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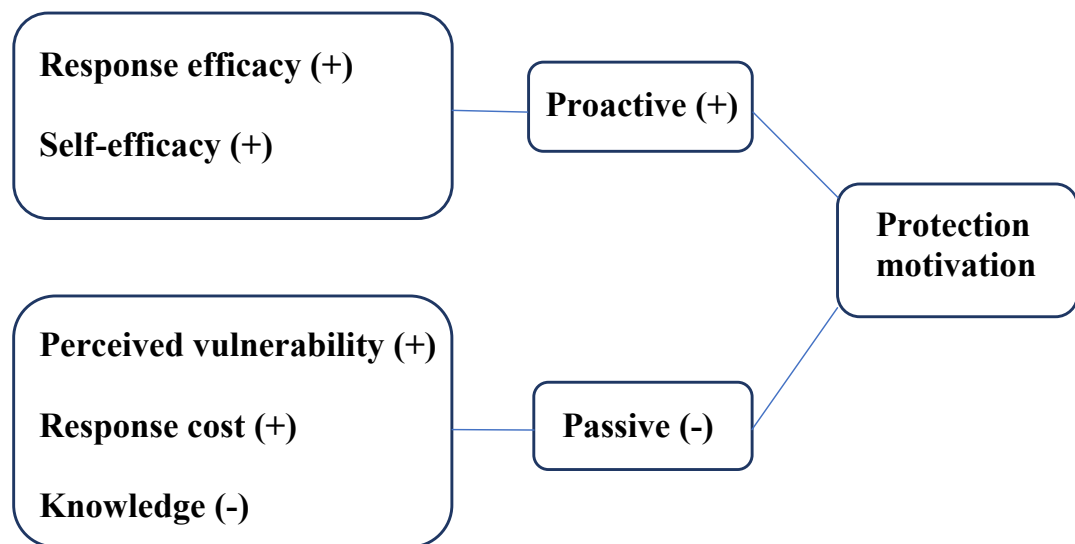
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# A CROSS-SECTIONAL EXAMINATION OF THE FACTORS RELATED TO EMERGENCY NURSES' MOTIVATION TO PROTECT THEMSELVES AGAINST AN EBOLA INFECTION



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## Graphical Abstract of Emergency Nurses' Motivation to Protect Themselves Against an Ebola Infection



Note: (+) indicates a positive association and (-) indicates a negative association

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**CE Earn Up to 8.0 Hours. See page 941.****Contribution to Emergency Nursing Practice**

- The current literature on protection motivation indicates only approximately 40% of emergency nurses felt prepared to provide care to patients potentially infected with Ebola virus.
- This article contributes to the understanding of protection motivation. Our study found that response efficacy and self-efficacy predicted emergency nurses' proactive protection motivation and perceived vulnerability, response cost, and knowledge predicted their passive protection motivation.
- Key implications for emergency nursing practice found in this article are: health system administrators are encouraged to provide continual education that will increase emergency nurses' capacity, skills, resources, understanding of pathophysiology, and use of protective equipment; to ensure job security; and to provide family and/or childcare support, professional practice insurance coverage, and paid leave for incidents owing to Ebola infection.

**Abstract**

**Introduction:** The 2014-2016 West African Ebola outbreak impacted the United States. Owing to the sporadic occurrence of the Ebola infection, there is insufficient research regarding how US emergency nurses provide care to patients potentially infected with the Ebola virus and the nurses' motivation to protect themselves when providing care to these patients. This study aimed to investigate the predictors of emergency nurses' protection motivation.

**Methods:** A cross-sectional design was employed. A survey developed based on a modified Protection Motivation Theory was administered to randomly selected members of the Emergency Nurses Association. Descriptive statistics, nonparametric Kruskal-Wallis H test (as well as post hoc Dunn-Bonferroni test), Spearman rho correlation, and stepwise multiple linear regression were conducted for data analysis.

**Results:** Protection motivation was found in 2 components: proactive and passive protection motivation. Regression analysis indicated that response efficacy ( $\beta = 0.27, P < 0.001$ ) and self-efficacy ( $\beta = 0.17, P < 0.01$ ) significantly predict emergency nurses' proactive protection motivation, whereas perceived vulnerability ( $\beta = 0.26, P < 0.001$ ), response cost

( $\beta = 0.19, P = 0.001$ ), and knowledge ( $\beta = -0.15, P < 0.01$ ) significantly predict emergency nurses' passive protection motivation.

