Original article: New perspectives on Nursing practice

Using the Theory of Planned Behavior to explore hospital-based nurses' intention to use peripherally inserted central catheter (PICC): a survey study

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Abstract. *Background and aim of the work:* The peripherally inserted central catheters (PICC) have become an alternative to the traditional CVC. PICCs are usually inserted by trained nurses who decided to attend and complete a special training on PICC insertion and management. The present work aimed to investigate the intention of using PICC in a sample of hospital-based nurses using the theory of planned behavior as theoretical framework. *Methods:* A cross-sectional design was used in which a questionnaire was delivered to 199 nurses. *Results:* According to the theory of planned behavior, the attitude toward the use of PICC, subjective norms and perceived self-efficacy predicted the intention to use PICC. Contrary to the expectations, the effect of subjective norms on intention to use PICC was mediated by attitude and self-efficacy. Finally, age of participants was negatively related to the intention to use the PICC. *Conclusions:* The theory of planned behavior offers a useful framework to explain nurses' intention to use PICC. Shared norms favoring the use of PICC seem to increase both nurse's positive attitudes and self-efficacy whit respect to the use of these devices. Thus, it appears that to train professionals individually does not necessarily results in an increased use of PICC.

Key words: Theory of planned behavior, PICC, CVC, behavioural intention

Background

Central inserted devices are a critical and important part of the modern health care practice, particularly in intensive care units (ICU). This procedure is routinely performed with a wide range of diseases and medications, because permits to dose chemotherapy, antibiotics or other drugs (1). Traditionally, physicians used central venous catheters (CVC) inserted into the superior vena cava through subclavian or jugular vein. The placement and maintenance of these devices entail a high risk of serious complications such as pneumothorax, stroke, thrombosis and infections (2-4). Therefore, CVC requires a specially trained physician who places the device and prevents complications. This makes CVC procedures very costly, given the presence of trained physicians and nurses, and the high risk of prolonged hospital care (1). Moreover, there are evidence that CVC has strong impact on the wellbeing of patients, in terms of pain, change of body image and restriction to daily activities (5).

More recently, the peripherally inserted central catheters (PICC) have become an alternative to the traditional CVC (6). PICC is a device that is inserted

percutaneously into a peripheral vein, and then advanced into the central circulation, usually in the superior vena cava. The procedure of PICC insertion seems to have several advantages with respect to the traditional CVC, such as reduced infection likelihood and fewer serious complications (1). Furthermore, PICC can be maintained in situ for a longer time than CVC (7). Moreover, given that trained nurses outside the operatory room can insert PICC, the cost and requested time for this procedure are reduced. In addition, there are evidence indicating that patients with PICC are satisfied about their daily life activities (8, 9). Accordingly, the use of PICC has increased because of it is generally considered a safe device for long-time administration of medicaments both in hospital and home care settings (1, 10).

As indicated above, PICCs are usually inserted by trained nurses who decided to attend and complete a special training on PICC insertion and management (1). In this sense, the use of this device is completely under the responsibility of nurses and then PICC represent a challenging procedure for nursing workforce (11), especially in critical care services. As it has been shown, indeed, poor trained nurses or nurses with a lack of knowledge on PICC and CVC lead to high rate of serious complication which in turn increase social and psychological cost of care (12, 13). Thus, increasing the number of nurses who want to use and manage PICC is a desirable outcome to meet by healthcare organizations, in order to improve the quality of patient care.

Unfortunately, to the best of our knowledge, no studies on the nurses' intention to use PICC are available in the literature. The aim of the present work was then to investigate the intention of using PICC in a sample of hospital-based nurses. More precisely, we were interested in the analysis of psychosocial variables that can favor or disfavor nurses' intention to approach and use new devices such as PICC. In order to meet this goal, we used the theory of planned behavior (TPB) (14, 15) as theoretical framework. The theory of planned behavior has been used in a variety of studies about healthcare processes (16, 17) including behavior of nurses (18-20), showing to be a useful framework to investigate a wide range of behavioral intentions. This approach proposes that one's behavioral intention is the proximal determinant of the actual behavior. Moreover, behavioral intention is expected to be predicted by three psychosocial variables. The first one is the people's attitude toward the behavior, that is to say a favorable or unfavorable evaluation of the target behavior along with the evaluation of the outcomes of performing the behavior. The second variable is subjective norms, which refers to the individual's beliefs about what other significant and important people think about the behavior. The third variable is the perceived behavioral control, or self-efficacy, that is to say the extent to which individuals believe to be able to perform, or the ease or difficulty of performing, the target behavior. In such a way, the TPB predicts that attitudes about the behavior, social norms and perceived self-efficacy together contribute to the formation of individuals' behavioral intention.

