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TABLE OF CONTENTS

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Effect of a Clinical Nursing Practice Guideline of Enteral Nutrition Care on the Duration of Mechanical Ventilator for Critically Ill Patients

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ABSTRACT (ENGLISH)

Purpose

Early enteral nutrition (EN) can improve clinical outcomes in critically ill patients. This study aimed to evaluate the effects of this clinical nursing practice guideline (CNPG) of EN care on the duration of mechanical ventilator in critically ill patients to investigate whether it was able to improve clinical outcomes.

Methods

This study compares a pretest-posttest design for the two groups, which was done before and after to determine the effects of a CNPG of EN care on the duration of a mechanical ventilator in critically ill patients. This study was performed on 44 critically ill patients admitted to the intensive care unit (ICU). The patients were divided into two groups according to EN. For the intervention group, CNPG started within the first 48 hours of admission to the ICU, and for the control group, they received standard nursing care.

Results

After the implementation, it showed significant associations between the duration of mechanical ventilator in ICU. The intervention group who received the CNPG had significantly shorter starting time of EN and a reduced duration of mechanical ventilator than those in the control group ($p < .001$).

Conclusion

A CNPG for EN care reduced the duration of mechanical ventilator. This could possibly improve the delivery of target calories when compared with current standard practice and improve the outcome of critically ill patients.

FULL TEXT

Introduction

Critically ill patients are patients who have severe illnesses with life threatening conditions that have serious consequences, including malnutrition [1]. They are typically associated with increased hypermetabolic [2] and the presence of lean body mass reduction that leads to malnutrition [3]. Patients' respiratory and cardiovascular systems are abnormal, leading to major organ failure in which they cannot function properly; respiratory insufficiency; impairment of healing; and increase in infections [2]. In addition, consequences associated with malnutrition in critically ill patients may include a prolonged duration of mechanical ventilation, increase in cost, duration of hospitalization, and higher mortality rates [4].

Malnutrition in critically ill patients is a global public health problem with a prevalence of 40% to 60% [3,5]. 50% of patients have malnutrition before hospitalization and from the pathology of a critical illness [4], while 70% of patients have malnutrition during hospitalization [6,7]. Critically ill patients cannot resume an oral diet, or most commonly, there is an interruption to the delivery of feeding, which is a problem related to bedside procedure, gastrointestinal

function as high gastric residual volume, the presence of diarrhea, and aspirated [2]. The management of nutrition is delayed in 60% of critically ill patients and causes an inadequate daily calorie target in 42% of these patients [7]. These conditions affect body muscle, particularly the diaphragm, which is used for respiration and may become weak and atrophic [8]. However, malnutrition could decrease patients' ability for weaning mechanical ventilation, increase the duration of mechanical ventilation [4], pressure sores [8], infections [6], and mortality rate [3,4]. Nutritional support is an important role in critically ill patients, The American Society of Parenteral and Enteral Nutrition (ASPEN) recommended that nutrition support therapy from early EN should start within 24-48 hours after ICU admission, or when there is stable hemodynamic condition after resuscitation [8], the functional integrity of the gut by maintaining the structural integrity and may help to maintain the systemic immune functions. Moreover, critically ill patients that received target calorie requirement during the first 7 days of hospitalization [7,8] and their respiratory muscle function improved, which would increase the ability to wean mechanical ventilation [5,6].

Previous studies have been shown in only a few studies, standardized enteral feeding guideline. Lack of such guideline leads to delayed enteral feeding for critical patients more than 24 hours after being admitted to the critical care unit [9], resulting in inadequate energy intake and complications, such as nausea, flatulence, dyspepsia, gastrointestinal hemorrhage, diarrhea, and hyperglycemia [10,11]. Nurse is the closest care provider and has a crucial role in nutritional care, such as nutrition assessment, assessment of energy and nutritional requirements, prefeeding readiness assessment, and the execution of enteral feeding [8]. The guideline that has been developed systematically based on reliable empirical evidence would assist practitioners to make decision on treatment. Implementation of clinical practices would lead to changes in overall practice, reduction in cost, and improvement in treatment quality [12]. These guidelines aim to standardize and automate the provision of EN, enabling bedside nurses to initiate, monitor, and alter the administration of feeding without direct orders from the attending physician. The guidelines create variances in nursing practice and have not been updated with evidence-based clinical practice guidelines from the actual problems. A clinical nursing practice guideline (CNPG) developed from evidence-based practice is suitable for the problem, is beneficial to the patient, and helps improve enteral feeding service quality. With such practice, complications from enteral feeding can be avoided and managed. Development of a comprehensive, standardized practice also provides clear roles for the interdisciplinary team [13].

The researcher, therefore, has an awareness and interest in using empirical evidence to develop a CNPG for enteral feeding in critically ill patients, applying the Australian National Health and Medical Research Council (NHMRC) [13], NHMRC supports the development and approval of high quality guidelines for critical practice. This systematic and standardized development of nursing practice development would allow feeding for critical patients within suitable time as well as obtain participation of practitioners, which foster a sense of responsibility and willingness to follow the guideline [4]. A guide to the development by NHRMC, implementation, and evaluation of CNPG may lead to adaptation of strategies suitable for local conditions and developed in concert with local clinicians in Thailand. In addition, there should be CNPG for EN specific to critically ill patients. This could provide patients with energy and protein requirements and nutrients, prevent feeding complications, reduce variety in practice, and develop more effective services [9]. This study was to evaluate the effects of this CNPG of EN care on the duration of mechanical ventilation in critically ill patients. The result of this study showed a reduced duration of mechanical ventilation. A clinical practice guideline may have resulted in an improvement in the delivery of EN to critically ill patients.

Nurses are the primary care provider for critically ill patients. For nutritional support, a nurse has an important role in identifying nutritional risk screening, assessing the adequacy calories target, starting and managing enteral feeding or parenteral nutritional, and monitoring patients for potential complication. Thus, a CNPG of EN care in critically ill patients is an integral part of evidence-based research and practice combined with clinical expertise of practitioners to make decisions for effective nursing care and the best performance with the patient that is suitable for the context. This study applies the scope used in the development of nursing practices by the Australian NHMRC [13]. The recommendations included are based on the ASPEN [4]. This guideline for clinical practice development comprises of seven steps: (1) determining the need for and the scope of the guidelines, (2) convening a multidisciplinary panel to oversee the development of the guidelines, (3) defining the purpose of and target audience for the guidelines, (4)

reviewing the scientific evidence and categorized levels of research, (5) proposing the validated evidence to the guideline development team, (6) formulating a dissemination and implementation strategy, and (7) implementing a CNPG and revising it. Furthermore, the researcher develops CNPG of EN care in critically ill patients with clinical expertise to make decisions in providing nursing care to maximize benefits for patients.