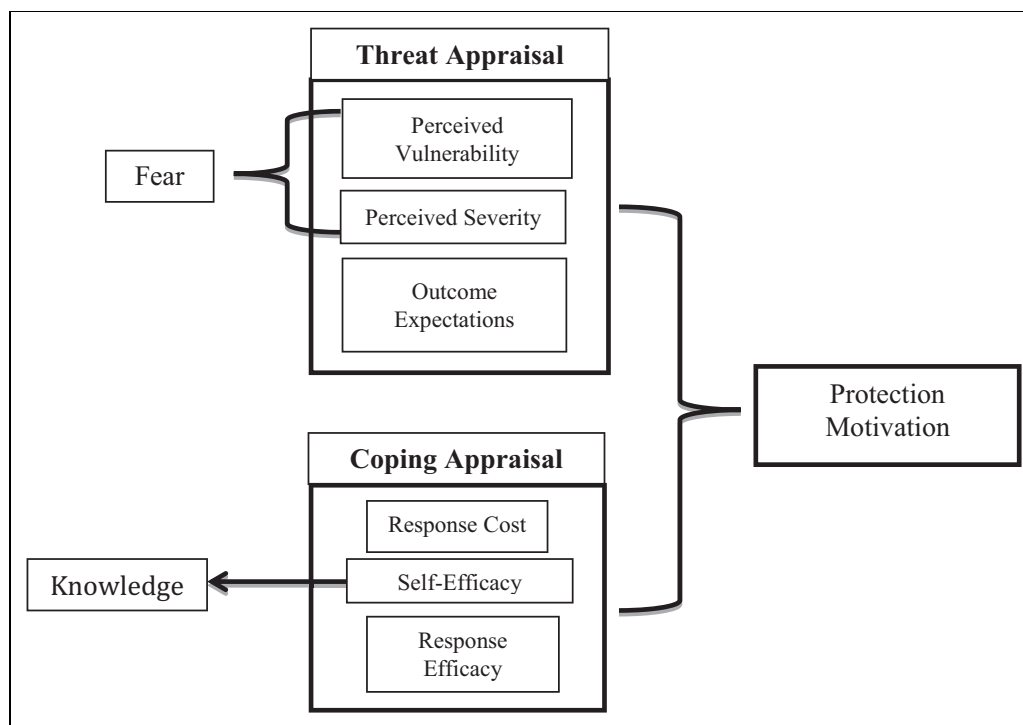
**Discussion:** The results indicate the need for interventions to improve emergency nurses' response efficacy, self-efficacy, and knowledge, while simultaneously reducing the nurses' perceived vulnerability and response cost. Such interventions would be expected to proactively motivate nurses to protect themselves when providing care to patients who exhibit the signs and symptoms of an Ebola infection and reduce their passive protection motivation.

**Key words:** Ebola virus infection; Emergency nurses; Protection motivation theory; Response efficacy

**Introduction**

Since the Ebola virus was discovered in the Democratic Republic of the Congo and the Republic of Sudan, it has caused at least 14 outbreaks around the world between 1976 and 2006, devastating towns, villages, and cities, especially in the Eastern and Central African regions.<sup>1,2</sup> During the 2014 outbreak, countries outside of the African region, such as the United States, were unexpectedly affected either by potential patients with the Ebola infection entering the country or by patients who were transferred for advanced medical care. The Ebola virus is still a potential threat because the World Health Organization recently reported 2,266 deaths from 3,456 total cases in the Democratic Republic of the Congo.<sup>3</sup>

The sporadic occurrence of this infection in countries such as the United States has resulted in limited research on the care of potential patients with the Ebola infection, because it has had a very low prevalence rate during past outbreaks.<sup>4</sup> In addition, there is insufficient research concerning how health care professionals treat patients potentially infected with the Ebola infection. In most health care settings, the emergency department is the first point of entry, and nurses have an increased risk of exposure to the virus, especially nurses who often come in direct and prolonged contact with patients while providing care. According to the Centers for Disease Control and Prevention (CDC), nurses often experience blood and body fluid exposure and have an annual exposure prevalence rate ranging from less than 10% to 44%.<sup>5</sup> Furthermore, during the 2014-2016 Ebola outbreak, 2 of the 4 US Ebola-infected cases were health care



FIGURE

Modified protection motivation theory. Outcome expectation and knowledge constructs were added as a modification to the protection motivation theory.

professionals who were exposed while providing care to an imported case from West Africa.<sup>6</sup> The purpose of this study was to use a modified Protection Motivation Theory (PMT) to explore US emergency nurses' motivation to protect themselves against patients with an Ebola infection whom they may encounter at work and to identify its associated factors and predictors.

#### PROTECTION MOTIVATION THEORY

PMT focuses on the cognitive meditational processes, which involve maladaptive and adaptive responses. Both responses can be processed as the threat appraisal and coping appraisal.<sup>7</sup> In this study, the modified PMT model (Figure) was used to investigate a social cognitive account of protective behavior in an attempt to provide clarity on the area of fear appeals and explain attitude and behavior change through matching cognitive processes that people use to evaluate threats and select coping alternatives.<sup>8,9</sup>

Protection motivation is an intermediate variable that functions to arouse, sustain, and direct protective health behavior within individuals. Similar to the intention to perform a behavior, it has a positive and negative linear

function. This includes whether the threat was considered severe (perceived severity), one's perception of one's vulnerability (perceived vulnerability), effectiveness of the recommended response (response efficacy), and the confidence an individual has in their ability to perform the recommended response (self-efficacy). The negative function is the cost of conducting the recommended response (response cost).<sup>10</sup> The constructs, perceived vulnerability and perceived severity are part of the threat appraisal, which results in fear. This means that the more an individual feels vulnerable and takes the threat seriously, the more their fear increases, which leads to a greater threat appraisal.<sup>8</sup>

