Understanding Hand Hygiene Behavior Among Jordanian Registered Nurses

An Application of Theory of Planned Behavior

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Abstract: The purposes of this cross-sectional study were to (a) determine the relationship between demographic characteristics of Jordanian registered nurses and theory of planned behavior concepts and (b) determine the relationships among theory of planned behavior concepts. One hundred fifty registered nurses of 250 were participated. Handwashing Assessment Instrument that assesses hand hygiene behavior, attitudes, and beliefs was used in this study.

Independent t tests and correlations were used to test hypotheses. Significant and positive correlations were found between intention to perform hand hygiene and the following variables: beliefs about outcomes, subjective norm, normative beliefs, and perceived behavioral control ($r = 0.566, 0.444, 0.400, and 0.500$), respectively.

Conclusions: Health education programs must be conducted to encourage hand hygiene behavior among Jordanian registered nurses who perceived their internal factors (eg, information, skills, and abilities) and external factors (eg, time, opportunity, and resources) to perform hand hygiene.

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Inadequate hand hygiene (HH) potentially allows the transmission of microorganisms from patient to patient and from health care workers (HCWs) to patients, which can lead to the development of nosocomial infections (NIs). Nosocomial infections by definition are infections that are neither present nor incubating when the patient enters the hospital. They are caused by microorganisms that constitute an individual’s personal flora (eg, Staphylococcus aureus, Escherichia coli, Candida albicans) or by exogenous flora, which are usually acquired by immunosuppressed patients during a prolonged hospital stay. The effects of NIs vary from discomfort to prolonged or permanent disability, and in a small proportion of cases, they may contribute to a patient’s death.

Nosocomial infections or hospital-acquired infections affect an average of 5% to 10% of patients admitted to acute care hospitals and can reach 30% among seriously ill patients. Burke estimates that the associated annual cost of NIs is $4.5 to $5.7 billion per year in the United States. Since 1975, the Centers for Disease Control and Prevention and the American Hospital Association have recommended standardized HH guidelines. Furthermore, the Association for Professionals in Infection Control and Epidemiology published HH guidelines in 1995 and 2002.

A review of the literature from 1977 to 1995 focusing on HH showed a temporal relation between HH practices and the rates of NI. Six of 7 quasi-experimental hospital-based studies showed statistically significant results of decreased NI rates as a result of improved HH practices. Despite this established relationship, compliance with HH among HCWs remains low.

A review of 11 studies conducted between 1981 and 1999 noted that the level of compliance with basic HH ranged from 16% to 81%. Of these 11 studies, only 2 noted compliance levels above 50%. These 2 studies reported that the results of the frequency of handwashing before care were 21 (27%) of 79. In addition, Davenport noted that handwashing did not occur before resuming care when health care was interrupted for any reason. Larson et al reported that only 38% of nursing staff washed their hands before performing invasive procedures.

Arab countries have very few programs directed toward infection control, and there are no guidelines or regulations that encourage such a service in health care institutions. In Jordan, which is one of the Arab countries, infection control programs are not mandatory in the hospitals. Therefore, the data that describe NIs and factors contributing to NIs in Jordanian hospitals are limited because they are based on very few studies. For example, one study showed that Methicillin-resistant S. aureus infections were isolated from 18 (8.8%) of 205 of patients’ specimens. A prospective study, which was conducted for 3 years between 1993 and 1995, reported that overall infection rates in a Jordanian university hospital were 17.2 per 100 patients in the medical/surgical intensive care unit (ICU), 14.2 to 18.5 per 100 patients in the neurosurgical ICU, and 13.4 to 73.5 per 100 patients in the high-risk nursery. Lack of adherence to HH behavior increased infection rates in those units. Finally, a study published in 2004 showed that during a 1-year period, 26 inpatients at a university hospital in Amman were detected with bacteremia (23 cases) and respiratory tract colonized with Burkholderia cepacia (3 cases). All cases were caused by a single epidemic strain of B. cepacia genomovar III. It was not possible to determine which aspect of patient care was associated with these NIs.