From a published literature review on nutritional promotion and EN care in critically ill patients during 2008-2016, the process of EN care in critically ill patients consisted of the time to start feeding, which should be within 24-48 hours [4]. Other assessment included the readiness for EN, gastric residual volume, an assessment of calories target requirements, and the monitoring of feeding complications [9]. There were 16 from 30 research articles which matched the research objectives. The researchers categorized levels of research credibility according to the criteria of the Royal College of Physicians of Thailand [14]. There were 11 quasi-experimental papers of research (level A) and five operational papers (level B). It could be summarized that the guidelines helped the patients receive EN within 24 hours. Starting EN as soon as possible without contraindication after resuscitation or with stable circulation [15] helped provide targeted calories to the patients [4,7]. It was also beneficial for the restoration of organs to function normally in critically ill patients who had EN within 6 hours after admission by improving intestinal absorption and preventing intestinal atrophy [6]. The patients received target calorie requirement during the first 7 days of hospitalization [7,8], and their respiratory muscle function improved, which would increase the ability to wean mechanical ventilation [5,6]. The content of the synthesis practice from systematic literature review based on empirical evidence, the best researches on the content of five activity categories: (1) Assessment for readiness of the critically ill patients before EN, (2) assessment of targeted calories requirement, (3) EN procedure, (4) prevention of EN complication, and (5) outcome evaluation after EN. In this regard, a CNPG for EN care by using demonstration methods together with the promotion of practice guidelines. There is a common goal of the interdisciplinary team, share information, and opinions in nursing together to follow the guidelines developed. The suggested summarizing content is shown in Table 1.

Methods Study design

This study used a quasi-experimental, pretest-posttest design with a comparison group, which was done before and after to determine the effects of a CNPG of EN care on the duration of a mechanical ventilator in critically ill patients.

Setting and sample

The participants were 44 critical ill patients at the Tertiary Hospital in Thailand from October 2018 to February 2019 in the intensive care unit (ICU), who understood the purpose and procedures of this study and voluntarily consented to the research that participated in this study. The inclusion criteria of participants were (1) being conciseness; (2) aged 18 years or over; (3) vital signs stable; (4) Acute Physiology and Chronic Health Assessment II (APACHE II) ≥ 15; (5) received the EN; and (6) willing to participate. Patients were deemed ineligible if they had other metabolic diseases (e.g., uncontrolled diabetes mellitus, thyroid disease, cancer, liver disease, or end of life) or were in a critical condition needing complete bed rest. Patients who were determined EN or noninvasive ventilator support were excluded from this study.

To calculate the number of participants, the effected size of intervention applied to CNPG for EN care in hospitalized in a previous study [15] was used. In this study, the effected size of the experimental group was .50. In applying alpha = .05, power = .80 on G*Power 3.1 software, a total of 44 critically ill patients were initially included in the study (22 in the intervention group and 22 in the control group). The participants included in the study were matched according to their age, diagnosis, and disease severity (APACHE II) to provide homogeneity in groups.

In addition, all patients received first time invasive a mechanical ventilator in the ICU for more than 6 hours during the period and hemodynamic stable before or after implementation of the CNPG with the permission from attending physicians were included in the study. Patients were divided into two groups based on the physician's judgment for EN onset; the first group included patients who received CNPG for EN care within 24 hours after being admitted into ICU and the control group received standard nursing.

Ethical consideration

This study was approved by the Research Ethical Committee of the Public Health Office Research Ethics Committee

(Approval no. KLS.REC096/2561) belonging to the researcher to protect the human rights of the research participants. Before starting data collection, the participants and guardians were given a full explanation of the purpose and procedure of the study to potential participants and that they could withdraw from the study at any time. All participants willing to participate voluntarily were asked to sign the informed consent. Guardians replied for patients for whom a response was too difficult because of cognitive functioning problems that developed during the study period.

Measurement Questionnaires and measurements

The participants' completed a demographic and clinical data sheet, included age, gender, diagnosis, disease severity (APACHE II), start EN (hours), daily calories target, and the duration of mechanical ventilator (hours) interviews by the researchers.

Disease severity assessment form

The researchers used the APACHE II which was developed by Knaus et al. [16]. The APACHE II is a universal tool and widely used for assessment of disease severity and forecast the mortality risk of the patients. The scores of disease severity were assessed by abnormal clinical signs during illness. The 12 variables were body temperature, mean arterial pressure, heart rate, respiration rate, blood pH, serum HCO_3, hematocrit, white blood cell count, serum creatinine, serum BUN, serum sodium, and serum potassium. The highest abnormal scores within 24 hours of admission in ICU were combined with Glasgow Coma Scores and were determined with chronic diseases, age, underlying diseases, white blood cell count, and type of surgery. The combined scores would determine the disease severity and forecast the risk of mortality in critically ill patients who were admitted in ICU; score ranged from 0-71 with the higher scores determined more severity and higher mortality. The APACHE II scores of 25 and over indicated more than 50% risk of mortality. In this study, this instrument was tested with 10 critical ill patents and The Cronbach α coefficients for the present study were .84 and for this study was .81.

The daily calories target requirement

The calories target was calculated based on 25 kcal per kg of body weight for patients in a catabolic phase and 30 kcal per kg of body weight for patients in an anabolic phase as per the Harris–Benedict equation x 1.0-1.3 and 1.0-2.0 gm/kg body weight [4], and EN was recorded within 7 days. For the intervention group, the assessment contained records of the daily calories target from the first hour that the patients had EN until they met the 7 days of daily calories target requirements. In this study, this instrument was tested with 10 critical ill patents, and the Cronbach α coefficients for the present study was .93, and for this study was .95.

The clinical nursing practice guideline of enteral nutrition care

The CNPGs for EN care. The researchers adapted a conceptual framework of clinical practice development from the NHMRC. The CNPG and the content of the synthesis practice from systematic literature review based on empirical evidence of which the best research on the content of five activity categories was (1) assessment for readiness of the critically ill patients before EN, (2) assessment of the daily calories target, (3) EN procedure, (4) prevention of EN complications, and (5) outcome evaluation after EN. In this regard, CNPG was used by demonstrating methods together with the promotion of practice guidelines. There is a common goal of the interdisciplinary team to share information and opinions in nursing together and to follow the guidelines developed. The control group used standard nursing who were informed about the project on the first day, and their information was recorded. The developed practice guidelines were examined by three experts for content validity; they were corrected as the experts' advice. The practice guidelines were tested with 10 critically ill patients to assess feasibility for implementation. The instruments were examined by three experts and were revised based on their suggestions. The test and retest reliability yielded .90 for the patients' version with 10 critically ill patients, and the Cronbach α coefficients for the present study was .89.