In the present work, we predicted that nurses' attitude toward the use of PICC, beliefs about what peer and colleagues think about the use of PICC and perceived efficacy to use PICC would increase the nurses' intention to use PICC. Moreover, we consider also the age of nurses as important variable affecting intention to use PICC. More precisely, since the use of PICC is challenging for professionals, the use of this device would be harder for older nurses. Indeed, there are evidence showing that demands to complete continuing education is challenging nurses as they aged (21). Accordingly, we expected to find that younger nurses would show higher intention to use PICC.

Method

Design, participants and procedure

Four hundred ninety-three questionnaires were distributed in the intensive care units of three public hospitals located in northern Italy. Questionnaires were hand-delivered to the CU head nurses who distributed them to nurses working in CU. After two weeks, researchers returned in the CU and collected the questionnaires. The first page of the questionnaire stated that collected data would be completely anonymous and participation was voluntary.

219 questionnaires were returned (response rate = 44%). Of those, 20 questionnaires were excluded be-

cause of missing values in the intention to use PICC measure. The analyzed sample was composed by 199 professionals of which 63 (32%) were men and 135 (68%) were women (1 participant did not report his/her sex). Two nurses had and age between 20 and 25 years, 51 between 26 and 30, 65 between 31 and 40, 49 between 41 and 45, and 30 nurses had more than 45 years.

Measures

Questionnaire was built ad-hoc following Ajzen's suggestions to create items for specific questionnaire to be used to assess the theory of planned behavior (22).

Attitude toward the use of PICC was measured with five items (e.g., "The use of PICC is safe", and "The PICC is an efficacious alternative to traditional VCC") asking participants to indicate the extent to which they agree with statements on a 6-point Likert-type scale (1 = strongly disagree; 6 = strongly agree).

Subjective norms were measured with three items (e.g., "The nursing coordinator of my care unit would agree to entrust the management of PICC to nurses") on a 6-point Likert-type scale (1 = not at all; 6 = sure).

Self-efficacy was measured with six items (e.g., "I feel to be able to use the PICC according to the recommendations") on a 6-point Likert-type scale 1 = strongly disagree; 6 = strongly agree).

Intention to use the PICC was measured with a single item asking participants to express the extent to which they want to use PICC on an 8-point Likert-type scale (1 = not at all, 8 = sure).

At the end, other information such as gender, age, tenure and CU in which professional worked were collected.

Results

Preliminary analysis

Table 1 shows zero-order correlations, Cronbach's alphas, and descriptive statistics of the considered measures. As one can see, all measures had satisfactory reliability. Moreover, intention to use PICC was positively correlated with all other constructs, but age that, instead, was negatively correlated with intention. It is worth noting that, despite patterns of positive correlations, coefficients are not so high in magnitude to impair discriminant validity of measures. Thus, the measures appeared to represent different, albeit related, constructs.

Hierarchical regression

Hierarchical regression analyses in which attitude, subjective norms, self-efficacy and age were inserted one by one in that order was performed. Results indicated that all predictor significantly affected intention to use PICC (see step 4 in Table 2). As one can see, the four predictors explained the 28% of the variance of the intention to use PICC. It is worth noting that the effect of subjective norms was reduced to marginal level of significance (b = .29, se = .15, p = .056) when attitude, self-efficacy and age were entered in the regression model.

Testing the model

The model expected by the TPB was tested with structural equation modelling with maximum likelihood estimation and robust standard error. Analysis

Table 1. Zero-order correlations, Cronbach's alphas, and descriptive statistics of measured constructs

	Attitude	Self-Efficacy	Subjective Norms	Intention	Age
Attitude	*.79*	.42**	.48**	.34**	.02
Self-Efficacy		*.85*	.52**	.45**	.02
Subjective Norms			*.72*	.38**	.03
Intention				-	-.20*
M	4.72	3.91	4.42	5.62	3.27
SD	0.92	1.05	1.12	2.21	1.04
Range	1-6	1-6	1-6	1-8	1-5

* $p < .05$; ** $p < .01$. Cronbach's alpha on the diagonal

Table 2. Hierarchical Regression Analyses of Intentions on Attitudes, Subjective Norms, Self-efficacy and participants' age

