

## Original Article

# Application of Neuman's Systems Model on Anxiety of Older Adults Waiting for Colonoscopy

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### ABSTRACT

**Background:** Older adults waiting for colonoscopy are anxious due to the lack of knowledge about the procedure, its preparations, and aftercare. **Objectives:** The aim of this study was to evaluate the effect of the Neuman systems model (NSM) on anxiety of older adults waiting for colonoscopy. **Methods:** A pre- and postintervention study was conducted on 72 older adults who were waiting for colonoscopy. The participants were randomly allocated to either a control ( $n = 36$ ) or an intervention group ( $n = 36$ ). The intervention was performed in four steps, namely determining the potential and actual stressors, setting the goals, nursing interventions, and evaluation, according to the four-step nursing process in the NSM. A need assessment checklist based on the NSM and the Geriatric Anxiety Scale was completed before and after the intervention. Data analysis was performed using Fisher's exact, independent, and paired  $t$ -tests. **Results:** At baseline, the mean score of total anxiety was  $35.66 \pm 7.58$  in the intervention group and  $35.29 \pm 6.52$  in the control group. After the intervention, these values changed to  $26.71 \pm 7.48$  and  $34.06 \pm 7.23$ . Before the intervention, there was no statistically significant difference between the anxiety scores of the two groups in cognitive, affective, and somatic dimensions and total anxiety scores ( $P > 0.05$ ). However, after the intervention, statistically significant differences were found between the two groups in the mean scores of the aforementioned components ( $P < 0.001$ ). **Conclusion:** Implementing an educational program based on NSM reduced anxiety in older adults waiting for colonoscopy. Nurses should be trained about the NSM to be able to use similar programs in reducing the anxiety of patients waiting for colonoscopy.

**KEYWORDS:** *Ageing, Anxiety, Betty Newman systemic model, Colonoscopy*

## INTRODUCTION

The age of the population is increasing in developing countries. The world's population over the age of 65 is projected to double in the next 40 years. About half of this population will live in Asian countries. With aging, the risk of developing chronic diseases such as gastrointestinal diseases and gastrointestinal cancers increases.<sup>[1-3]</sup> Timely diagnosis through early screening techniques is the most effective way to reduce cancer mortality.<sup>[2]</sup>

Gastrointestinal cancers are common in older adults.<sup>[3-5]</sup> A study found that 47.5% of colorectal cancers occur among older adults.<sup>[5]</sup> Another study reported that more

than 90% of colorectal cancers are diagnosed after the age of 50. Therefore, it is recommended that all people over the age of 50 be screened for colorectal cancer.<sup>[5-7]</sup>

Colonoscopy is the gold standard for the screening and diagnosis of colorectal cancers.<sup>[4,8]</sup> However, this diagnostic procedure induces more side effects in older adults than in young people.<sup>[8,9]</sup> Poor understanding and poor adherence to preparation instructions cause water

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and electrolyte imbalance, intestinal impurity, and failure to diagnose neoplastic lesions.<sup>[10]</sup>

Fear and anxiety are common in older adults who are waiting for colonoscopy.<sup>[11]</sup> Lack of knowledge and unfamiliarity with the technique and the procedure are common causes of this anxiety and can result in inadequate preparations. A recent study by Yekefallah *et al.* showed that candidates for endoscopic procedures suffer from moderate to very severe anxiety due to lack of knowledge about the procedure and uncertainty of the required preparations.<sup>[12]</sup> Parker *et al.* have also reported that 21% of people on the waiting list for colonoscopy experienced moderate-to-severe anxiety which consequently resulted in painful, difficult, and incomplete procedures and increased the need for sedatives.<sup>[13]</sup> Therefore, it is necessary for nurses to use appropriate methods for reducing anxiety in patients who are waiting for invasive procedures such as colonoscopy.<sup>[9]</sup>

Anxiety is usually treated with anxiolytic drugs. However, these drugs are associated with several side effects, and the side effects might be more severe in older adults.<sup>[8,12]</sup> Therefore, nurses are responsible to reduce the anxiety of their clients – especially older adults – through safe and preferably nonpharmacological interventions.<sup>[13,14]</sup>