Data collection

The data collection period was from October 2018 to February, 2019, in an ICU at the Tertiary Hospital in Thailand were recruited by purposive sampling. The purpose of this study was explained to evaluate the effects of this CNPG of EN care on the duration of mechanical ventilator in critically ill patients to investigate whether it was able to

improve clinical outcomes. The patients were divided into two groups according to EN. The data collection in the control group was conducted first to prevent contamination of the care. The researcher reviewed patients' medical records to identify those who met inclusion criteria for the control group. Demographic data and history of illness were recorded from the medical records, and the interview was conducted to respondents or guardians at the time of enrollment. Disease severity and the daily calories target requirement were assessed within 7 days. The control group received treatment and usual nursing care as following the standard of care for EN care. Patient outcome included daily calories target requirements, and the duration of mechanical ventilator (hours) was assessed by a researcher.

Once data collection in the control group was finished, the intervention group was recruited, and those phases of the study began. The intervention group's baseline data were collected through the medical records within 24 hours of hospitalization. A CNPG started within the first 48 hours of admission to the ICU, and the time to first enteral feeding prescription was recorded. We included patients' age ≥ 18 years or over on mechanical ventilator ≥6 hours, and they received EN. To calculate the daily calories target requirement using the Harris–Benedict equation x 1.0-1.3 and 1.0-2.0 gm/kg body weight, and EN was recorded within 7 days. The participants in the intervention and control groups were monitored for the duration of the mechanical ventilator from the first day of invasive mechanical ventilator and after hemodynamic stable within 6 hours.

Data analysis

The data were analyzed using SPSS, version 22.0, statistical program (IBM Corp., Armonk, NY, USA). Descriptive statistics, such as number, percentage, mean, and standard deviation, were used to analyze the participants' demographics. Chi-square test and t test were used to compare baseline variables between the intervention and control groups. The significance test was used to examine differences in quantitative variables between the groups. Continuous variables were compared using the independent sample t test. An independent sample t test was used to compare the differences between pretest and posttest scores of the participants' in the intervention and control groups. A paired sample t test was used to compare the differences between pretest and posttest scores of the participants' at each group. For all analyses, *p* **Results Comparison of demographic characteristics between two groups**

There was no statistically significant difference in demographic characteristics (age, diagnosis, and disease severity) between the intervention and control groups. The mean age of the participants was 47.11 years, ranging from 31-70 years, 39.4% were female, 54.5% were diagnosed with septicemia, and 60.7% were mild severity of APACHE II score. No statistically significant difference were found between the intervention and control groups regarding age, diagnosis, and disease severity (APACHE II). ([Table 2]).

Starting time of enteral nutrition and daily calorie target

The compared mean scores for the starting time of EN and daily calorie target requirement in the first 7 days before and after implementation were analyzed by t test. The EN start was within 8.78 hours (min-max = 5-42 hours, mean = 8.63, SD = 6.15), and the daily calorie target requirement in 7 days was 4590.91 kcal/kg/day (min-max = 1,400-19,600 kcal/kg/day, mean = 6,700, SD = 4575.50). The results showed that mean scores on starting time of EN and the daily calorie target requirement after using CNPG were different from the scores before using the practice guidelines with a statistical significance (*p* Table 3).

Duration of mechanical ventilator

The comparison of the mean scores for the duration of mechanical ventilation before and after implementation were analyzed by t test. The duration of mechanical ventilation was 33.64 hours (min-max = 24-192 hours, mean = 56.18,SD = 37.55) after using CNPG, and the intervention group had a shorter of duration of mechanical ventilation than the control group, with a statistical significance (*p* Table 3.

Discussion

The results of this study showed that early EN in critically ill patients before and after implementation of CNPG was analyzed. The initial EN started within 48 hours after the patient was admitted and stabilized of hemodynamic. For all patients in this study, an invasive mechanical ventilator was initialed on the first day admission as well. To

investigate the implementation of CNPG improvement of early EN, the target calorie daily requirements in day 7 and the reduced duration of the mechanical ventilator were compared. The implementation of EN guidelines led to the achievement of the initialed early EN reach within 8.67 hours, significantly after the implementation.

The study showed that the intervention group had a reduced time of duration of mechanical ventilator than the control group with a statistical significance (p 4,[9]]. Dhaliwal et al. [[17]] studied factors that could affect EN. They found that having practice guidelines could help patients to receive EN in 24 hours, who benefited from organ restoration to its normal function [[4]]. EN care for critically ill patients within 6 hours after being admitted into ICU showed improved intestinal absorption and prevention of intestinal atrophy [[17]]. They also received an adequate target calorie requirement which promoted respiratory muscle function [[3]].

EN in patients admitted to ICU is often delayed because of reasons including procedures, gastrointestinal dysfunction, and nurses having a lack of knowledge. Nurses have an important role in the nursing care, nursing plan, preventing and managing complications, and coordinating the multidisciplinary team to have the patients receive nutrition as soon as possible if there is no contraindication. After implementing CNPG, the intervention group had different durations of time on the mechanical ventilation from the control group with a statistical significance (p 18], the duration of mechanical ventilation use would decrease. The patients with a ventilator need a higher target calorie daily requirement than other patients [[3],[19]]. This was consistent with the study of McClave et al. [[4]], which found that having critically ill patients in the medical ward receive EN within 48 hours, and an adequate target calorie daily requirement as soon as possible was related to the duration of mechanical ventilation use with a statistical significance [[6]]. However, there were other factors besides nutrition that affected the duration of a ventilator, such as age, disease severity, and underlying diseases [[8]].

In recently developed clinical practice guidelines for EN, it states that is a benefit for the potential risks and complications of that experiment [[20]], promotes early EN, and minimizing interruptions in feeding should be encouraged to be used. Nurses may be able to eliminate delay feeding and consultation with the multidisciplinary team, confirmation of timing to initial EN [[8]]. Also, ensuring a timely resumption of enteral feeding when interruptions are no longer necessary may be beneficial [[2]]. Furthermore, evidence suggested that a clinical practice guideline recommendation into nurse-initial to start enteral feeding is an effective strategy to improve the delivery of nutritional feeding. The clinical practice guideline for EN care is the potential role of critical care nurse in improving nutrition practice; critical nurses play an important role ensuring that patients meet nutritional target goals and an adequate prescription and delivery of nutrition therapy [[2],[3],[5],[8]].

Study limitation

The approach of our study had a relatively small number of patients who enrolled in our study and applied in one ICU hospital. Indeed, the participants of this study were recruited at a single hospital limits the full generalization of the research findings.

Conclusion

The findings of this study indicate that the integration of the CNPG of EN care could reduce the duration of mechanical ventilation in critically ill patients. It is recommended to start feeding as soon as possible within 24 hours so to receive the adequate target calorie daily requirement in the first 7 days. Therefore, this program can guide nurses to assist EN care in the ICU. Future studies should investigate other types of patients and factors such as length of hospital stay and infections.