To enhance the study, 2 additional constructs, knowledge and outcome expectation, were included to strengthen the predictability. The knowledge construct is found in other health behavior theories such as the Integrated Behavioral Model (IBM). Within the IBM, the intention to perform a behavior is considered the most important determinant of a behavior; however, knowledge is needed to carry out the behavior.<sup>11</sup> The outcome expectation construct is found in the Social Cognitive Theory. Within this theory, the expected outcome is the belief that multiple consequences might result from the behaviors a person chooses to perform.<sup>12</sup>

Thus, for this study, it was hypothesized that each of the emergency nurses' psychological variables (ie, self-efficacy, response efficacy, response cost, knowledge, outcome expectation, perceived vulnerability, perceived severity, fear, and protection motivation) are significantly correlated with, and predictive of, their motivation to protect themselves against an Ebola infection. In summary, this study used a modified PMT model to examine the emergency nurses' motivation to protect themselves and determine their apprehension to provide care to potential patients who may have an Ebola infection, and their related factors.

## Methods

A cross-sectional research design was used to examine emergency nurses' motivation to protect themselves when providing care to a potential patient with an Ebola infection during a single point in time.<sup>13</sup> The research protocol was approved by the Emergency Nurses Association (ENA), the Institute for Emergency Nursing Research director, and the University of Toledo Institutional Review Board (#200929).

### SOURCE POPULATION AND SAMPLE SIZE JUSTIFICATION

In 2015, the United States had approximately 33,573 ENA members.<sup>14</sup> A power analysis using G\*Power (Heinrich Heine University, Düsseldorf, Germany) was conducted and a sample size of 436 was estimated to achieve a satisfactory statistical power. Multiple linear regression was selected as the statistical test for sample size estimation, and a projected power of 0.95, type I error of 0.05, and a conservative effect size of 0.03 were entered into the estimation.<sup>15</sup>

### SURVEY INSTRUMENT

A systematic literature review was conducted to determine the journal articles that have used PMT as the theoretical backbone in conjunction with examining an infectious disease (unpublished data).<sup>7,16</sup> On the basis of the review, the survey items were developed using previous articles on Ebola and other infectious diseases,<sup>17-20</sup> then refined with the assistance of a focus group. A focus group (n = 10)<sup>21</sup> was conducted to gather primary qualitative data from 10 emergency nurses working at a university teaching hospital. On the basis of the focus group discussion, the survey questions were modified to remove or include additional questions.

As part of instrument testing, face validity was established through the systematic literature review and the focus group.<sup>22,23</sup> Content validity was established by a panel of infectious disease, public health, and research measurement experts. In addition, construct validity was examined through Principal Component Analysis (PCA) using the same study sample population. The PCA yielded 2 components in protection motivation: proactive protection motivation and passive protection motivation (unpublished data). Four items loaded as proactive protection motivation, which examined the emergency nurses' motivation to actively identify and seek resources or prevent the spread of the Ebola virus by adhering to the rules and regulations set by their place of employment. One item loaded as passive protection motivation, which examined the emergency nurses' motivation to stay inactive by being hands-off (such as avoiding going to work) when confronted with a situation where a patient might have the Ebola infection. Each of the remaining survey constructs, that is, self-efficacy, response efficacy, response cost, knowledge, outcome expectation, perceived vulnerability, perceived severity, and fear yielded only 1 component with the PCA. To test the reliability of the instrument, internal consistency and stability were evaluated using a convenience sample of emergency nurses (n = 23) to conduct Cronbach's alpha and Spearman rho correlation respectively. Cronbach's alpha ranged between 0.46 and 0.97, with 6 of the 8 survey constructs having an alpha of 0.80 or greater, which were within the recommended range.<sup>24</sup> Spearman rho correlation was conducted to assess the stability of responses in each construct at 2 different points in time by examining the statistical significance of the coefficient. Items that had a *P* value less than or equal to 0.05 were removed or modified. The survey had 10 sections comprising items for each construct and demographic questions. The instrument included 6 items on perceived vulnerability, 7 items on perceived severity, 4 items on response efficacy, 5 items on self-efficacy, 7 items on fear, 5 items on response cost, 5 items on protection motivation, and 6 items on outcome expectation, with each item having 5-point, unidirectional response options. The knowledge portion of the survey had 6 multiple-choice and 7 true or false questions. Last, the instrument had 16 demographic questions.