Application of Theory of Planned Behavior and HH

The guiding framework for this study was the Theory of Planned Behavior (TPB). This theory specifies that human behavior will, in general, be determined by 3 factors. The first factor is attitude, which includes positive and negative aspects of a specific behavior. The second factor is social influences or the subjective norm. The third factor is perceived behavioral control, which refers to an individual’s belief about his or her ability to perform particular behaviors (Fig. 1).

According to TPB, intention to perform or not perform a behavior is the single predictor of a person’s behavior and can be affected by 3 independent variables: attitude, subjective norm, and perceived behavioral control. For example, an individual’s intention to perform physical exercise is affected by his or her perception of what significant others would think about exercise, and his or her...
Subject attitude is a function of an individual’s beliefs that performing the behavior leads to various outcomes. Attitude is affected by an individual’s belief about the consequences of this behavior, which could be positive or negative. Attitude is measured either by direct or indirect measures. A direct measure gives an overall evaluation of the behavior. An indirect measure contains behavioral belief and outcome evaluation. Behavioral belief is a belief that behavioral performance is associated with certain outcomes. The term evaluation refers to the value attached to the behavioral outcome.

Subjective norm is a perception of social pressures to perform or not perform a behavior in question. It is measured by direct and indirect measures. Direct measure associates an individual’s belief about whether most people approve or disapprove the behavior. An indirect measure includes normative belief and motivation to comply. Normative belief refers to an individual’s belief concerning referent people’s approval or disapproval of the behavior. Motivation to comply measured the motivation to do what each referent thinks is appropriate.

According to TPB, perceived behavioral control is determined by control beliefs concerning the presence or absence of facilitators and barriers to perform the behavior. It is weighted by the perceived power to impact each factor of the behavior to facilitate or inhibit it. Perceived behavioral control reflects personal beliefs about how easy or difficult it is to perform the behavior, and it is affected by external and internal factors. External factors are time availability, money, and social support, whereas the internal factors are ability, skills, and information.

The Theory of Planned Behavior has been tested with a variety of health behaviors, such as smoking cessation, automobile safety behavior, exercising behavior, clinical and screening behavior, HIV/AIDS-related behavior, and oral hygiene behavior. It successfully predicted intention from perceived behavioral control and attitude (Fig. 1).

**RESEARCH QUESTIONS**

1. What are the relationships between demographic characteristics of Jordanian registered nurses (JRN) and TPB concepts, such as attitude, subjective norm, perceived behavioral control, intention in ICUs, and medical surgical floor?

2. What are the relationships among TPB concepts?

**METHODOLOGY**

**Research Design and Sample**

Cross sectional design was used in this study, which was conducted in 2 hospitals in Jordan. The hospitals are the 2 major public hospitals serving the population of Amman, the capital of Jordan. The hospitals have the following units: (a) coronary care unit, (b) ICU, (c) surgical ICU, (d) intermediate care unit, (e) cerebral vascular accident care unit, and (f) neonatal ICU. Throughout the study, all JRN had access to soap, running water, and paper towels. Jordanian registered nurses were selected as participants in this study because they had the most frequent direct patient contact compared with various technicians.

**Sample**

Two hundred fifty JRN of both sexes, with different experience levels, who provided direct patient care and who worked at least 1 day per week were invited to participate in the study. After discussions with the nurse managers, arrangements were made for the investigator to present information about the study to the nurses. Information was provided about the nature of the study, the relationship of this study to nursing practice, and the potential participant’s role in the study. One hundred fifty JRN agreed to participate in the study; the response rate was 60%.

**Ethical Considerations**

Participants were informed that they could choose to refuse to participate or could withdraw from the study at any time before completion of the study. All of the data were treated, analyzed, and presented as group data. Confidentiality of all information was maintained throughout the study, and no individual nurse’s performance was identified.

**Instrumentation**

The Handwashing Assessment Instrument (HAI) was used in this study for the self-report of HH performance. This tool had been previously modified by O’Boyle et al to measure many aspects of HH behavior that might motivate JRN to comply with HH guidelines. The researchers obtained permission to use HAI. The purposes of this instrument were to describe the theoretical and clinical keystones that increased the motivation to perform HH and to identify important factors that forced HCWs to practice HH or not. For example, HAI was used to measure registered nurse (RN) participants’ attitudes, beliefs, and intentions toward their future HH behavior.