Conflict of interest

The authors declared no conflicts of interest.

Acknowledgment

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Issue	Information available in clinical nursing practice guideline
Assessment for readiness before enteral nutrition and time to start enteral nutrition [3,6,15,19] (Grade B)	Before enteral nutrition, critically ill patients must be corrected for the shock of the blood circulatory system until the circulation is stable for at least 6 hours. With the doctor's order and no contraindication, the enteral nutrition is started. The assessment criteria consist of the followingsa.Heart rate less than 120 bpmb.Average arterial pressure is 65 mmHg and overc.Inotropic drug of less than 5 microgram/kg/min is receivedd.No direct vasopressor druge.Base excess is more than −2.5 mEq/liter or blood lactate is less than 2.5 mEq/literIn the case of patients with risks of abdominal compartment syndrome, they must be monitored for intraabdominal pressure to be less than 15 mmHg. The risks of abdominal compartment syndrome include abdominal organ injury, receiving more than 6 units of blood or blood components in the first 12 hours after injury, abdominal distension, and signs of increased intraabdominal pressure which are oliguria, hypotension, hypoxia, and increased intracranial pressure. The enteral nutrition is started when the patients pass all assessments for readiness, and the doctor is consulted if there is an abnormal condition.
Assessment of energy and protein requirement [3,6,15,16,19] (Grade B)	The daily calories target requirement is 25 kcal/kg/d as Harris–Benedict equation x 1.0-1.3 and 1.0-2.0 gm/kg/body weight (BW) and EN was recorded within 7 days. The current or ideal BW was used in the patients whose body mass index (BMI) = 18-30 kg/m^2. Ideal BW in males = 50.0 + 0.91 kg (height = 152.4 cm) and in females = 45.5 + 0.91 kg (height = 152.4 cm). For obese patients (BMI >30), an adjusted body weight is used instead of their current weight. The adjusted BW = 0.5 (current weight + ideal weight)

Tube insertion techniques and placement confirmation [3,16] (Grade A)	Identifying the location of the feeding tube as the followings:a.Identifying the location of the feeding tube before feeding every 4 hours incontinuous feeding and before next feeding in intermittent feeding.b.Identifying the location of the feeding tube by;•Length of the feeding tube from the nose or mouth angle without folding in the mouth.•Characteristics of the aspirated gastric contents which should be clear or grassy-green and mixed with the remaining food. If the gastric contents could not be aspirated or no certain location of the feeding tube, it could be tested by pumping 10-20 ml of air into the feeding tube and listening to the air sound at epigastrium with stethoscope. This must be confirmed by two nurses. If the feeding tube is not in the right location, the doctor will be consulted to reinsert the feeding tube.Selecting enteral nutrition pattern and adjusting diet amount. Continuous feeding should be started in critically ill patients for 24 hours with the rate of 20 ml/hr. If the patients are well tolerated (gastric residues less than 200 ml in 4 hours and no enteral nutrition complication), the feeding amount of 20 ml/hr is added every 8 hour until the targeted calories is met. Selection of diet for critically ill patients: a. Standard concentration of enteral nutrition for critically ill patients is 1 kcal/ml. b. Other choices of specialized diet depend on the doctor's consideration. Preparing enteral nutrition and diet sets for the patients [3,16]a.Preparing bottled liquid diet with sterile water and a sterile technique.b.The liquid diet prepared at the ICU is recommended to be fed within 24 hrs.c.The bottled liquid diet is prepared by the nutritional unit and should be stored in the refrigerator for not more than 24 hours and should be put at room temperature before feeding within 4 hours with the any leftover discarded.d.Washing hands before holding food supplies and when feeding the patients.e.Wearing clean gloves to wash feeding equipment.f.All equipment for enteral and medicine feeding should be washed and dried before the next feeding:•the feeding syringe should be washed with clean water, left to dry before the next use and changed to a new set every shift•the continuous feeding set (kangaroo pump set) should be washed with hot water after feeding for 4 hours, dried before the next use and changed to a new set every 7 day•the intermittent feeding set should be changed to a new set for each feeding•the medicine cup and diet preparing equipment should be washed with dish washing soap and clean water and dried before the next use.

Prevention of enteral nutrition complications [3,6,13,16,19] (Grade B)	Enteral nutrition should be temporarily stopped if there vital signs change to a state of shock which needs an increasing dose of cardiac drugs that cause blood vessel constriction. The enteral nutrition can be started with the same rate after the patients' circulatory systems become stable. Prevention of aspiration with the following procedures [16]:a.Positioning the patients' beds to a 30° elevated head tilt during enteral nutrition (if no contraindication) and spending the least time in a recumbent position or less than a 30° head tilt.b.If there is contraindication of the elevated head tilt position, such as a spinal cord injury, the patients' bed should be in a reverse Trendelenburg position.c.If the patient needs to lower the head tilt or recumbent position for a longer period of treatment, the enteral nutrition should be temporarily stopped until their conditions allow an elevated head tilt position.d.The gastric residual volume (GRV) should be evaluated every 4 hours in continuous enteral nutrition and before each feeding in intermittent feeding.e.When there is regurgitation, vomiting, or choking, the enteral nutrition must be temporarily stopped, and the cause should be investigated and solved before the next feeding.f.The patients' oral care with sputum suction should be provided every shift. The enteral nutrition should be temporarily stopped during sputum suction to prevent choking and movement of the feeding tube. The feeding can be restarted promptly after sputum suction.g.The endotracheal tube cuff pressure should be checked for a peripheral leak to obtain peak inflation pressure. The endotracheal tube cuff pressure should not be over 24-30 cm H2O and should not be totally deflated to prevent choking food into the trachea during using a ventilator.Management of gastric residues by the followings [3,16]:a.If the GRV is 200-300 ml, the rate of feeding should remain the same, and all residues should be put back. If the patients have nausea, vomiting, choking, abdominal distension, and severe abdominal pain, the enteral nutrition should be temporarily stopped, and 500 ml of GRV can be put back.b.If the GRV is more than 500 ml, the enteral nutrition should be temporarily stopped and 500 ml of GRV put back and the rest discarded. The GRV is reevaluated every 2 hours.c.If the GRV twice is more than 500 ml, the causes should be investigated and corrected. The probable causes are body condition, gastrointestinal tract abnormality, blood glucose, and sedatives. A prokinetic drug such as metoclopramide should be prescribed by the doctor. Additionally, if the gastric residues remain, the enteral nutrition should not