### PROCEDURES

The survey was administered online using Qualtrics software (Qualtrics LLC, Provo, Utah). On obtaining permission from the ENA Institute for Emergency Nursing Research

TABLE 1  
 Sample characteristics and bivariate Kruskal-Wallis H test  $\chi^2$  values ( $n = 388$ )

Characteristics			Psychological variables									
Variables	N	%	PM1	PM2	PV	RE	SE	FE	RC	OE	PS	KN
Gender (df = 2)			7.60	3.97	3.75	4.66	9.42	0.84	11.74*	1.43	4.39	1.40
Male	73	19.8										
Female	293	79.6										
Other	2	.5										
Age (df = 3)			11.76	29.04‡	18.48†	3.97	10.00	5.31	18.41†	1.88	6.69	0.79
21–35	129	36.4										
36–49	123	34.7										
50–65	100	28.2										
66+	2	.6										
Race (df = 4)			1.74	9.12	5.61	3.60	8.01	2.99	3.44	7.80	6.00	7.99
African American	12	3.3										
Caucasian	326	88.6										
American Indian	4	1.1										
Asian or Pacific Islander	7	1.9										
2 or more races	19	5.2										
Level of education (df = 4)			1.16	6.46	8.32	5.81	3.20	3.39	3.42	3.87	1.35	6.84
Diploma	16	4.3										
Associate degree	69	18.8										
Bachelor's degree	211	57.3										
Master's degree	60	16.3										
Doctoral degree	12	3.3										

*continued*

TABLE 1  
Continued

Characteristics			Psychological variables									
Variables	N	%	PM1	PM2	PV	RE	SE	FE	RC	OE	PS	KN
Licensure (df = 3)			11.35	3.53	7.23	4.38	3.19	3.06	6.39	2.62	9.50	0.13
LPN/LVN	7	1.9										
Registered nurse	339	92.1										
Clinical nurse specialist	9	2.4										
Nurse practitioner	13	3.5										
Employment setting (df = 2)			12.29*	1.32	3.55	3.67	2.35	4.28	1.90	0.40	3.07	1.42
Urban	205	55.7										
Suburban	112	30.4										
Rural	51	13.9										
Years of practicing emergency nursing (mean = 11.2, SD = 9.7 y) (df = 1)			4.08	6.41	1.38	.72	0.02	0.25	<0.01	1.89	0.63	.12
<25 y	323	87.8										
≥ 25 y	45	12.2										
Hours per week providing direct care to patients in the ED (mean = 29.4, SD = 14.2 h) (df = 1)			4.48	0.03	1.40	0.05	0.05	0.29	0.91	0.12	0.04	1.71
<36 h	139	38.1										
≥ 36 h	226	61.9										
Number of hours of training received on controlling Ebola infection (mean = 6.6, SD = 12.2 h) (df = 1)			0.19	0.38	4.38	5.12	29.17 <sup>‡</sup>	18.48 <sup>‡</sup>	9.64*	2.55	4.89	1.02
<10 h	228	84.4										
≥ 10 h	42	15.6										
Number of hours of training received on controlling Ebola infection from place of employment (mean = 5.9, SD = 10.5 h) (df = 1)			0.09	1.70	2.36	3.41	23.25 <sup>‡</sup>	14.17 <sup>†</sup>	8.69*	0.26	4.76	1.86
<10 h	211	85.4										
≥ 10 h	36	14.6										

*continued*

TABLE 1  
Continued

Characteristics			Psychological variables									
Variables	N	%	PM1	PM2	PV	RE	SE	FE	RC	OE	PS	KN
Does your place of employment have any accommodation to give care to a possible patient with Ebola? (df = 2)			14.56 <sup>†</sup>	2.97	6.45	3.93	16.69 <sup>†</sup>	2.19	1.88	0.22	4.33	8.38
No	38	10.4										
Yes	307	83.7										
Not sure	22	6.0										
Does your place of employment have the necessary equipment to give care to a possible patient with Ebola? (df = 2)			6.92	3.88	10.15	5.20	19.38 <sup>‡</sup>	5.31	3.24	0.05	0.89	5.69
No	33	9.0										
Yes	289	78.7										
Not sure	45	12.3										
Do you feel prepared to give care to a possible patient with Ebola? (df = 2)			1.01	13.79*	39.65 <sup>‡</sup>	9.11	75.17 <sup>‡</sup>	42.65 <sup>‡</sup>	16.49 <sup>†</sup>	13.52*	15.63 <sup>†</sup>	6.91
No	153	41.7										
Yes	152	41.4										
Not Sure	62	16.9										

Percentages may not equal 100% owing to rounding off.

Type I error was adjusted by the Bonferroni correction for multiple tests.

PM1, proactive protection motivation; PM2, passive protection motivation; PV, perceived vulnerability; ED, emergency department; RE, response efficacy; SE, self-efficacy; FE, fear; RC, response cost; OE, outcome expectation; PS, perceived severity; KN, knowledge; LPN, Licensed Practical Nurse; LVN, Licensed Vocational Nurse.

\*  $P < 0.005$ .

†  $P < 0.001$ .