		R^2	ΔR^2	F	df	b	se
Step 1							
	Attitude	0.12	0.12	26.49	1,195	0.82**	0.16
Step 2							
	Attitude	0.17	0.05	20.20	2,194	0.51**	0.18
	Subjective norms					0.52**	0.15
Step 3							
	Attitude	0.24	0.07	19.98	3,193	0.34*	0.18
	Subjective norms					0.28†	0.15
	Self-efficacy					0.63**	0.16
Step 4							
	Attitude	0.28	0.04	18.9	4,192	0.35*	0.17
	Subjective norms					0.29†	0.15
	Self-efficacy					0.64**	0.15
	Age					-0.45**	0.13

† $p < .07$; * $p \leq .05$; ** $p < .01$

were performed with R software (23). The top panel of Figure 1 shows the first tested model. As indicated, intention to use PICC was positively and significantly predicted by attitude, subjective norms and self-efficacy, and negatively predicted by nurses' age. The overall fit of the model, however, was not satisfactory $\chi^2(6) = 111.39$, $p < .001$, CFI = .394, TLI = -.011, RMSEA = .299, $p < .001$, 90%CI = .254 - .345, SRMR = .201.

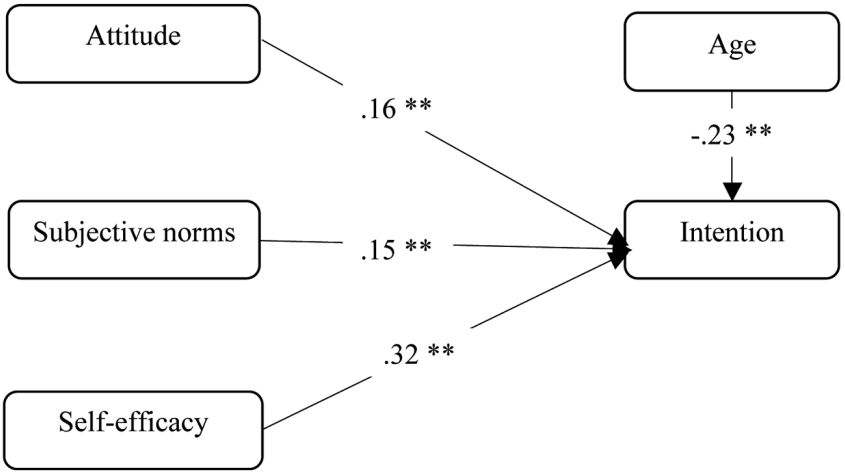
Observing correlational patterns and regression analysis, and in order to observe whether fit would be improved, a second model was tested in which the effect of subjective norms was mediated by both attitudes and self-efficacy. The model is shown in the bottom panel of figure 1. As indicated, intention was still significantly and positively predicted by attitude and self-efficacy, and negatively by age. However, the effect of subjective norms was reduced and become not significant, $b = .29$, $SE = .16$, $p = .08$. This occurred because the effect of subjective norms was significantly mediated by attitude, $b = .14$, $SE = .063$, $p = 024$, and self-efficacy, $b = .31$, $SE = .08$, $p < .001$. This model had satisfactory fit, $\chi^2(3) = 11.27$, $p = .01$, CFI = .952, TLI = .857, RMSEA = .118, $p = 04$, 90%CI = .051 - .194, SRMR = .04, and was better than the previous model in term of goodness of fit, $\chi^2(3) = 93.35$, $p < .001$.

Discussion and conclusion

The aim of the present research was to investigate the intention to use PICC (peripherally inserted central catheters) among hospital-based nurses. The nurses' intention to use of PICC is an important topic since this device has proved to be a valid and less costing alternative to traditional central catheters (1, 8, 9). Thus, to know what might favor or hinder nurses' intention to insert and manage PICC is particularly important in order to increase the number of professionals who may use this device. To the best of our knowledge, this is the first research that analyses this important aspect. To this end, we used the theory of planned behavior (14, 15) as theoretical framework.