	be stopped for a longer period, but the feeding volume should be reduced instead.d.For patients with a severe head injury who cannot tolerate enteral nutrition within 48 hours after injury, the location of the feeding tube should be moved to the small intestine under the doctor's order for more food tolerance and safety from choking.e.An occlusion of the feeding tube can be prevented by washing the tube with 20 ml of drinking water every 4 hours in continuous feeding and washing after intermittent feeding, after checking gastric residues, before and after giving medicines via feeding tube and when stopping the enteral nutrition.Managing abdominal distension by evaluating the symptoms from inquiry and physical examination. Abdominal distension should be managed as follows:a.Less abdominal distension—keep the same feeding rate and monitor the symptoms with a record every 4 hours. If the symptoms remain the same, the feeding volume can be increased as normal practice.b.Moderate abdominal distension or the patients complains of more distension—the feeding rate and volume should be reduced to half. The causes should be investigated including the monitoring GRV and intraabdominal pressure. The doctors should be consulted to prescribe a prokinetic drug and to adjust the feeding rate and volume. The symptoms should be monitored and recorded every 4 hours.c.Severe abdominal distension or the patients complain of severe abdominal distension, become nervous, have a rapid pulse rate and rapid respiration—the enteral nutrition must be temporarily stopped, and the causes should be investigated. The doctor should be consulted to treat or order more investigations such as abdomen X-ray. The symptom should be followed and recorded every 4 hours.Managing diarrhea as the followings:a.Diarrhea 3-4 times or 400-600 ml/day—The feeding rate and volume should remain the same. If diarrhea persists for more than 48 hours, the doctor should be consulted to investigate the causes such as side-effects of a prokinetic drug and a drug that contains sorbitol, magnesium, or phosphorus.b.Diarrhea for more than 4 times/day or more than 600 ml/day—the feeding rate and volume should be reduced to half. The doctor should be consulted to investigate the causes from intestinal infection and treat the patients.c.If the patients have risks of wound or central venous line contamination from stool, the doctor should be consulted to treat and prevent infection.

Outcome evaluation after enteral nutrition as follows [13] (Grade B)	Record of feeding diet in every meal—type of diet, feeding rate, volume, and gastric residues. Evaluation of enteral nutrition complications every 4 hours—abdominal distension, vomiting, choking, diarrhea, and change in vital signs. The complications are recorded and corrected.

Demographic characteristics	Intervention group (n = 22)	Control group (n = 22)	t or χ^2	p
Age (yrs) (M ± SD)	47.18 ± 10.32	47.05 ± 10.96	.04[a]	.966
APACHE II (M ± SD)	20.16 ± 3.96	21.09 ± 5.49	-.44[a]	.662
	n (%)	n (%)		
Sex			.54	.766
Men	10 (22.7)	8 (18.2)		
Women	12 (27.3)	14 (31.8)		
Diagnosis			.77	.540
Septic shock	18 (40.9)	18 (40.9)		
Pneumonia	2 (4.5)	1 (2.3)		
Heart disease	2 (4.5)	3 (6.8)		

Variables	Intervention group (n = 22)	Control group (n = 22)	t	p
M ± SD	M ± SD	Starting time of enteral nutrition (hours)	8.63 ± 6.15	24.00 ± 10.49
6.19	<.001	Daily calorie target requirement in the first 7 days (kcal/day)	6700.00 ± 457 5.50	2481.82 ± 121 6.80

−3.95	<.001	Duration of mechanical ventilation (hours)	33.90 ± 11.25	78.45 ± 41.50

DETAILS

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Multilevel Effects of Community Capacity on Active Aging in Community-Dwelling Older Adults in South Korea

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ABSTRACT (ENGLISH)

Purpose

This study aimed at identifying the level of active aging in older adults and the influence of the individual and community levels of community capacity on active aging.

Methods

A cross-sectional survey was conducted on a stratified sample of 380 older adults living in 35 neighborhoods of five regions in Seoul, the capital of South Korea. The structured questionnaire included the Korean version of instruments that measure active aging and community capacity at the individual level. Secondary data including metropolitan statistical information, a public data portal, and a city plan were used to acquire community-capacity factors at the community level. Data were analyzed with multilevel models.

Results

The overall active aging mean score was 3.00 ± 0.55 out of 5; the highest mean score was in the security domain (3.46 ± 0.65) and the lowest one was in the participation domain (2.71 ± 0.66). Individual factors associated with active aging included age, education, income, and community capacity at the individual level. At the community level, two community-capacity factors (senior leisure welfare facilities and cooperative unions) were significantly associated with active aging. In active aging, 6.4% and 4.1% of total variance could be explained by 35 neighborhoods, after considering individual and community level variables, respectively.

Conclusion

This study showed that community capacity is important for active aging among older adults. Appropriate strategies that consider both individual and community factors, such as contextual indicators of community capacity, are necessary to improve active aging.

FULL TEXT

Introduction

Active aging is the process of ensuring necessary health, social participation, and safety opportunities to maintain a high quality of life in old age [1]. Active aging allows individuals to realize their potential for physical, mental, and social well-being and participate in society while receiving appropriate protection and care [1]. It also empowers individual abilities and fosters participation in activities that contribute to happiness [2]. Being “active” means “continuing participation in social, economic, cultural, spiritual, and civic affairs, not just the ability to be physically active or to participate in the labour force” [1]; active aging emphasizes health, autonomy, and independence during the aging process [1,3].

In recent years, based on the concept of active aging, national and international strategies have worked to raise older adults’ health and participation levels and highlight their potential [3]. Individual health habits and sociocultural, situational, and environmental influences affect health [4]. The World Health Organization (WHO) [1] identifies five types of factors that relate to health and social services (e.g., health-promotion and therapeutic, long-term care, and mental health services): behavioral (e.g., smoking, physical activity, diet, and oral health), social (e.g., social support and education), economic (e.g., income, social protection, and labor), physical environment, and personal factors (e.g., biological, genetic, and psychological factors).

Community capacity is also closely related to health and it is increasingly becoming an important strategy for health promotion [4]. Community capacity is defined as the interaction of human capital, organizational resources, and social capital within a community, which can be used to solve the population's problems and improve or sustain the community well-being through informal social processes and systematic efforts [5]. Community capacity can be categorized into individual, organizational, and community capacities [6], or individual and community level capacities [7]. Individual level community capacity involves community participation, leadership, connections, sense of place, community attitudes, and problem assessment [8]. It also includes community satisfaction, which means that people experience a sense of community [7]. Previous studies have attempted to identify the relationship between individual-level community capacity and self-rated health [7,9]. Community satisfaction was related to self-rated health [7]. At the community level, community capacity refers to a community's infrastructure and resources to solve problems or achieve common goals, in this case: to improve community health, social conditions, well-being, and quality of life to solve problems or achieve common goals.