The first page of HAI was designed to obtain relevant demographic information about the individual, such as age, sex, years of experiences in patient care, and unit of assignment.

To avoid respondent fatigue, the items on the HAI instrument were both positively and negatively worded and keyed. A variety of response formats were used in the HAI scale, such as a 7-point Likert scale and a semantic differential scale. In the semantic differential technique, the respondent was asked to rate a given concept on a series of bipolar adjectives, such as effective-ineffective and good-bad. For example, the handwashing protocol is frustrating and the handwashing protocol is not frustrating.

The response scales ranged from extremely unlikely to extremely likely. Then, responses were summed across the bipolar scales to make a total score. The responses in the HAI tool were scored in a way that supported positively worded statements and did not support negatively worded statements. In positively phrased statements, the answer extremely likely was...
planned to comply with HH. In contrast, if the statement was negatively worded, the answer extremely likely was given a score of 1, which indicated unfavorable feelings toward HH.

Items in HAI were placed in 8 sections according to the concepts of TPB. The various sections of HAI were (a) beliefs about outcomes, (b) attitude, (c) normative beliefs, (d) subjective norm, (e) intention, (f) control beliefs, (g) perceived behavioral control, and (h) self-reported HH. The following is a brief description of each section:

**Beliefs About Outcomes**
An indirect measure of attitude was obtained in this section, which represents the subject’s assessment of the consequences of HH behavior. The following is an example of one item, which was designed to measure the subject’s beliefs about the outcomes of HH protocol: If I regularly follow the hospital’s handwashing protocol, my patients will have fewer hospital-acquired infections. Responses were measured on a 7-point Likert scale, which ranged from extremely unlikely to extremely likely.

**Attitude**
A direct measure of attitude toward HH among nurses was assessed using semantic differential 7-point bipolar scales, with different end points, such as practical-impractical, convenient-inconvenient, and necessary-optional.

**Normative Beliefs**
An indirect measure of subjective norm scores was obtained by having participants rate normative beliefs about whether specific other people think that nurses should perform HH behavior. Normative belief ratings for each source of influence were made on 7-point bipolar scales with end points I should not to I should.

**Subjective Norm**
A direct measure of subjective norm was obtained in this section by one item, which was designed to measure the subject’s cognitive assessment of the degree to which important people in their lives supported or encouraged HH. The item was most people who are important to me think I should follow the hospital’s handwashing protocol. Ratings were made on a 7-point scale with end points extremely unlikely to extremely likely.

**Perceived Behavioral Control**
A direct measure of perceived control was obtained by summing 2 items, which were measured by 7-point bipolar scales with end points up to me–not up to me and under my control–not under my control.

**Control Beliefs**
The control beliefs section obtained an indirect measure of perceived behavioral control. Control beliefs measured the subject’s estimation of the level to which he or she had access to resources to comply with HH recommendations. For example, I am confident of my knowledge about the hospital’s handwashing protocol. Responses ranged from extremely unlikely to extremely likely on a 7-point scale.

**Intention**
A direct measure of intention was obtained on 7-point bipolar scale with end points extremely unlikely to extremely likely. This section represented the nurses’ plans to comply with HH in different situations. It was measured by using 5 items focusing on whether the nurses would perform HH under the following situations: (a) when a patient has an infection, (b) when the nurses are busy, (c) in routine work, (d) when nurses’ hands are injured or sore, and (e) when the patient is in a crisis condition. For example, I intend to follow the unit’s handwashing protocol in every situation in which it is indicated HH.

**Self-Report**
In this section, nurses estimated their rates of HH performance by percentage of time (from 0% to 100%) in 7-patient situations that match HH indications. For example, what percentage of time will you estimate that you wash your hands before beginning to provide care to the patients: 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100%. Registered nurses were asked to circle the number that best described their overall HH compliance rates.