The Neuman systems model (NSM) is a nursing theory based on the individual's reaction to stress. According to the NMS, people are always threatened by stressors of extrapersonal, interpersonal, and intrapersonal origins. If the individual's three defense lines (i.e. the flexible and normal lines of defense, and the lines of resistance) cannot properly respond to these stressors, stress, anxiety, energy depletion, system instability, and illness occur.<sup>[15]</sup> The purpose of the nurse is to alleviate the stress and anxiety and retain the system's stability through primary, secondary, or tertiary prevention interventions. Before the client system reacts to stressors and to prevent a stressor invasion, nursing actions – mainly healthy lifestyle education – should be implemented as primary prevention to promote wellness of the client system. The nurse implements secondary prevention actions whenever reactions occur to stressor and symptoms are present. Tertiary prevention interventions – such as education and rehabilitation – are nursing actions after a therapeutic modality to maintain and reestablish the client system stability.<sup>[16]</sup>

A number of studies reported the beneficial effects of implementing the NSM in identifying the stressors and coping patterns and alleviation of stress and anxiety in patients with laryngeal cancer,<sup>[14]</sup> prehypertension,<sup>[17]</sup>

and stroke.<sup>[18]</sup> However, these studies are mostly descriptive<sup>[14,17]</sup> or case reports,<sup>[18]</sup> and no experimental study is available in this area. Due to the widespread use of colonoscopy in older adults,<sup>[19]</sup> and considering the nurses' responsibility for prevention or alleviation of stress and anxiety in this vulnerable population, the question is whether the application of the NSM can reduce the level of anxiety in older adults awaiting colonoscopy?

## Objectives

This study aimed to evaluate the effect of the NSM on the anxiety of older adults waiting for colonoscopy.

## METHODS

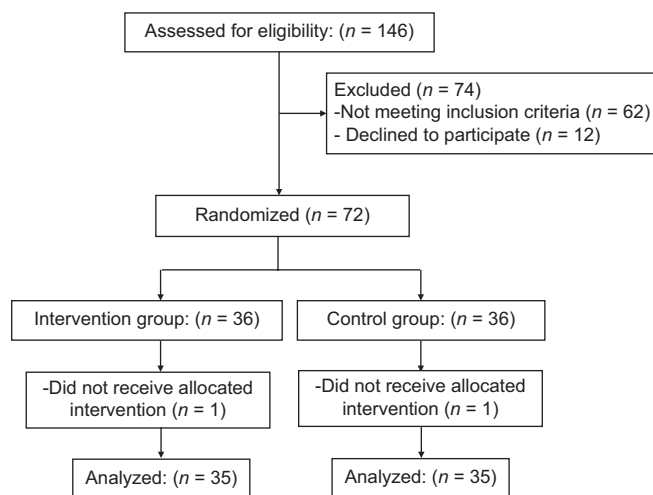
### Design, setting, and participants

The present study used a pre- and postintervention design. The study population included all older adults waiting for colonoscopy and referred to the endoscopy department of Imam Sajjad Hospital in Ramsar, Iran. Seventy-two older adults waiting for colonoscopy participated in the study between 2019 and 2020.

The sample size was estimated based on a pilot study on eight older adults waiting for colonoscopy in which their total anxiety score was decreased from  $8.88 \pm 1.8$  to  $7.94 \pm 2.25$  and using the following formula:  $N = (Z_{1-\alpha/2} + Z_{1-\beta})^2 (\delta_1^2 + \delta_2^2) / (\mu_1 - \mu_2)^2$ . Then, with a  $\delta_1^2 = 1.8$ ,  $\delta_2^2 = 2.25$ ,  $\mu_1 = 8.88$ ,  $\mu_2 = 7.94$  and considering a confidence level of 0.95, and a power of 0.8, the sample size for each group was estimated at 28. However, given the possible attrition, we recruited 36 ones per group.

Inclusion criteria were age between 60 and 74 years, fluency in the Persian language, receiving no anxiolytic and antipsychotic drugs in the last 6 months, no hearing and cognitive impairments, experiencing no severe stress such as losing a close relative in the last 3 months, no history of endoscopy or colonoscopy, and obtaining at least 50% of the total score of the NSM need assessment checklist. The participants were excluded if they did not cooperate at any stage of the study or did not refer for colonoscopy [Figure 1].

The list of older adults who were candidates for colonoscopy has regularly been obtained from the endoscopy unit. Then, the researcher made a call to the candidates, explained them the goals of the study, and invited them to participate in the study. If a candidate agreed to participate, she/he was invited to the hospital conference room to complete the study questionnaires. Then, their training needs were assessed using a checklist based on the NSM. Older adults who obtained at least 50% of the score of the need assessment were



**Figure 1:** The study flow diagram

included in the study. Sampling continued until the sample size reached 72. The participants were randomly allocated to an intervention or a control group. To this end, a numerical list of 72 hypothetical participants was created, and odd and even numbers were respectively allocated to either the control or the intervention group. The sampling was completed in about 3 months.