There is more community-based participatory research on community competencies, which allows community members to participate equally as partners in the research design, address health care gaps, and improve community health [10]. As active aging emphasizes the autonomy and independence of older people in the community at the individual level, it is necessary to examine the community capacity to create a supportive environment to improve active aging.

The conceptual framework of this study (Figure 1) was adopted and modified from the “Community capacity for mobilization: a theoretical framework” [7] and “The determinants of active ageing” [1]. This framework assumes that active aging is related to community capacity at both individual and community levels as well as socioeconomic position. The individual level capacity includes the community-dwelling population's ability to foster individual and community capacity. Based on literature reviews, the community level capacity includes community organization and resources [6,7]. The older adult population is diverse and requires more than just passive services and support [11]. Nurses in primary health care settings have to understand the needs of older adults in the community and assess both their health priorities and the barriers to creating an age-friendly community environment [12]. However, for older people in the community, the health care system mainly focuses on disease treatment and physical health; it lacks a holistic approach that considers physical, social, and environmental factors [13]. In recent years, there has been a growing emphasis on the need to build health care systems that support community participation and intervention to foster healthy aging and improve community health [13]. Prior to planning a health-promotion program, it is important to assess the capacity of the community, individual health risks, and health needs [4]. However, few empirical studies

on how community capacity affects active aging in older adults exist.

This study examined the relevance of community capacity factors associated with active aging at the individual and community levels. It provides a theoretical basis for improving active aging through community capacity. It identified the level of active aging in older adults and examined how community capacity affects active aging at the individual and community levels.

Methods Study design

This study conducted descriptive research, which examined different levels of individual and community factors, to identify the relationships between active aging and community capacity.

Sample and setting

Adults aged 65 years and above participated in this study. The selection criteria included the ability to communicate, lead a normal daily life, demonstrate mobility, and provide informed consent.

To produce statistical power greater than 0.8 with a medium effect size, multilevel analysis requires a minimum of 10 samples from 35 level 2 groups with a minimum sample size of 350 [14]. This study randomly selected 35 neighborhoods, which are a sub-level administrative unit consisting of 3–5 “dong” in Seoul city through stratified sampling and randomly selected 7 neighborhoods per region (total 5 regions in the city). We selected senior citizens' centers in the neighborhoods randomly and explored the possibility of data collection; the consenting center was then sampled. Additionally, 10 to 11 older adults were sampled from the senior citizens' center of each neighborhood. A total of 380 respondents were selected. The senior citizens’ center is the most common and easily accessible leisure welfare facility for older adults [15].

Ethical considerations

The Institutional Review Board of the Yonsei University health system reviewed and approved this research (Approval no. Y-2017-0112). Informed consent was obtained from all participants.

Measures

The measures consisted of 51 active aging items, 26 community capacity items at the individual level, participants’ general characteristics, and a structured health-related characteristics questionnaire.

Active aging

The active aging scale was modified with the permission of the original author [16]. The scale measures three subcategories—personal participation, health, and safety—to study older adults' activity. These subcategories include a total of 51 items: 30 participation items, 13 health items, and 8 safety items. The Cronbach α values at scale development were .89 (participation), .79 (health), and .62 (safety). In this study, the overall Cronbach α for the scale was .91, with .89 for participation, .85 for health, and .65 for safety.

Community capacity (individual level)

Individual level community capacity was measured using the Community Capacity Instrument developed by Lovell, Gray, and Boucher [8], which was translated into Korean with the approval of the original developer. The Community Capacity Instrument consists of 26 items, which cover participation, leadership, connections, sense of place, community attitudes, and problem assessment.

Participation in the community capacity subdomain implies supporting the local school, participating in community events, and investing money or time for community development in a community organization to which one belongs. Leadership refers to the leadership of local leaders and possibility of access to leaders. Connections refer to the degree of trust among local residents and their relationships with others. Sense of place refers to a certain familiarity with the history of the region and an affinity for the place. Community attitudes indicate how positive attitudes are in relation to the community and the future. Problem assessment refers to communicating in order to solve problems.

The committee translation approach was used to translate the original instrument into Korean [17,18]. Committee translation methods use the consensus of collaboration and translation to reduce cultural prejudice against the original meaning [18]. The translation committee included four nursing professors who were fluent in Korean and English and had expertise in society and culture. Three of the four members independently translated the Community Capacity Instrument. Three translation team members and one researcher discussed the three

translated versions to ensure that the original meaning did not change and the tool was properly translated. Through discussion, researchers revised “community” to “our neighborhood” and “people” to “residents” in accordance with Korean culture. To derive the final version, the fourth member reviewed the proposed translation through discussion with the committee. This was supervised by a person who specialized in Korean literature.

Each question is rated on a seven-point Likert scale: the higher the score of the question after conversions of inverse questions, the higher the community capacity. During the instrument's development, the Cronbach α was .88 and it was .85 in this study.

Community capacity (community level)

At the community level, community capacity refers to the community's infrastructure and resources to improve the health and quality of life of community members [6]. The context of community capacity is how resources are used to achieve intended outcomes, focusing on the effectiveness and sustainability of programs and services. It also considers the resources and inputs for activities—such as financial capital, human capital, social capital, etc.—and represents the existence and distribution of infrastructure at the community level [6]. Composite indices are recommended when using information to summarize or highlight complex or multidimensional data [19]. Composite indicators may be used by global organizations to compare national human development indices or measure social characteristics or subjective health [20].

This study applied the method of composite index composition used by the Organization for Economic Cooperation and Development (OECD), which effectively summarizes multidimensional data and makes it easy to interpret separate variables [21]. The OECD composite index consists of 10 steps [21]. In this study, composite indicators were constructed by applying the five steps (theoretical framework, data selection, imputation of missing data, multivariate analysis, and normalization) required for research purpose and analysis methods.

Following the conceptual framework (Figure 1) and literature review [6,7,15,22], the community level community capacity was selected for numerous senior leisure welfare facilities, cooperative unions, public sports facilities, and traditional markets that provide infrastructure and resources to the local community. Based on prior research [6,15,22], the contextual aspects (senior leisure welfare facilities and cooperative associations) of participation and cooperation to achieve common goals were distinguished from the spatial and structural resources (public sports facilities and traditional markets) where local residents develop a sense of community and belonging.

The senior leisure welfare facilities provide programs and services, and elderly people can gather at these facilities to form community capacity through their social relations, social support, and participation [23,24]. Cooperative unions play a role in active aging as an organization established to solve the problems faced by the local community [25]. In addition, public sports facilities and the traditional markets are conceptual spatial resources in the local community [26,27].

The data were obtained from the existing administrative (statistical) data and included the number of senior citizens (aged 65 years and above), welfare facilities [28], public sports facilities [28], traditional markets [29], and cooperative unions [30]. The composite index was calculated as two groups: (1) resource and (2) shared interests and collaboration context.

