2 | 3.76 | 0.826| −0.592   | 0.783    |
| PBC3 | 4.18 | 0.647| −0.195   | −0.665   |
| PBC4 | 4.14 | 0.706| −0.460   | −0.024   |
| INT1 | 4.00 | 0.760| −0.756   | 1.510    |
| INT2 | 4.13 | 0.659| −0.149   | −0.710   |
| INT3 | 4.38 | 0.579| −0.280   | −0.720   |
| INT4 | 4.36 | 0.655| −0.526   | −0.685   |
| EPB1 | 4.22 | 0.756| −0.884   | 1.123    |
| EPB2 | 3.73 | 0.902| −0.554   | −0.009   |
| EPB3 | 3.62 | 1.064| −0.465   | −0.679   |
| EPB4 | 4.17 | 0.882| −1.040   | 0.743    |
| EPB5 | 4.40 | 0.748| −1.155   | 0.983    |
| EPB6 | 3.59 | 1.117| −0.453   | −0.524   |
| EPB7 | 3.60 | 1.339| −0.390   | −1.202   |

Note: S.D. refers to standard deviation.

### Table 4. Goodness of fit.

| Parameters | Desirable range | CFA | SEM |
|------------|----------------|-----|-----|
| $\chi^2$   |                | 410.832***| 410.973*** |
| DF         |                | 215  | 219 |
| $\chi^2$/DF| ≤3.0           | 1.911| 1.877 |
| SRMR       | ≤0.08          | 0.0769| 0.0794 |
| RMSEA      | ≤0.08          | 0.067| 0.066 |
| GFI        | ≥0.90          | 0.852| 0.853 |
| TLI        | ≥0.90          | 0.901| 0.905 |
| CFI        | ≥0.90          | 0.916| 0.917 |

Note: ***p < 0.001.
3. Results and discussions

3.1. Statistical fitness

The relationship or influence between intention and behavior is a general assumption in psychology. In this study, intention and behavior each contained several items, and their connection could not be presented in direct correspondence between items and must pass statistical testing and logical discussion of variable. The structural equation modeling reported good overall fit to the data according to tables 3 and 4. All values of skewness and kurtosis were between $-3.0$ and $+3.0$ as well as $-10.0$ and $+10.0$ respectively [77] indicating normality. Values of fit statistics for the confirmatory factor analysis model had $\chi^2$ of 410.832 with 215 degrees of freedom ($p < 0.001$); $\chi^2$/DF = 1.911; SRMR = 0.0679; RMSEA = 0.067; GFI = 0.852; TLI = 0.901; CFI = 0.916. All values of the fit test were within the desirable ranges, except for GFI which was almost within desirable range but still acceptable [78, 79]. In addition, four items (AT4, INT3, EPB1 and EPB7) with low loading estimates ($<0.50$) were deleted to decrease measurement error, as shown in table 5.

The survey findings needed to be tested for reliability and validity. Cronbach’s alpha above 0.70 shows adequate reliability [77] and all constructs in this present study fulfilled this criterion, showing moderate or high internal consistency reliability, as shown in table 6. In the confirmatory factor analysis model, each construct was well qualified for structural regression models as each construct had at least three measures [77] modified from various references listed in table 2 and in-depth discussion with personnel involved with hospitals environment protection policies. All measures were significantly linked with the specified constructs ($p < 0.001$) with standardized regression weights larger than 0.5. Furthermore, the Kaiser-Meyer-Olkin test produced values greater than 0.70 for all constructs and each construct had only a single eigenvalue having value greater than 1, indicating good construct validity from exploratory factor analysis [80].

| Constructs                        | Measures | Standardized regression weights |
|-----------------------------------|----------|--------------------------------|
| Ethical Leadership                | EL1      | 0.910                          |
|                                   | EL2      | 0.623***                       |
|                                   | EL3      | 0.562***                       |
|                                   | EL4      | 0.928***                       |
| Attitude                          | AT1      | 0.802                          |
|                                   | AT2      | 0.850***                       |
|                                   | AT3      | 0.865***                       |
|                                   | AT4(deleted) | /                            |
| Subjective Norms                  | SN1      | 0.826                          |
|                                   | SN2      | 0.911***                       |
|                                   | SN3      | 0.536***                       |
|                                   | SN4      | 0.660***                       |
| Perceived Behavioral Control      | PBC1     | 0.796                          |
|                                   | PBC2     | 0.671***                       |
|                                   | PBC3     | 0.787***                       |
|                                   | PBC4     | 0.724***                       |
| Environmental Protection Intention| INT1(deleted) | /                              |
|                                   | INT2     | 0.794                          |
|                                   | INT3     | 0.782***                       |
|                                   | INT4     | 0.652***                       |
| Environmental Protection Behavior | EPB1(deleted) | /                             |
|                                   | EPB2     | 0.697                          |
|                                   | EPB3     | 0.541***                       |
|                                   | EPB4     | 0.384***                       |
|                                   | EPB5     | 0.352***                       |
|                                   | EPB6     | 0.323***                       |
|                                   | EPB7(deleted) | /                            |