‡  $P < 0.0001$ .



and the University of Toledo Institutional Review Board, a randomized mailing list of emergency nurses within the United States was obtained from the ENA. To reduce external validity threats and increase response rates, best practices in survey research were used.<sup>25</sup> These included using the 3-wave mailing process to maximize response rates. A systematic review of electronic surveys has shown that nonmonetary incentives, the use of a university letterhead, and personalization of cover letters might increase the response rate.<sup>25</sup>

## DATA ANALYSIS

Descriptive statistics (frequencies, mean, and SD), nonparametric Kruskal-Wallis H test (which generates  $\chi^2$  values, as well as post hoc Dunn-Bonferroni test which generates  $t$  values), Spearman rho correlation, and stepwise multiple linear regression were performed using SPSS version 26 (International Business Machines Corporation, Armonk, NY). These methods were chosen owing to their ability to identify associations more conservatively without normality assumptions. The Bonferroni correction for multiple tests was applied to adjust the significance levels of Kruskal-Wallis H tests and Spearman rho correlation. The significant variables were considered a priority in the stepwise multiple linear regression. An incomplete answer to a particular question was treated as missing data and was excluded from the statistical analysis involving the particular question. No participant missed all the questions.

## Results

### SAMPLE CHARACTERISTICS

Of the randomly selected participants, 388 emergency nurses completed the online survey. Most of the participants were Caucasian (88.6%), female (79.6%), between the ages of 21 years and 35 years (36.4%), and registered nurses (92.1%) working in an urban setting (55.7%). Most of the participants had a bachelor's degree (57.3%) and on average had practiced emergency nursing for 11.2 years (SD = 9.7 years), with 29.4 hours per week (SD = 14.2 hours) of direct care to patients. Of the emergency nurses who responded, 85.4% indicated that they received less than 10 hours of training at their place of employment on controlling an Ebola infection.

### BIVARIATE ANALYSIS

The bivariate analyses for each of the demographic characteristics and each investigated PMT construct are documented in [Table 1](#). The assumptions of the

nonparametric Kruskal-Wallis H test were met, which illustrated a statistically significant difference between the genders. Post hoc Dunn-Bonferroni tests indicated that male respondents had significantly higher self-efficacy ( $t = 2.85$ ,  $P < 0.005$ ), whereas the female nurses had significantly higher response cost ( $t = 2.81$ ,  $P = 0.005$ ). Among the age groups, there was a statistically significant difference with regard to the emergency nurses' passive protection motivation ( $\chi^2_{(3)} = 29.04$ ,  $P < 0.0001$ ), perceived vulnerability ( $\chi^2_{(3)} = 18.48$ ,  $P < 0.001$ ), and response cost ( $\chi^2_{(3)} = 18.41$ ,  $P < 0.001$ ). Post hoc Dunn-Bonferroni tests indicated that participants aged 50 years to 65 years, when compared with those who were aged 21 years to 35 years and 36 years to 49 years, had significantly lower passive protection motivation ( $t = 4.89$  and  $4.26$  respectively, both  $P < 0.0001$ ). Furthermore, participants aged 50 years to 65 years perceived themselves to be less vulnerable to the infection than those aged 21 years to 35 years ( $t = 3.76$ ,  $P < 0.001$ ). In addition, compared with those aged 36 years to 49 years ( $t = 3.88$ ,  $P < 0.001$ ) and 21 years to 35 years ( $t = 2.41$ ,  $P < 0.05$ ), participants aged 50 years to 65 years believed that the response cost associated with protecting themselves from the infection was relatively lower.

The total training hours on controlling an Ebola infection and the hours received from their place of employment illustrated statistically significant differences in the participants' self-efficacy ( $\chi^2_{(1)} = 29.17$ ,  $P < 0.0001$  and  $\chi^2_{(1)} = 23.25$ ,  $P < 0.0001$ , respectively), fear ( $\chi^2_{(1)} = 18.48$ ,  $P < 0.0001$  and  $\chi^2_{(1)} = 14.17$ ,  $P < 0.001$ , respectively), and response cost ( $\chi^2_{(1)} = 9.64$ ,  $P < 0.005$  and  $\chi^2_{(1)} = 8.69$ ,  $P < 0.005$ , respectively). Emergency nurses who received more than 10 hours of training on controlling an Ebola infection, either from their place of employment or from elsewhere, had significantly higher self-efficacy, less fear, and lower response cost in managing an Ebola infection than those who had fewer than 10 hours of training. These results demonstrate to health care administrators that providing more than 10 hours of training in infection control for emergency nurses will make them better prepared and confident.

Emergency nurses who felt prepared (as opposed to those who felt unprepared) to provide care to potential patients with an Ebola infection had significantly lower passive protection motivation ( $t = -3.33$ ,  $P < 0.001$ ), lower perceived vulnerability ( $t = -6.30$ ,  $P < 0.0001$ ), higher response efficacy ( $t = 3.01$ ,  $P < 0.001$ ), higher self-efficacy ( $t = 8.67$ ,  $P < 0.0001$ ), less fear ( $t = -6.30$ ,  $P < 0.0001$ ), lower response cost ( $t = -3.80$ ,  $P < 0.001$ ), lower outcome expectation ( $t = -3.65$ ,  $P < 0.001$ ), and lower perceived severity ( $t = -2.90$ ,  $P < 0.005$ ).