General and health-related characteristics

General and health-related characteristics were examined with 10 items on age, sex, income, education, marital status, family, health care insurance, residential area, residence period, and chronic disease.

Data collection

A preliminary survey was conducted to check the appropriateness of the research methods and tools. Data were collected from March 8, 2018 to May 14, 2018. Two to three researchers and trained research assistants collected data through participant self-reports or face-to-face interviews. A total of 35 neighborhoods were surveyed. Prior to conducting the survey, one to three senior citizens' centers were randomly selected from each neighborhood. The purpose of the research, time required for it, and benefits of participating were explained, and 10 to 11 individuals from each neighborhood who consented to participate were visited, and they completed the questionnaire.

Analysis

The data were analyzed using SPSS Statistics, version 23.0 (IBM Corp., Armonk, NY, USA) and STATA 13.0 (StataCorp, College Station, TX, USA). Participant and study variable characteristics were analyzed using descriptive statistics (frequency, percentage, means, and standard deviations). T-test and ANOVA were used to analyze differences in active aging by general participant characteristics. Then, multilevel analysis was used to identify personal and regional factors that affected active aging and their effects at each level.

To analyze the fixed and random effects in the multilevel analysis, a null model was constructed containing only the constant, followed by Model 1, which included the individual level, and Model 2, which included the individual and community levels.

Results

Table 1 shows participants' general characteristics; of the participants, 62.6% were women and the mean age was 80.13 years. Table 2 shows the level of active aging and individual level community capacity. In the case of active aging, the average value was 153.03 ± 27.82 from a possible range of 51 to 255, and the mean rating was 3.00 ± 0.55 out of 5. The mean score for security was 3.46 ± 0.65, and the average score for participation was the lowest at 2.71 ± 0.66.

Results of the univariate analysis (Table 3) showed that active aging was significantly higher in men than women (t = 4.62, *p* = .032), and participants aged 65–74 years had significantly higher active aging scores than those in the other age groups (t = 20.76, *p* p p p p p p p = .045) between active aging and community capacity in terms of community level shared interests and collaborative contexts.

In the multilevel models, Model 1 included individual level independent variables (Table 4). Individual factors such as age, marital status, living with family members, education, monthly average income, and chronic diseases were used as independent variables. The Wald Chi-square value of Model 1 was 315.69 (*p* p = .013). The intraclass correlation coefficient (ICC) was .064, which accounted for 6.4% of the total variance in active aging at the community level. The statistically significant fixed-effect factors included age, education, monthly average income, and individual community capacity.

Multilevel Model 2 included both individual and community level independent variables (Table 4). Community level independent variables were Factors 1 and 2 in the composite index, which were estimated for 35 neighborhoods using principal component analysis, and the resulting Z-score was applied. Factor rotation was conducted using Varimax. The eigenvalue of "resource" (Factor 1) was 1.73, which showed an explanatory power of 34.6%. The eigenvalue of "shared interests and collaboration context" (Factor 2) was 1.23, and the two factors were combined to give a cumulative explanatory power of 59.1%. Factor 1 had a factor load of 0.82 in the traditional market and 0.74 in the public sports facility, and in Factor 2, the cooperative union loading was 0.73 and that of the senior leisure welfare facility was 0.68. Factor 1 included resources (traditional markets, public sports facilities), whereas Factor 2 included common interests and cooperative contexts (cooperative union, senior leisure welfare facilities).

The value of the Wald Chi-square in Model 2 was 328.66 (*p* p-value for the random-effects model was .064. However, with the input of community capacity variables, the ICC in 35 neighborhoods indicated 4.1% variance, suggesting that, even after considering the community characteristics, community differences still accounted for 4.1% of active aging. Thus, the fixed effects, age (*p* = .005, *p* = .001), education (*p* = .012, *p* p p p = .027).

Discussion

There is growing interest in how individual and community related factors affect older adults' health, particularly active aging. However, empirical studies do not provide adequate information about active aging. This is the first study to investigate the influence of both individual and community level community capacities on active aging.

In this study, the average active aging score was moderate. Of the three subdomains, scores on "safety" were the highest, followed by "health" and "participation" scores. Another study measured the active aging of older people in Korea based on the three domains specified by the WHO: safety, health, and participation in that order [31]. However, in a prior study of senior citizens from 16 countries, Korea ranked the 15th in the active aging, and the level of the Korean population was 0.47, which was significantly lower than the overall average of 0.56 [32].

In the present study, participation in active aging refers to the level of personal participation, such as self-

development, religious activities, social activities, family support, and leisure activities. A prior study that compared active aging in other countries found participation to be the lowest among the three subdomains [32]. Denmark and Sweden, countries with high employment rates and well-developed social security systems for older adults, have much higher levels of active aging than other countries [32]. However, only about 31% of older people in Korea were engaged in economic activities, with about 40% performing simple labor [15]. The economic activities of older people in Korea are relatively low, and their activities are not diverse. In addition, though there are public facilities where older people can participate in leisure activities, including senior citizens' centers and senior welfare facilities, the utilization rate of the former differed about nine times between high and low regions, and that of the latter about three times [15]. The most common reason for dissatisfaction with the senior citizens' center was related to the lack of harmony with the actions and characters of other people who used the center (69.4%), and about 26% of dissatisfaction was related to insufficient facilities and programs [15]. In Korea, older people face limitations in their participation and leisure activities that involve the use of public facilities.

Active aging through participation promotes life satisfaction and personal well-being. Participation-related activities were associated with cognitive function, subjective health conditions, frequency of interacting with family and friends, and higher education levels [33]. This suggests that there are personal and social factors that influence participation, and social participation is an important factor in active aging [34]. In order to improve active aging, it is necessary to promote the diverse participation of the elderly. Social efforts are needed to enhance older adults' participation. To maintain active lives, older adults need to prepare for their future by planning activities in advance. Age, education level, income, and community capacity are factors shown to affect active aging. A prior study also found that active aging was higher in elderly people with a lower age [32,35,36] and higher education level [32].

Old-older people need to increase their physical activity, mental management, and functional preservation early in order to reduce risk factors [37]. They need cognitive and behavioral training to adapt to changing environmental factors [37]. In particular, the level of active aging was high in senior citizens with educational levels higher than middle and high school. For older adults with strong educational backgrounds, stable employment is often guaranteed, increasing the retirement age and ensuring an active entry into the labor market [32]. Moreover, the higher the level of education, the higher the e-health literacy [38]. Web-based health education, which is emphasized by social change, affects health-related decision-making [38]. Elder individuals with low levels of education need continuous lifelong education.