Note: regression weights of EL1, AT1, SN1, PBC1, INT2 and EPB2 were assumed to be 1.000; ***$p < 0.001$. 
3.2. Effects of ethical leadership on attitude, social norms and perceived behavioral control

The standardized estimates were showed in figure 2. As shown in Table 5, the SEM fitted the data well according to model fit statistics, with χ² of 410.973 and 219 degrees of freedom (p < 0.001); χ²/DF = 1.877; SRMR = 0.0794; RMSEA = 0.066; GFI = 0.853; TLI = 0.905; CFI = 0.917.

Results showed that respondents held favorable views of ethical leadership, strong attitude, favorable subjective norm and strong perceived behavioral control of environmental protection in the healthcare sector as well as preference toward environmental protection intention and behaviors. Ethical leadership had a significantly positive correlation with attitude (β = 0.281, p < 0.001), subjective norms (β = 0.535, p < 0.001) and perceived behavioral control (β = 0.384, p < 0.001).

Results showed that ethical leadership had the strongest positive correlation with subjective norms, as informal pressure from supervisors was usually a positive force, especially during change management. The positive correlation of ethical leadership with attitude, subjective norms, and perceived behavioral control was evidenced, similar to existing literature [72–74]. Qin et al [72] surveyed workers from hotels and golf clubs in China and observed that ethical leadership improved workers’ customer-oriented behavior through their individual work attitudes. Saxena and Prasad [74] explored the relationship between ethical leadership and innovative work behavior through the theory of planned behavior. Discussion with respondents showed that supervisors’ views, supports and actions toward environmental protection influenced healthcare personals as the Taiwan healthcare working environment was predominating top-down managed, accounting for the strong positive correlation between ethical leadership and subjective norms. This was followed by perceived behavioral control where supervisors leading by examples allowed healthcare personals to realize that environmental protection was actionable. Lastly, the effect of ethical leadership on healthcare personals’ attitude was relatively weaker, possibly due to the low ranking of environmental protection on healthcare sector’s ethical values.

Table 6. Summary of latent variables.

| Constructs                     | Measures | Cronbach’s alpha coefficient | Kaiser- Meyer- OIkin values | Mean | S.D. |
|--------------------------------|----------|------------------------------|----------------------------|------|------|
| Ethical Leadership             | EL1-4    | 0.840                        | 0.739                      | 3.70 | 0.867|
| Attitude                       | AT1-3    | 0.875                        | 0.734                      | 4.64 | 0.501|
| Subjective Norms               | SN1-4    | 0.814                        | 0.802                      | 3.93 | 0.753|
| Perceived Behavioral Control   | PBC1-4   | 0.828                        | 0.751                      | 4.03 | 0.761|
| Environmental Protection Intention | INT2-4  | 0.787                        | 0.701                      | 4.29 | 0.641|
| Environmental Protection Behavior | EPB2-6 | 0.703                        | 0.728                      | 3.90 | 1.004|

Note: S.D. refers to standard deviation.
observations were exploratory and different from Qin et al [72]; more research needed to be further conducted before more conclusive findings could be determined.

3.3. Application of theory of planned behavior on environmental protection behaviour

Attitude ($\beta = 0.177, p < 0.01$) and perceived behavioral control ($\beta = 0.928, p < 0.001$) were positively related to the intention of environmental protection behavior. Intention ($\beta = 0.439, p < 0.001$) had a significantly positive relationship with behaviors. But, the relationship between subjective norm ($\beta = -0.041, p > 0.05$) and intention was found to be non-significant.

Results were consistent with previous studies, except for the role of subjective norms. It was worth highlighting that previous research had showed that situations with weak social connection did weaken the role of subjective norms. Within the hospitality industry, Chou et al [37] attempted to include the innovation adoption theory with the theory of planned behavior to determine factors affecting behavioral decision on adopting green practices in the food and beverage industry in Taiwan. Results showed that attitude and perceived behavioral control had positive correlation to behavioral intention while the correlation of social norm was limited. Perceived innovation characteristics were also found to have direct positive correlation to the attitude and indirect positive impacts on behavioral intention.

Du and Pan [54] attempted to incorporate the role of personal moral norm into the theory of planned behaviors, to understand their effects on energy saving behaviors among postgraduates staying in dormitory in universities in Hong Kong. Energy saving behavior was found to be strongly influenced by intention, while intention was significantly affected by personal moral norm, followed by perceived behavioral control and attitude. However, intention was not significantly affected by subjective norm. Within student hostels with mostly single rooms, students lacked social interaction which led to a non-significant role of subjective norms within the issue of energy saving behavior.