Furthermore, the results showed that the level of licensure is associated with the emergency nurses' proactive

TABLE 2

**Spearman rho correlation matrix showing the bivariate correlations among the modified protection motivation theory constructs**

Variable	PM1	PM2	PV	RE	SE	FE	RC	OE	PS	KN
PM1	1									
PM2	-0.02	1								
PV	-0.03	0.34 <sup>‡</sup>	1							
RE	0.26 <sup>‡</sup>	-0.05	-0.26 <sup>‡</sup>	1						
SE	0.18 <sup>‡</sup>	-0.09	-0.28 <sup>‡</sup>	0.38 <sup>‡</sup>	1					
FE	0.08	0.24 <sup>‡</sup>	0.39 <sup>‡</sup>	-0.10	-0.29 <sup>‡</sup>	1				
RC	0.03	0.30 <sup>‡</sup>	0.26 <sup>‡</sup>	-0.04	-0.15*	0.57 <sup>‡</sup>	1			
OE	0.16*	0.18 <sup>†</sup>	0.24 <sup>‡</sup>	0.03	-0.07	0.50 <sup>‡</sup>	0.41 <sup>‡</sup>	1		
PS	0.17 <sup>†</sup>	0.05	0.09	0.04	-0.02	0.49 <sup>‡</sup>	0.32 <sup>‡</sup>	0.36 <sup>‡</sup>	1	
KN	0.03	-0.18 <sup>†</sup>	-0.01	0.12	0.03	-0.00	0.01	0.08	0.09	1

Type I error was adjusted by the Bonferroni correction for multiple tests.

PM1, proactive protection motivation; PM2, passive protection motivation; PV, perceived vulnerability; RE, response efficacy; SE, self-efficacy; FE, fear; RC, response cost; OE, outcome expectation; PS, perceived severity; KN, knowledge.

\*  $P < 0.005$ .

†  $P < 0.001$ .

‡  $P < 0.0001$ .

protection motivation ( $\chi^2_{(3)} = 11.35, P < 0.05$ ) and their perceived severity of the infection ( $\chi^2_{(3)} = 9.50, P < 0.05$ ). Further analysis exploring the differences by licensure found that, when compared with registered nurses and clinical nurse specialists, licensed practical nurses/licensed vocational nurses had significantly lower proactive protection motivation ( $t = -3.08, P < 0.005$  and  $t = -2.65, P < 0.01$ , respectively) and perceived severity ( $t = -3.06, P < 0.005$  and  $t = -2.35, P < 0.05$ , respectively).

The Spearman rho correlation matrix in Table 2 displays the computed coefficients for each psychological variable when associated with the outcome variables. Proactive

protection motivation was highly and positively correlated with response efficacy ( $\rho = 0.26, P < 0.0001$ ), self-efficacy ( $\rho = 0.18, P < 0.0001$ ), outcome expectation ( $\rho = 0.16, P < 0.005$ ), and perceived severity ( $\rho = 0.17, P < 0.001$ ).

The second outcome variable, passive protection motivation, was highly and positively correlated with perceived vulnerability ( $\rho = 0.34, P < 0.0001$ ), fear ( $\rho = 0.24, P < 0.0001$ ), response cost ( $\rho = 0.30, P < 0.0001$ ), and outcome expectation ( $\rho = 0.18, P < 0.001$ ). In addition, knowledge ( $\rho = -0.18, P < 0.001$ ) was highly and negatively correlated with passive protection motivation.

TABLE 3

**Stepwise multiple linear regression results showing predictors of proactive protection motivation and passive protection motivation**

Outcome variables	Predictors	B	SE	Beta	t	Sig.	F	R <sup>2</sup>
Proactive protection motivation	(Constant)	15.32	0.59		26.11	<0.001	24.03	0.14
	Response efficacy	0.16	0.04	0.27	4.49	<0.001		
	Self-efficacy	0.06	0.02	0.17	2.78	0.006		
Passive protection motivation	(Constant)	1.31	0.46		2.85	0.005	17.67	0.16
	Perceived vulnerability	0.08	0.02	0.26	4.66	<0.001		
	Response cost	0.05	0.02	0.19	3.34	0.001		
	Knowledge	-0.11	0.04	-0.15	-2.80	0.006		

R<sup>2</sup>, coefficient of determination; F, F statistic; B, unstandardized regression coefficient.

## MULTIVARIATE ANALYSIS

Stepwise multiple linear regression was conducted for each outcome variable (proactive protection motivation and passive protection motivation) to estimate their predictors and their proportion of variance. All the psychological explanatory variables were entered into the regression model, and the stepwise procedure selected and removed the predictors on the basis of their significance levels. Response efficacy ( $\beta = 0.27$ ,  $P < 0.001$ ) and self-efficacy ( $\beta = 0.17$ ,  $P < 0.01$ ) were significant predictors of proactive protection motivation and accounted for 14% of the variance. Perceived vulnerability ( $\beta = 0.26$ ,  $P < 0.001$ ), response cost ( $\beta = 0.19$ ,  $P = 0.001$ ), and knowledge ( $\beta = -0.15$ ,  $P < 0.01$ ) were significant predictors of passive protection motivation and accounted for 16% of the variance as illustrated in [Table 3](#).