Internal consistency, measured by Cronbach coefficient alpha, has been reported for some sections of HAI constructs. For example, the perceived control of HH behavior section yielded an alpha of 0.68 and for the attitude section yielded an alpha of 0.91. The Handwashing Assessment Instrument was reviewed for construction validity by one of the creators of the TPB, Ick Aizen. RESULTS

Data analyses were performed using the Statistical Package for Social Sciences Windows Release 15.0. All 150 subjects completed the HAI questionnaire, which provided self-reported HH data.

**Pilot Testing**
To assess the psychometric analysis for HAI in Jordan, a pilot study was conducted in which 35 JRNPs participated. The reliability analysis (alpha) for HAI subscale in this pilot study was close to the results of O’Boyle and his colleagues; the items were internally consistent. The reliability results for HAI subscales in comparison with the results of O’Boyle and his colleagues were the following: (a) alpha for attitude was equal to 0.70, whereas the results of O’Boyle and his colleagues was 0.83; (b) alpha for normative beliefs was equal to 0.65, whereas the results of O’Boyle and his colleagues was 0.89; (c) there was a single item that measured subjective norm; therefore, no reliability results were reported in either studies; (d) alpha for perceived behavioral control was 0.82, whereas the results of O’Boyle and his colleagues was 0.631 (e) alpha for intention was 0.83, which was slightly higher than the result obtained by O’Boyle and his colleagues (ie, 0.74); (f) alpha for beliefs about outcome was 0.80, whereas O’Boyle and his colleagues did not report any result for this variable; and (g) alpha for self-reported was 0.90, which was slightly higher than the result obtained by O’Boyle and his colleagues (ie, 0.87). These data provide evidence of cross-cultural consistency. The results are summarized in Table 1.

**Demographic Characteristics of RNs and TPB Concepts by Departments**
The first research question examined the relationships between demographic characteristics of JRNPs (age, sex, and years of experiences) and TPB concepts (attitude, subjective norm, perceived behavioral control, and intention) in different departments, such as medical-surgical wards and ICUs.

**Ages of RNs and TPB Concepts by Departments**
The ages of RNs who participated in the study (n = 150) ranged from 20 to 50 years. Based on the median age, the RNs...
were classified into 2 age categories: 25 years or older and younger than 25 years.

It was hypothesized that there would be no differences between the older and younger age groups in their attitudes, subjective norms, normative beliefs, perceived behavioral control, and intention toward HH in different departments. Data from questionnaires were analyzed using independent t tests to test these hypotheses. The results of analyses revealed that there was significant differences among JRNs who are 25 years or older and younger than 25 years in their intention toward HH \((P = 0.015)\) in different departments. The results are summarized in Table 2.

### Gender and TPB Concepts by Departments

It was hypothesized that there would be no differences between male and female JRNs in selected TPB concepts (attitude, subjective norm, normative belief, perceived behavioral control, and intention) in different departments. Data from questionnaires were analyzed using independent t test to test this hypothesis. The results revealed no differences between groups for the following TPB concepts: attitude, subjective norm, normative beliefs, perceived behavioral control, and intention. The results are summarized in Table 2.

### Years of Experience and TPB Concepts

The years of experience of all JRNs who participated in the study ranged from 6 months to 20 years. Jordanian registered nurses were classified into 2 experience categories: more than or equal 5 years and less than 5 years.

It was hypothesized that there would be no differences between the 2 groups in TPB concepts, such as attitude, subjective norm, normative beliefs, perceived behavioral control, and intention. Data were analyzed using independent t test to test this hypothesis. The results revealed no differences between groups for the following TPB concepts: attitude, subjective norm, normative beliefs, perceived behavioral control, and intention. The results are summarized in Table 2.

### TPB Mean Scores in Medical Surgical Wards and ICUs

It was hypothesized that there would be no differences between medical surgical wards and ICUs in the mean scores of TPB concepts, such as attitude, subjective norms, normative beliefs, perceived behavioral control, and intention. Data were analyzed using independent t test to test this hypothesis. The results of analyses revealed that there were significant differences among JRNs who are more than or equal 5 years and less than 5 years in their intention toward HH \((P = 0.015)\) in different departments. The results are summarized in Table 2.