### Data collection instruments

Data collection instruments included a demographic questionnaire, Geriatric Anxiety Scale (GAS), and a need assessment checklist based on NSM. The demographic questionnaire included questions on the participants' age, sex, marital status, employment status, place of residence, adequacy of income, insurance status, and other people who lived with them.

The GAS is a 25-item self-report scale designed for the screening of anxiety in older adults. Items are categorized into three subscales for assessing somatic (9 items), cognitive (8 items), and affective symptoms of anxiety (8 items). All items are scored on a 4-point scale as follows: 0: "Never," 1: "Sometimes," 2: "Often," and 3: "Always."<sup>[20]</sup> The score ranges between 0 and 75. Higher scores indicate more anxiety. Participants are asked to rate each question according to how they felt last week. The reliability of the Persian version of this scale has been confirmed by Bolghan-Abadi *et al.* and the Cronbach's alpha for of the total scale and its somatic, cognitive, and affective subscales was 0.92, 0.84, 0.81, and 0.80, respectively.<sup>[21]</sup>

The need assessment checklist was developed through a literature review.<sup>[18,22]</sup> The checklist consists of 33 items in five subscale, namely physiological (9 items), psychological (11 items), sociocultural (5 items), evolutionary (3 items), and spiritual (5 items) dimensions. All items are scored as 1: "Yes" or 0:

"No." Content validity of the need assessment checklist was confirmed by 10 nursing instructors at the nursing department of Babol University of Medical Sciences. For test-retest reliability assessment, 10 older adults waiting for colonoscopy completed the checklist twice with a 2-week interval ( $r = 0.78$ ).

### Intervention

The intervention was performed in four steps namely determining the potential and actual stressors, setting the goals, nursing interventions, and evaluation, according to the four-step nursing process in the NSM.<sup>[23]</sup>

In the first stage, participants in both the study groups completed the demographic questionnaire, GAS, and need assessment checklist a week before colonoscopy. In the second step, appropriate goals and nursing interventions were identified for each patient in the intervention group to strengthen their normal and flexible defense lines. Then, in the third stage, nursing interventions (training and counseling) were performed for the participants in the intervention group based on the specific needs of each client. Nursing interventions were performed in the form of teaching relaxation and distraction techniques, encouraging family members to talk to the older adults about their feelings, and providing necessary explanations about the patient's fears, concerns, and questions. The educational session for each patient lasted for 30–50 min. During the week before colonoscopy, the researcher called each participant and if necessary, a telephone consultation was conducted. In addition, one or two additional training sessions were arranged for each patient as needed and the duration of these additional sessions varied from 15 to 30 min. In the final step (i.e. 7 days after the first session), the evaluation was done by measuring the anxiety through completing the GAS.

Participants in the control group were provided with routine colonoscopy preparation instructions (colon preparations, diet, medications, and transportation, through a face-to-face educational session and a pamphlet). All participants in the control group also completed the GAS at the end of the study (i.e. before the colonoscopy procedure). In both groups, all instruments were completed through face-to-face interviews conducted by the first researcher.

### Ethical considerations

This study was approved by the Ethics Committee of Babol University of Medical Sciences, Babol, Iran (code: IR. MUBABOL.HRI.REC.1398.1261). Moreover, the study was registered in the Iranian Registry of Clinical Trials (code: IRCT20200211046461N1). Participants completed a written consent form, were assured of the

data confidentiality, and could withdraw from the study at any stage.

### Data analysis

Study data were analyzed using the SPSS software version 16.0 (SPSS Inc., Chicago, IL, USA). The normality of the data was tested using a Smirnov–Kolmogorov test. Between-group comparisons respecting categorical and numerical variables characteristics of the participants were made using the Fisher's exact test and the independent-samples *t*-tests, respectively. Within- and between-group comparisons respecting the mean anxiety scores were made using the paired and the independent samples *t*-tests.

## RESULTS

Overall, 70 older adults waiting for colonoscopy completed the study. The mean age of the intervention and control groups was  $64.06 \pm 4.058$  and  $63.40 \pm 4.14$  years, respectively. Most of the participants were married. The education level of the participants was mostly high school diplomas and most of the participants in the two groups lived in rural areas. The results of Chi-square and Fisher's exact tests showed no statistically significant difference between the groups respecting participants' personal characteristics [ $P > 0.05$ , Table 1].