## Discussion

The results from the study revealed a statistically significant relationship between the outcome variables and the modified PMT variables, which rejects the null hypotheses that the psychological variables do not correlate with protection motivation and that there are no significant predictors of the nurses' motivation to protect themselves against potential patients with the Ebola infection. The outcome variable, protection motivation, was divided into proactive protection motivation and passive protection motivation on the basis of the PCA. Although the bivariate analyses showed multiple paired associations, multiple linear regression was able to further identify statistically significant predictors after controlling other explanatory variables.

On the basis of the results from the multivariate analysis, response efficacy and self-efficacy positively predicted emergency nurses' proactive protection motivation. Both response efficacy and self-efficacy are part of the coping appraisal in the PMT. Response efficacy assesses the belief that the recommended coping response might be effective in reducing the threat, and self-efficacy assesses the perceived ability to perform the recommended coping response.<sup>8</sup> Both constructs influence the nurses' motivation to conduct the recommended coping response. The regression coefficients from these 2 constructs indicate that higher self-efficacy and/or higher response efficacy can lead to an increase in the nurses' proactive protection motivation. These findings are consistent with those of previous studies that used the PMT as their theoretical framework. Coping strategies available for participants have a stronger effect on whether they will conduct the protective behavior, and high response efficacy strengthens their intention to protect themselves and reinforces their belief that the protective behavior is effective.<sup>7,8</sup>

For passive protection motivation, the regression analysis indicated that perceived vulnerability positively, response cost positively, and knowledge negatively predicted passive protection motivation. Perceived vulnerability assesses the likelihood of contracting the disease, response cost assesses the cost associated with performing the recommended protective behavior, and knowledge is the amount of information needed to carry out the behavior.<sup>8,11</sup> The more vulnerable the nurses believe they are, the more likely that they will exhibit passive protection motivation behavior. Perceived vulnerability was the strongest predictor of passive protection motivation. Vulnerability is associated with fear of the disease and in the belief that the individual has a higher likelihood of being exposed to and contracting the disease. Previous researchers have examined behavioral intention and vulnerability relating to the individual hearing about the threat, assessing how dangerous the disease is, and estimating their personal vulnerability before determining whether to perform the protective behavior.<sup>8</sup>

Added to perceived vulnerability, the cost associated with the protective behavior and the limited knowledge they had about the disease led to an increase in passive protection motivation. Limited knowledge about the Ebola virus and the protective behaviors determine whether a nurse will actively perform the protective behavior or possibly avoid the place of employment owing to potential patients that they might encounter. According to the American Nurses Association survey of registered nurses ( $n = 7,353$ ), health and safety at their workplace were cited as influencing concerns on whether nurses will continue working in the field and the type of nursing work they choose to perform.<sup>5</sup> In addition, media messages and incorrect information can lead to heightened perception of risk, which could increase fear and perceived vulnerability. The CDC reported that the high frequency of risk-elevating messages in news coverage can increase public concern and perception and contribute to social amplification of risk, which leads to the spread of misinformation.<sup>26</sup> Continual re-education, training, and demonstrations of preventive recommendations and nonpharmacological interventions<sup>6</sup> will not only increase nurses' confidence in providing care to potential patients, they might also reduce passive protection motivation.

## Limitations

There are some limitations to this study. The random sample of emergency nurses comprise ENA members. ENA members may not demographically represent all emergency nurses in the United States, which presents a potential threat to the external validity of the findings. However, it can be

hypothesized that ENA members might be professionally dedicated and experienced, and the current findings represent a liberal estimate of the nurses' motivation to protect themselves when providing care to potential patients with the Ebola infection.

In addition, the timing of the Ebola outbreak might have influenced the nurses' motivation toward engaging in protective practices while providing care to patients possibly infected with the disease. The outbreak occurred more than a year before the survey was distributed, and the nurses' heightened awareness of the disease might have decreased considerably, affecting the response rate. The study response rate was 23% (388/1,686), which yielded a power of 93%. The power analysis indicated a strong probability that the research might only commit a small type II error.