### TABLE 1. Reliability Scale of Handwashing Instrument Among JRNs (n = 35)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cronbach Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beliefs about outcomes</td>
<td>0.80</td>
</tr>
<tr>
<td>Attitude</td>
<td>0.70</td>
</tr>
<tr>
<td>Subjective norm</td>
<td>-</td>
</tr>
<tr>
<td>Normative beliefs</td>
<td>0.65</td>
</tr>
<tr>
<td>Intention</td>
<td>0.83</td>
</tr>
<tr>
<td>Perceived behavioral control</td>
<td>0.82</td>
</tr>
<tr>
<td>Self-report</td>
<td>0.90</td>
</tr>
</tbody>
</table>

*The dashes indicate that the mean and standard deviation were not calculated.

### TABLE 2. Means, Standard Deviations, and Significance Level of Differences by Demographic Characteristics of Registered Nurses and TPB Concepts by Departments

<table>
<thead>
<tr>
<th>TBP</th>
<th>Age, y</th>
<th>Sex</th>
<th>Years of Experience</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≥25</td>
<td>&lt;25</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Attitude</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>22.60</td>
<td>22.40</td>
<td>22.37</td>
<td>22.8</td>
</tr>
<tr>
<td>SD</td>
<td>8.71</td>
<td>8.76</td>
<td>9</td>
<td>8.2</td>
</tr>
<tr>
<td>P</td>
<td>0.886</td>
<td></td>
<td>0.74</td>
<td>0.84</td>
</tr>
<tr>
<td>Normative beliefs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>11.62</td>
<td>11.25</td>
<td>11.6</td>
<td>11</td>
</tr>
<tr>
<td>SD</td>
<td>5.09</td>
<td>4.79</td>
<td>5.1</td>
<td>4.4</td>
</tr>
<tr>
<td>P</td>
<td>0.640</td>
<td></td>
<td>0.46</td>
<td>0.27</td>
</tr>
<tr>
<td>Perceived behavioral control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>36.75</td>
<td>35.277</td>
<td>35.3</td>
<td>37.2</td>
</tr>
<tr>
<td>SD</td>
<td>8.44</td>
<td>7.35</td>
<td>8.4</td>
<td>7.0</td>
</tr>
<tr>
<td>P</td>
<td>0.254</td>
<td></td>
<td>0.168</td>
<td>0.68</td>
</tr>
<tr>
<td>Intention</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>49.48</td>
<td>45.81</td>
<td>47.11</td>
<td>49.01</td>
</tr>
<tr>
<td>SD</td>
<td>9.27</td>
<td>8.944</td>
<td>9.7</td>
<td>8.2</td>
</tr>
<tr>
<td>P</td>
<td>0.015†</td>
<td></td>
<td>0.22</td>
<td>0.27</td>
</tr>
<tr>
<td>Subjective norm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>5.31</td>
<td>5.29</td>
<td>5.28</td>
<td>5.32</td>
</tr>
<tr>
<td>SD</td>
<td>1.5</td>
<td>1.2</td>
<td>1.3</td>
<td>1.6</td>
</tr>
<tr>
<td>P</td>
<td>0.91</td>
<td></td>
<td>0.88</td>
<td>0.90</td>
</tr>
<tr>
<td>Beliefs about outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>43.34</td>
<td>42.48</td>
<td>42.1</td>
<td>44.5</td>
</tr>
<tr>
<td>SD</td>
<td>9.90</td>
<td>9.24</td>
<td>9.8</td>
<td>8.2</td>
</tr>
<tr>
<td>P</td>
<td>0.585</td>
<td></td>
<td>0.137</td>
<td>0.26</td>
</tr>
<tr>
<td>Self-report</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>52.13</td>
<td>47.611</td>
<td>5.4</td>
<td>5.1</td>
</tr>
<tr>
<td>SD</td>
<td>15.71</td>
<td>15.16</td>
<td>1.41</td>
<td>1.45</td>
</tr>
<tr>
<td>P</td>
<td>0.074</td>
<td></td>
<td>0.131</td>
<td>0.50</td>
</tr>
</tbody>
</table>

*P ≤ 0.01.
†P < 0.05.