Six nursing diagnoses related to stressors induced by colonoscopy were determined, based on the need assessment checklist. Accordingly, imbalance of fluid and electrolytes, activity intolerance, fear, anxiety, lack of knowledge about colonoscopy procedure, sleep disturbance, and disturbance in social interactions were the most important nursing diagnoses in the present study. The most common nursing diagnoses were related to psychological, fear, and anxiety dimensions (78%) [Table 2].

At baseline, the mean score of total anxiety was  $35.66 \pm 7.58$  in the intervention group and  $35.29 \pm 6.52$  in the control group. After the intervention, these values changed to  $26.71 \pm 7.48$  and  $34.06 \pm 7.23$ , respectively. The independent *t*-test showed that before the intervention, there was no statistically significant difference between the anxiety scores of the two groups in cognitive, affective, and somatic dimensions and total anxiety scores ( $P > 0.05$ ). However, after the intervention, statistically significant differences were found between the two groups in the mean scores of the aforementioned components [ $P < 0.001$ , Table 3].

## DISCUSSION

The results showed that the implementation of the nursing process based on the NSM reduced cognitive, somatic, and affective symptoms of anxiety as well

as the total anxiety scores. Our intervention included distraction and drawing attention toward the positive aspects of the examination. All of these interventions can reduce people's anxiety. A former study also reported that the implementation of the nursing process based on the Betty Neuman model could reduce anxiety in men with laryngeal cancer.<sup>[14]</sup> A systematic review also concluded that the implementation of NSM in the intensive care units has decreased the occurrence of delirium in patients and developed a relaxing environment.<sup>[22]</sup> Other studies also reported that the implementation of the NSM was effective in reducing anxiety in patients with multiple sclerosis<sup>[24]</sup> and before orthopedic surgery.<sup>[25]</sup> All these findings confirm the beneficial effects of the implementation of NSM in reducing anxiety in all patients including older adults. Neuman considers patient education, counseling, and psychological support as the most important preventive measures that nurses can implement to reduce the impact of stressors on their clients. All these measures not only strengthen the patients' flexible and normal defense lines but also can make the clients' resistance lines stronger.<sup>[23]</sup>

Based on the results, "fear and anxiety" and "lack of knowledge" were among the most common nursing diagnoses in older adults waiting for colonoscopy. The possibility of diagnosing dangerous diseases was one of the important sources of fear and anxiety in older adults awaiting colonoscopy. A study showed that fear of pain and the possibility of infection transmission through the endoscope cause anxiety before lower gastrointestinal endoscopy.<sup>[13]</sup> Another study also reported that – due to the lack of time and lack of a coherent plan – health-care professionals often do not properly prepare the client and do not give sufficient information to them on how the examination is done.<sup>[26]</sup> It seems that routine preparations for colonoscopy mainly focus on bowel preparations, and little information is given to the patients about the procedure. However, implementation of the nursing process based on the NSM and patient education about the procedure, the examination environment, colonoscopy device, and how it works increases the patients' awareness of the examination and its goals, eases the acceptance of the diagnostic method, helps clients to cooperate, and reduces their anxiety and fear.<sup>[16]</sup> Consistent with this conclusion, Hsueh *et al.* have reported that a multimedia guide to the colonoscopy procedure could effectively reduce the examination-related anxiety and pain of patients.<sup>[9]</sup>

In the present study, the willingness to participate in the study was considered as an inclusion criterion. It is possible that older people who were willing to participate in the study had lower levels of anxiety, which can be considered as a limitation.