Wang et al [62] included personal moral norm, habit and positive anticipated emotion into the theory of planned behavior in order to understand household electricity saving behavior in China. Results showed that personal moral norm and habit were important and positively linked to electricity saving behavior, while positive anticipated emotion was important but negatively linked. Furthermore, electricity saving behaviors at home outside the social interactions of friends, also led to a non-significant role of subjective norms. The targeted respondents were personnel working in the healthcare sector in Taiwan, heavily burdened with workload especially during the Covid-19 crisis. Due to the heavy workload and restrictive measures, doctors and nurses shared that personals usually managed their own schedules in the hospitals and reduced engagement of other medical related functions. Environmental protection normally did not rank high on the list. Supervisors leading by example, out of ethical consideration, in exhibiting environmental protection behaviors were found to have positive correlation with the attitude, subjective norms and perceived behavioral control of healthcare personnel.

3.4. Respondents’ attitude and behavior on environmental protection

In the issue of attitude towards environment protection, as seen in table 3, the mean values were all above 4.5, showing a very strong and positive attitude. In the area of environmental protection behavior, the mean values ranged from 3.59 to 4.40. In ‘EPB6, I walk or cycle for distances less than a kilometer’, with a mean of 3.59, the convenience of public transport and motorcycles in Taiwan showed an alternative way of environmental friendliness. ‘EPB7, I eat a plant-based diet instead of meat and plant-based diet’, with a mean of 3.60, was a relatively new environmental protection behavior which affected one’s personal choice and still faced uphill struggles during promotion. In ‘EPB3, I take the stairs instead of using the elevator when walking up/down less than three floors’, with a mean of 3.62, respondents shared that the working nature of a hospital required personnel to be constantly walking or standing, leading to a lower inclination to take the stairs.

‘EPB2, I use reusable bags instead of disposable bags’, with a mean of 3.73, it was observed that the widespread adoption of online food and grocery delivery changed the eating behavior of respondents, from purchasing food from stores within the hospital to ordering food outside of hospital to be delivered; the later eating behavior had no opportunity to use reusable bags. This was in contrast with ‘EPB4, I use reusable eating utensils instead of disposable eating utensils’, with a mean of 4.17 where respondents had the option of choosing the type of utensils regardless of eating behavior.

For ‘EPB1, I switch off lights and other electrical appliances when not in use’, with a mean of 4.22, showing that this environmental protection behavior was widely implemented within the healthcare sector. Lastly,
4. Conclusions

This research applied relevant theoretical models and empirical results, undergoing verification through data analysis. From this exploratory research, the application of ethical leadership and the theory of planned behavior allowed a better explanation of the social-psychological indicators affecting environmental protection behaviors in the healthcare sector. With respect to Hypothesis 1, attitude, subjective norms and perceived behavioral control were positively correlated to ethical leadership regarding environmental protection behaviors in a hospital setting. With respect to Hypothesis 2, environmental protection behavior was strongly correlated to environmental protection intention, while environmental protection intention was significantly correlated to perceived behavioral control which was the strongest predictor, followed by attitude. However, subjective norms was not significantly correlated to environmental protection intention, where results were reasonable among personnel working in the healthcare sector with high educational level, stressful workloads and weak social engagements.

Results from the questionnaire survey showed that the awareness and attitude of environmental protection in the Taiwan healthcare sector was high but lack data for comparison. The environmental protection behaviors of personnel in the Taiwan healthcare sector ranged from moderate to high, depending on the nature and ease of the tasks as well as external regulations and restrictions, which in turn caused differences in behaviors compared to the general public of Taiwan.

Energy saving and environmental protection interventions in hospitals should be discussed in details according to validated behavior and behavior change theories. Though personnel in the healthcare sector displayed high awareness of environmental protection and have positive attitude towards environmental protection, there was still room for improvement. Appropriate intervention approaches, such as supervisors leading by example improving their environmental protection behaviors as well as education and information campaigns highlighting individual’s ease and control in environmental protection, could build and improve environmental protection behaviors by improving related social-psychological indicators. However, interventions such as social comparison and feedback, which served to call upon subjective norms, were not suitable. These conclusions would produce a better understanding of the behaviors of personnel working in Taiwan’s healthcare sector and thus contributed to promoting environmental protection behaviors.

Data availability statement

The data generated and/or analysed during the current study are not publicly available for legal/ethical reasons but are available from the corresponding author on reasonable request.

Ethical statement

This research is approved by the Research Ethics Committee on 06 October 2020. The committee is organized under, and operates in accordance with, the Good Clinical Practice guidelines and governmental laws and regulations. Consent had been gained from all human participants in the survey conducted, where information was used in this research.

Author contributions

Conceptualization, methodology, survey design, software analysis and writing—review and editing, A Y J T;
Funding acquisition, conceptualization, methodology, survey design, software analysis, investigation and writing—original draft, A Y K T.

All authors have read and agreed to the published version of the manuscript.

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Conflicts of interest

The authors declare no conflict of interest.

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