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beliefs, perceived behavioral control, and intention. Data that were completed by 150 participants were analyzed using independent t-test to test this hypothesis. The results revealed that the mean score for the attitude, intention, and beliefs about outcomes were not similar in medical surgical wards and ICUs. The results are summarized in Table 2.

**Relationships Among TPB Concepts**

The second research question was “What are the relationships among TPB concepts?” To answer this question, data from 150 JRNs who answered questionnaire and worked in medical surgical wards and ICUs were used. The correlations and significant levels are summarized in Table 3.

**DISCUSSION**

Hand hygiene is considered the most important single procedure for preventing nosocomial infections. Failure to wash hands or perform HH is a complex problem that may be caused by a number of external and internal factors. To change HH behavior, it is helpful to have some understanding of the factors that influence this behavior. More studies are needed to identify which of these factors, alone or in combination, contribute significantly to the problem of poor compliance with HH recommendations. With this information about underlying factors influencing the decision to practice or not practice HH, the probability for developing successful interventions to modify this behavior is heightened.

**Demographic Characteristics and TPB Concepts**

The first research question in this study examined the relationships between demographic characteristics and TPB concepts, such as attitude, subjective norm, perceived behavioral control, and intention. The study results showed that there were no relationships between sex and years of experiences of JRNs and TPB concepts (as shown in Table 2). This study supported the study of Burnett et al., who reported that there were no relationships between intentions and demographic characteristics or personality have no direct effect on behavior.

Approximately 60% of current RNs are older than 40 years, whereas the number of RNs younger than 30 years has fallen since 1988 by nearly 40%. This aging trend is expected to continue over the next 10 years when more than 40% of the RN workforce is expected to be older than 50 years. The study results showed that age seemed to have influence on the intensity toward HH behavior in Jordan. The current study showed that the median age for those Jordanian RNs who participated in this study was 25 years. This finding contrasts with the age of RNs who work in the United States, in which the number of RNs younger than 30 years has decreased by 41%.

**TPB and Working Department**

Unlike the work of physicians, the work of RNs in hospitals is rarely organized around disease-specific populations; rather, patients are generally grouped by age and/or by intensity of nursing care (eg, pediatric units/adult floors or intensive care/general floors). Nurses who work in ICUs have high workload in comparison to those nurses on general floors. In fact, multiple factors influence the development of NIs in hospital patients: individual factors (eg, severity of patient illness) care variables (eg, antibiotic use), and organizational variables (eg, staffing) can affect NI.

This study showed that there was significant difference between JRNs who worked in ICUs in comparison to medical surgical wards in their attitude, intention, and beliefs about the outcome of performing HH. For example, JRNs who were working on the floor had a positive attitude toward HH more than JRNs who were in ICUs. Intention and beliefs about outcome toward performing HH were higher among JRNs who were working in ICUs than JRNs who were working on medical surgical floors.

A large observational study was conducted to evaluate the predictors that affect compliance with HH procedures. There were 2834 opportunities for HH during the study period, and the overall compliance to HH protocols was 48%. The HH compliance rate was found to be 70% in 1248 HH indications among RNs who worked in ICUs.

Noncompliance was more common in settings where the need of patient care is the highest. The lowest compliance rate of