**Table 1: The frequency distribution of the participants' characteristics**

Variable	Groups		P
	Intervention, n (%)	Control, n (%)	
Gender			
Male	18 (51.4)	18 (51.4)	0.99
Female	17 (48.6)	17 (48.6)	
Age			
64-60	23 (65.7)	24 (68.6)	0.99
69-65	7 (20)	7 (20)	
75-70	5 (14.3)	4 (11.4)	
Marital status			
Married	31 (88.6)	30 (7/85)	0.99
Widow/widower	4 (11.4)	5 (14.3)	
The people who lived with the elder			
Spouse	12 (34.3)	21 (60)	0.04
Spouse and children	19 (54.3)	9 (25.7)	
Relatives	0 (0)	1 (2.9)	
Alone	4 (11.4)	4 (11.4)	
Level of education			
Illiterate	0 (0)	1 (2.9)	0.77
Primary school	7 (20)	9 (25.7)	
High school	6 (17.1)	8 (22.9)	
College	14 (40)	10 (28.6)	
University	8 (22.9)	7 (20)	
Having insurance			
Yes	35 (100)	34 (1/97)	0.99
No	0 (0)	1 (9/2)	
Place of living			
Urban	16 (45.7)	14 (40)	0.34
Rural	14 (40)	11 (31.4)	
Suburbs	5 (14.3)	10 (28.6)	
Adequate income			
Yes	10 (28.6)	4 (11.4)	0.72
No	8 (22.9)	9 (15.7)	
Partially	17 (48.6)	22 (62.9)	
Having other diseases			
Yes	11 (34.4)	7 (20)	0.77
No	24 (68.6)	28 (80)	
Employment status			
Employee	2 (5.7)	0 (0)	0.61
Farmer	3 (8.6)	5 (14.3)	
Manual worker	2 (5.7)	3 (8.6)	
Housewife	9 (25.7)	13 (37.1)	
Self-employed	8 (22.9)	6 (17.1)	
Retired	11 (31.4)	8 (22.9)	

One of the strengths of the present study is that it examined anxiety of older adults using a coherent model and based on a need assessment tool. This fact shows the beneficial effects of the implementation of the nursing process based on NSM.

## CONCLUSION

The results showed that the implementation of an educational program based on NSM reduced anxiety in

older adults awaiting colonoscopy. It is recommended that nurses use similar programs based on NSM in clinical settings to reduce anxiety and improve the health of the older adults waiting for colonoscopy. The use of this model for identifying the patients' stressors can improve the quality of nursing care, decrease the patients' anxiety, and increase the patients' cooperation during colonoscopy examinations. Then, the likelihood of complications and adverse effects would be decreased.

**Table 2: Nursing process based on Betty Neuman system model for 70 elderly candidates for colonoscopy**

Stressor dimensions/ stressors	Type of stressors			Nursing diagnoses	Nursing interventions	Percentage
	Intrapersonal	Inter personal	External			
Physiologic						78
Paleness, dryness of the oral mucosa and mucous membranes	✓			Water and electrolyte imbalance due to diarrhea-related to intestinal preparation	Controlling vital signs Advising the client to consume fluids in more meals with less volume	
Physiologic						71.8
Fatigue, inability to perform activities	✓			Intolerance to activity due to recent health problems	Recommending the consumption of high-calorie liquids	
Physiologic						70.8
Sleeplessness	✓			Sleep pattern disorder characterized by a reduction in sleep time from 5-6 h to 3-4 h	Creating a calm environment Advice not to consume the caffeinated compounds	
Psychological						78.5
Anxiety, despair, fear of the future	✓			Fear and anxiety about problems with a possible diagnosis after colonoscopy	Training relaxation and distraction techniques Encouraging family members to ask the patient to talk about his feelings	
Evolutionary						62.5
Lack of knowledge	✓			Lack of knowledge about colonoscopy procedure	Providing explanations on the procedure and endoscopy room	
Sociocultural						26
Isolation, unwillingness to communicate with others		✓	✓	Disruption of social interactions due to recent health problems	Encouraging the elderly to communicate and interact with others to get rid of loneliness	

**Table 3: Comparison of mean dimensions of anxiety among the intervention and control groups' participants**

Outcomes/ time	Group		P <sup>a</sup>	Mean difference
	Control	Intervention		
Affective				
Before	10.31 ± 3.70	10.86 ± 3.71	0.54	-0.03 ± 3.99
After	10.29 ± 2.82	8.14 ± 3.49	0.006	-2.71 ± 3.78
P <sup>b</sup>	0.96	<0.001		0.005
Cognitive				
Before	10.97 ± 2.35	10.97 ± 3.02	0.99	-0.74 ± 2.98
After	10.23 ± 2.32	8.40 ± 2.63	0.003	-2.57 ± 3.15
P	0.15	<0.001		0.015
Somatic				
Before	14 ± 2.76	13.83 ± 3.51	0.82	-0.46 ± 3.11
After	13.54 ± 3.54	10.17 ± 3.28	<0.001	-3.66 ± 3.11
P	0.39	<0.001		<0.001
GAS total				
Before	35.29 ± 6.52	35.66 ± 7.58	0.82	-1.23 ± 5.6
After	34.06 ± 7.23	26.71 ± 7.48	<0.001	-8.94 ± 6.61
P	0.20	<0.001		<0.001

<sup>a</sup>t-test, <sup>b</sup>paired t-test. GAS: Geriatric Anxiety Scale

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### Conflicts of interest

There are no conflicts of interest.

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