Previous studies that surveyed emergency nurses and other health care professionals achieved high or low response rates depending on the research topic and their specialty. Studies that focused on stress, burnout, and depression among nurses had a response rate of 84%,<sup>27</sup> substance abuse study had a response rate of 69%,<sup>28</sup> research focused on exposure to various common diseases had response rates between 66% and 83%,<sup>29</sup> and workplace injury research had response rates between 67% and 75%,<sup>30</sup> whereas a violence surveillance study had a response rate of 9.5%.<sup>31</sup>

### Implications for Emergency Nurses

This study identified that perceived vulnerability, response cost, and knowledge have an impact on whether the nurses exhibit passive protection motivation behavior. Thus, it is recommended that administrators provide continual training and simulations for nurses. Administrators need to provide continual education regarding the disease, its method of transmission, and current CDC personal protective equipment (PPE) recommendations when providing care to Ebola-infected patients. Rebmann et al<sup>6</sup> identified that fewer than 15% of health care personnel correctly don and doff the PPE needed to provide care to an Ebola patient, whereas hand hygiene compliance was between 40% and 53% among triage nurses in an emergency department. Continual training and education acquired by nurses would reduce their perceived vulnerability toward the disease and increase their self-efficacy and response efficacy toward the protective behavior, such as using the recommended equipment and guidelines. Such educational intervention also improved PPE compliance from 44% to 69%.<sup>6</sup> In instances where the infectious agent is new, such as with the current coronavirus disease (COVID-19) pandemic, nurses can use prior education and training to direct their current protective behaviors.

In addition, emergency care leaders need to have updated protective equipment such as adequate respirators, disposable impermeable gowns/coveralls, disposable examination gloves with extended cuffs, disposable boot covers, and disposable aprons available in their hospitals and clinics.<sup>32</sup> The availability of PPE has emerged as a major barrier to nurses and other health care professionals, with regard to their self-efficacy and response efficacy toward their protective behaviors in the current COVID-19 pandemic. Furthermore, administrators should be aware of the influencing factors and barriers that prevent the use of PPE among nurses. A focus group study indicated that emergency situations, availability of equipment, negative influence of protective equipment on nurses, patient discomfort, being busy, implementing guidelines being time-consuming, and physicians' influence were cited as barriers that may influence a nurse's compliance with standard precautions, even if they received continual training.<sup>33</sup> Although these factors were identified by participants in the focus group as barriers to the use of PPE among nurses, these findings may not be supported for other communicable infectious diseases. The transmission route, knowledge, and outcome expectation as well as the mortality and morbidity associated with an infectious disease may have an influence on nurses' proactive protection motivation, which could limit their engagement in the recommended protective health behaviors. More specifically, nurses' perceived severity of and perceived vulnerability to an infectious disease may have a stronger impact than their response efficacy and self-efficacy, which might enable them to be proactive in their motivation to engage in protective health behaviors. During the current COVID-19 pandemic, multiple anecdotal evidences are emerging in support of nurses being proactive in their motivation to engage in protective health behaviors.

Adequate accommodation, such as a single-patient room with a private bathroom, and dedicated medical equipment should be made available while also adhering to the hospital's environmental infection control guide.<sup>34</sup> Reducing the response cost, such as making the protective equipment readily available and up to date, can limit the nurses' passive protection motivation behavior. Finally, having a standard operating procedure for receiving patients with a potential Ebola infection is also recommended.

### Conclusions

To our knowledge, this is the first study to examine emergency nurses' motivation to engage in protective procedures to help prevent the transmission of the Ebola virus, based on

demographics (ie, gender, race, level of education, current licensure, age, employment setting, and years of emergency nursing) and psychological variables (ie, self-efficacy, response efficacy, response cost, knowledge, outcome expectation, perceived vulnerability, perceived severity, fear, and protection motivation) using a modified version of the PMT model. The lessons learned from this study, although about the Ebola virus infection, can be applied to the COVID-19 pandemic because their transmission routes are similar; therefore, nurses' protection motivation can be reasonably projected.

Future research should focus on conducting a longitudinal study that examines how knowledge affects nurses' motivation to protect themselves from the Ebola virus or other infectious diseases. Transmission routes and ease of transmission, as well as the morbidity and mortality of the disease, should be examined to explore if there is a relationship between these factors and nurses' motivation to protect themselves from infectious diseases and if their protection motivation varies across diseases. The low variance found in the analysis did not indicate very strong predictors of protection motivation within the modified PMT model. However, the PMT has been used by previous researchers to examine the prevention of HIV and nurses' motivation to care for HIV patients.<sup>8,10</sup> Similar infectious-disease studies have used the PMT to explore nurses' motivation for care; this suggests that the theory is appropriate for this study. The addition of other constructs to the original PMT model and modifying the survey items might be other suggestions that could indicate stronger predictors of protection motivation.

This research did not measure the actual behavior of nurses but focused on their intended behavior. It is suggested that future research should examine the nurses' actual behavior and the use of preventive recommendations and nonpharmacological interventions when providing care to infected patients in comparison with the nurses' intended behavior. Legitimate reasons, such as fear and limited knowledge, also determine whether nurses conduct proactive protection motivation behavior or passive protection motivation behavior. Fear, possible response cost, and limited knowledge hinder, and possibly influence, nurses providing care to potential patients infected with Ebola. Efforts should be focused on providing support, continual training, and current resources and guidance that empower and encourage nurses to exhibit proactive protection motivation behavior.

### Author Disclosures

Conflicts of interest: none to report.

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