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**TABLE 3. Correlation Matrix of the Concepts in the TPB Applied to HH Behavior Among RNs (n = 150)**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Beliefs About Outcomes</th>
<th>Attitude</th>
<th>Normative Beliefs</th>
<th>Subjective Norm</th>
<th>Perceived Behavioral Control</th>
<th>Intention</th>
<th>Self-Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beliefs about outcomes</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>$r = 0.260$</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>$P = 0.001^*$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normative beliefs</td>
<td>$r = 0.368$</td>
<td>$r = 0.067$</td>
<td></td>
<td>$r = 0.413$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P = 0.000^*$</td>
<td>$P = 0.413$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subjective norm</td>
<td>$r = 0.426$</td>
<td>$r = 0.097$</td>
<td>$r = 0.479$</td>
<td>$r = 0.000^*$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P = 0.000^*$</td>
<td>$P = 0.23$</td>
<td>$P = 0.000^*$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived behavioral control</td>
<td>$r = 0.499$</td>
<td>$r = 0.016$</td>
<td>$r = 0.378$</td>
<td>$r = 0.372$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P = 0.000^*$</td>
<td>$P = 0.841$</td>
<td></td>
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<td>$P = 0.000^*$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention</td>
<td>$r = 0.566$</td>
<td>$r = 0.150$</td>
<td>$r = 0.400$</td>
<td>$r = 0.444$</td>
<td>$r = 0.500$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P = 0.000^*$</td>
<td>$P = 0.066$</td>
<td></td>
<td></td>
<td>$P = 0.000^*$</td>
<td>$P = 0.000^*$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-report</td>
<td>$r = 0.255$</td>
<td>$r = 0.120$</td>
<td>$r = 0.117$</td>
<td>$r = 0.110$</td>
<td>$r = 0.203$</td>
<td>$r = 0.316$</td>
<td></td>
</tr>
<tr>
<td>$P = 0.002^*$</td>
<td>$P = 0.143$</td>
<td></td>
<td></td>
<td>$P = 0.152$</td>
<td>$P = 0.177$</td>
<td>$P = 0.013^*$</td>
<td>$P = 0.000^*$</td>
</tr>
</tbody>
</table>

* $P < 0.01$  
† $P < 0.05$
36% occurred in places such as ICUs where the indications for HH occur more frequently because the transmission of microorganisms is more likely (eg, before intravenous care, 39%; before respiratory care, 18%; between a dirty and clean body site, 11%; after contact with body fluid, 63%; and after wound care, 58%). In general, compliance with HH became worse when the requirement for hand cleaning was higher.23

**TPB Concepts**

The second research question examined the relationships among TPB concepts. Pearson correlations were computed to explore the relationships among all TPB variables (ie, attitude, subjective norm, perceived behavioral control, and intention, as shown in Table 3).

Godin and Kok15 reviewed 56 publications with 87 health-related applications based on TPB. This review revealed that the attitudes toward the action and perceived behavioral control were the most significant variables for intention. The overall average correlations between intention and other TPB variables (attitude, subjective norm, and perceived behavioral control) were 0.46, 0.34, and 0.46, respectively. For example, a study used TPB as a framework to investigate 104 homeless people’s participation in outreach service programs. Attitude was the dominant predictor of behavioral intentions, and intention and perceived behavioral control were predictive of behavior.24

This study showed a significant correlation between attitude and beliefs about outcomes \((r = 0.264, P = 0.001)\). This result supported a study25 that examined the power of attitude, social norm, perceived control, and underlying beliefs in 11- to 15-year-olds’ breakfast choices of milk with different fat content and high-fiber bread. More than 1700 students in the fifth, seventh, and ninth grades were asked to complete a questionnaire based on TPB. The results indicated that consumption of milk and high-fiber bread was predicted by intention. In addition, perception of the parents’ consumption (norms) of the specific food played an important role. It was also found that attitude concerning the consumption of milk and high-fiber bread was influenced by beliefs about health aspects.

On the other hand, the results of this study contradicted several researchers who reported a significant relationship between attitudes and intention. For example, TPB was used to predict students’ intentions to apply to graduate school and application behaviors from their attitudes, subjective norms, and perceived behavioral control. Sixty students aged 20 to 24+ years participated in this study. The single predictor variable of intentions in this study was the students’ attitudes about graduate school and how graduate school could be helpful for their future careers. Perceived behavioral control was also a significant predictor of actual application behaviors.26

Other significant positive correlations found in this study were between intention and the following variables: beliefs about outcomes, subjective norm, normative beliefs, and perceived behavioral control \((r = 0.566, r = 0.444, r = 0.400 \text{ and } r = 0.500, \text{ respectively})\). The significant correlations between intention and other variables, such as perceived behavioral control and subjective norm concurred with the result reported by Backman et al.,27 who mentioned that intention to eat a healthful diet was influenced most by attitude and then by perceived behavioral control and subjective norm. Furthermore, Bogers et al.,28 found that perceived behavioral control was the strongest predictor of intentions.