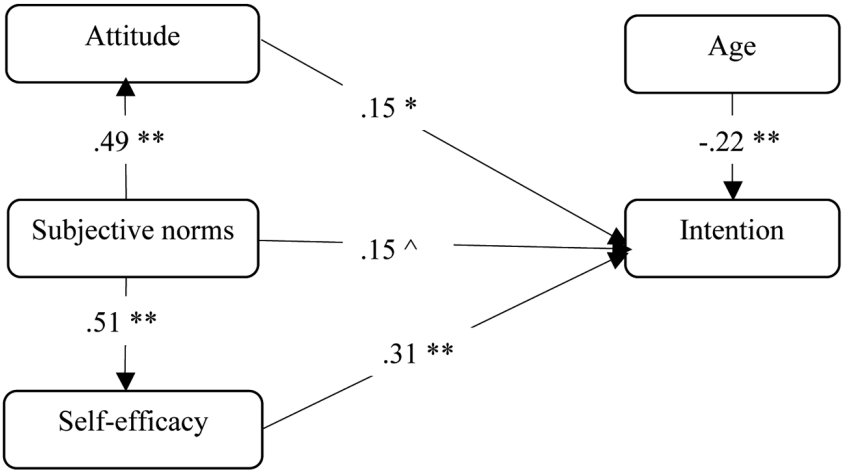
Results indicated that, according to the TPB, attitude toward the use of PICC, subjective norms and perceived self-efficacy were all significant predictors of the intention to use the PICC. More precisely, to hold a positive attitude toward the use of PICC, to believe that colleagues and other professionals would think positively about the use of PICC and the perception to be able to manage the PICC, increased the intention to use PICC. Moreover, also age was a predictor of the intention to use PICC, but the effect of its effect was negative. This means that older nurses were less intentioned to use PICC. This is not surprising, given

Model 1: attitude, self-efficacy, subjective norms and age directly predict the intention to use PICC



Model fit: $\chi^2(6) = 111.39$, $p < .001$, CFI = .394, TLI = -.011, RMSEA = .299, $p < .001$, 90%CI = .254 - .345, SRMR = .201

Model 2: attitude and self-efficacy mediated the effect of subjective norm on intention to use PICC



Model fit: $\chi^2(3) = 11.27$, $p = .01$, CFI = .952, TLI = .857, RMSEA = .118, $p = 04$, 90%CI = .051 - .194, SRMR = .04

Note: completely standardized coefficients are reported.

^ $p < .06$; * $p < .05$; ** $p < .01$

Figure 1. Results of path analysis on the two tested model

that younger professionals would be less challenged by learning to use and manage a new device. This is also consistent with findings indicating that older nurses perceive continue education and new technologies as more challenging than younger nurses (21).

Results indicated also that subjective norms had an indirect effect on intention to use PICC via attitude and self-efficacy. More precisely, subjective norms were positively associated with both positive attitudes toward the use of PICC and increased perception of self-efficacy. Moreover, both attitudes and self-efficacy mediated the effect of subjective norms on the intention to use PICC. This seems to suggest that a working context that is perceived as favoring the use of new devices would improve nurses' positive attitudes and self-efficacy about the use of these devices. This may be due to the particular type of job organization in care units. Indeed, care units are usually multi-professional contexts in which the job of each professional must be coordinated and in collaboration with other professionals (24, 25). Moreover, each professional should work according with the guidelines of his/her CU and hospitals. This implies that the choice to use new devices such as PICC is not under the willingness of professionals, but it is primarily linked to decision of CU staff. In such a way, norms shared in CU strongly affect the behavior of CU members who may be more or less oriented to act in a particular way depending on the CU's central norms. Thus, present results suggest that CU norms bolstering and favoring the use of PICC can affect individuals' attitude and self-efficacy toward the use of this device.

Implications

Present results confirm that the theory of planned behavior offers a useful framework to explain nurses' intention to use new device such as PICC. Findings also suggest that attitudes, subjective norms and self-efficacy may not be independent predictors of intention but rather they can influence one to another.

Present research has of course a number of limitations. Data came from a correlational design that imposes to be cautious about causal relationship among variables. Furthermore, the correlational nature of this work may generate biases in the results given the presence of a common method (26). These aspects can affect generalizability and robustness of present results. However, the relatively large sample size and the strong theoretical anchorage of the presented research may mitigate these shortcomings.

Beyond these limitations, the current study highlights some practical utilities for managers of healthcare organization. An understanding of predictors of nurses' intention to use PICC is important since nurses are usually deputed to use this device. In the same way, to know attitude, subjective norms and self-efficacy is important since they have been proved to affect behavioral intentions. In this vein, a possible strategy which can be used to increase nurses' behavioral intention to use PICC could be to promote a positive attitude toward (and knowledge of) PICC and increase the professionals' sense of efficacy and mastery. Moreover, an important aspect that emerges from present results is that shared norms that favor the use of PICC in CU seem to increase both nurse's positive attitudes and self-efficacy whit respect to the use of these devices. Thus, it appears that to train professionals individually does not necessarily results in an increased use of PICC. Rather, it should be more efficacious to promote, along with specialist trainings, also a collective culture favoring the use of new devices and stressing the active role of nurses in the use and management of such devices.

Acknowledgment

This research has been conducted as part of the Master "Nursing in critical care", University of Parma-

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Received: 30 August 2016
Accepted: 30 September 2016
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