A prospective design was used to evaluate TPB for understanding exercise motivation and behavior in 37 bone marrow transplantation patients. On admittance to the hospital, participants completed a baseline questionnaire that assessed the TPB concepts and then monitored the frequency and duration of exercise during their hospitalization. Intention and perceived behavioral control explained 36% of the variance in exercise behavior. Moreover, attitudes and perceived behavioral control explained 68% of the variance in exercise intentions.29

The Theory of Planned Behavior was used as a framework for understanding exercise intention and behavior during and after phase 2 cardiac rehabilitation. Fifty-seven men and 24 women participated in this study. This study indicated that attitude, subjective norm, and perceived behavioral control explained 38% of the variance in exercise intention. Intention explained 23% of the variance in exercise adherence. At post-rehabilitation follow-up, attitude, subjective norm, and perceived behavioral control explained 51% of the variance in exercise intention, whereas intention explained 23% of the variance in exercise adherence.30

Perceived behavioral control in this study significantly associated with the following variables: beliefs about outcomes, normative beliefs, subjective norm, and intention \((r = 0.499, r = 0.378, r = 0.372 \text{ and } r = 0.500, \text{ respectively})\). The results of this study supported a study31 that was conducted to investigate Tanzanian teachers’ intention to give dietary advice using TPB. A questionnaire survey was distributed to 232 primary school teachers. The results indicated that dietary advice intentions were primarily directed by perceived behavioral control in both groups.

Another study32 showed the effect of perceived behavioral control on intention. The Theory of Planned Behavior was used to examine age differences in beliefs regarding breast cancer and intentions to seek medical care for symptoms. A sample of 546 women (aged 16 years and older) completed a postal questionnaire. The results of the study of Grunfeld and his colleagues32 showed that women aged 35 to 54 years had negative attitudes toward seeking medical help for breast cancer symptoms, and a negative belief in one’s ability to seek help (perceived behavioral control) was a predictor of intention not to seek help.

Other significant correlations were found in the current study between normative beliefs and the following variables: beliefs about outcomes, subjective norm, perceived behavioral control, and intention \((r = 0.368, r = 0.479, r = 0.378, \text{ and } r = 0.400, \text{ respectively})\).

The subjective norm variable was measured in this study by direct measure by using participants’ cognitive assessment of the degree to which important people in RNs lives supported or encouraged HH. The current study showed significant correlations between the subjective norm and the following variables: perceived behavioral control and intention \((r = 0.372 \text{ and } r = 0.444, \text{ respectively})\). These results were concurred with the results reported by Aminzadeh and Edwards.33 The Theory of Planned Behavior was used to investigate how to enhance the acceptance of mobility aids. Their study was designed to examine the factors linked to cane use among community-dwelling older adults. Data were collected in a cross-sectional survey of 106 community-residing older adults (aged 65+ years). The results indicated that subjective norms, attitudes, and age were key variables associated with cane use in this sample.33

**Implication for Nursing Practice**

There is an urgent need to develop an effective intervention infection program that is based on TPB to encourage JRNs to perform HH. The methods that were used in this study are important steps toward adding insights to a limited body of research in the area of infectious diseases in developing countries, especially nosocomial infections and HH. Further research is needed to gain a deeper understanding of this problem. In
addition to TPB, exploring other theoretical frameworks to identify variables that may be related to HH among direct patient care may introduce new challenges that need to be investigated.

CONCLUSIONS

The results of the study confirmed the following: (a) the results were consistent with Wambach (1997) who indicated that a significant relationship between the variables of TPB and the intention was more likely than a significant relationship between TPB variables and the behavior of interest; (b) Jordanian RNs perceived their internal factors (eg, information, skills, and abilities) and external factors (eg, time, opportunity, and resources) to perform HH; (c) younger RNs perform HH more than elderly, which could be explained as curriculum effect; (d) performance HH on floors is more than in ICUs; and (e) Jordanian RNs perceived that others viewed the action of HH as a favorable behavior.

Limitations of the Study

The subjects were volunteers from 2 institutions in Jordan so that the findings can be generalized only to similar health care settings.

REFERENCES