In addition, active aging of older people who had an income of 1.5 million won per month was higher than that of older people without an income. Income is one of the main influences on active aging: the lower the income, the greater the risk of illness and disability [1]. This indicates that individual level socioeconomic positions can also majorly affect active aging.

Individual level community capacities have been identified as factors that affect active aging. They include participation, leadership, connections, sense of place, community attitudes, and problem assessments. The Canadian Regional Health Survey identified a sense of community belonging as a component of community capacity with socioeconomic determinants; it was found to have a positive effect on subjective health and behavioral changes [39]. Community capacities are closely related to health [4] and play a positive role in behavioral change. If older adults' quality of life improves with an increase in active aging, it may also play a cyclical role and lead to an increase in older adults' participation.

Given the distribution of the 35 neighborhoods used to identify community capacities and active aging, 6.4% and 4.1% of the total variance in active aging could be explained by neighborhoods, after considering individual- and community level variables, respectively.

Previous studies have shown that a community's active aging can vary significantly [40] and that community social relationships and networks are relevant in cultivating active aging [34]. Because the rate of aging, number of senior citizens, and level of socioeconomic development vary across regions, distinct active aging programs should be developed based on the characteristics of each region, with policies implemented through senior citizen programs, rather than at the same level across all regions.

In this study, community level measures were identified, including older adult welfare facilities and cooperative unions, which are part of a shared interest and collaborative context. To enable active aging in senior leisure welfare facilities, social relationships can be formed through communication and exchanges among residents with similar interests [15]. Social cooperatives in cooperative unions are voluntary organizations that solve the problems of the community, revitalize communities, and make villages more livable [22]. This strongly suggests that the opportunities for senior citizens to participate in projects will increase, thereby strengthening the community capacity to promote active aging. This suggests that voluntary groups or organizations with shared interests and collaboration are needed to improve community capacity. In addition, community nurses and health practitioners who provide primary health care need to consider it to organize and apply health-promotion interventions for older adults. However, the resources at the community level were not associated with active aging. Community factors affecting older adults vary with the circumstances and research setting [41]. It is assumed that resources have spatial meaning; the common goal does not regularly interact with it and it plays an indirect role. Therefore, meaningful activities should be performed so that social exchanges can occur, not merely the spatial meaning of resources.

This study has limitations in that it used operational definitions to measure the concept of individual participation in the subdomains of active aging and community participation in the subdomains of community capacity. Participants were older people who engaged in the senior citizens' center in the community, and there are limitations to generalizing these findings to all senior citizens, including those who are not involved in the senior citizens' center and who are vulnerable. In addition, interpretations regarding community capacities at the individual and community levels are limited because this study did not examine the validity of the translation of the Community Capacity Instrument. This study used public data based on the operational definitions and composition scores used in social capital research. This study did not include the overall capacity of the community in terms of context, resources, activities, and outcomes considered in preceding studies.

However, this study is meaningful because it examines community capacities based on the theory of individuals' community connectivity, community consciousness, and health relationships and verifies their relationship with, and influence on, active aging. It is also meaningful in terms of multidimensional community environmental considerations, which provide the basis for theoretical foundations.

Conclusion

This study was conducted to identify the level of active aging in older adults and the influence of individual community level community capacities on active aging. Results indicate that community capacity is an important resource for active aging among older adults and suggest the need to develop appropriate strategies that consider both individual and community factors, such as the contextual indicators of community capacity, to improve active aging.

Conflict of interest

The authors declare that there are no conflicts of interest.

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Characteristics	Categories	n (%)	M ± SD
Gender	Men	142 (37.4)	
Women	238 (62.6)		Age (yrs)

65–74	73 (19.2)	80.13 ± 6.55	75–84
206 (54.2)		≥85	101 (26.6)
	Marital status	Married	203 (53.4)
	Widowed	170 (44.8)	
Single/Divorced	7 (1.8)		Living
With family	269 (70.8)		Alone
111 (29.2)		Education	None
65 (17.1)		Elementary school	124 (32.6)
	Middle school	73 (19.2)	
≥High school	118 (31.1)		Monthly income (10,000 KRW)
None	41 (10.8)		<50
149 (39.2)		50–<150	131 (34.5)
	≥150	59 (15.5)	
Residence period (years)			22.47 ± 18.00
Region	Seobuk-gwon	75 (19.7)	
Dongbuk-gwon	77 (20.3)		Seonam-gwon
74 (19.4)		Dongnam-gwon	77 (20.3)
	Dosim-gwon	77 (20.3)	
Presence of chronic disease	None	35 (9.2)	
One	91 (24.0)		Two or more

Variables	Score range	Min	Max	M ± SD	Average score[a]

Active aging	51-255	93	246	153.03 ± 27.82	3.00 ± 0.55
Participation	30-150	40	150	81.18 ± 19.88	2.71 ± 0.66
Health	13-65	19	63	44.21 ± 8.75	3.40 ± 0.67
Security	8-40	14	40	27.65 ± 5.20	3.46 ± 0.65
Community capacity (individual level)	26-182	50	179	119.99 ± 23.12	4.62 ± 0.89
Participation	4-28	4	28	14.71 ± 5.17	3.68 ± 1.29
Leadership	4-28	4	28	17.68 ± 4.94	4.42 ± 1.24
Connections	5-35	5	35	26.22 ± 5.02	5.24 ± 1.00
Sense of place	3-21	3	21	13.39 ± 4.35	4.46 ± 1.45
Community attitudes	4-28	4	28	20.61 ± 4.65	5.15 ± 1.16
Problem assessment	6-42	6	42	27.39 ± 7.56	4.56 ± 1.26

Characteristics	Categories	Active aging		
M ± SD	t or F	p	Gender	Men
157.06 ± 30.16	4.62	.032	Women	150.63 ± 26.10
		Age (yrs)	65–74[a]	167.77 ± 26.79
20.76	<.001	75–84[b]	153.42 ± 25 .92	
a>b>c	≥85[c]	141.59 ± 27.36		
Marital status	Married[a]	159.93 ± 27.91	14.89	<.001
Widowed[b]	145.54 ± 25.63		a>b	Single/Di vorced[c]

135.00 ± 23.82			Living	With family	
156.59 ± 27.31	3.96	<.001	Alone	144.41 ± 27.25	
		Education	None[a]	139.43 ± 25.17	
23.19	<.001	Elementary school[b]	144.95 ± 24.49		
d>a,b,c	Middle school[c]	155.19 ± 24.73		c>a	
≥High school[d]	167.69 ± 27.60			Monthly income (10,000 KRW)	
None[a]	141.73 ± 22.88	24.43	<.001	<50[b]	
144.28 ± 25.98		d>c>b	50–<150[c]	156.44 ± 24.95	
	d>a	≥150[d]	175.46 ± 27.45		
	Number of chronic diseases	None[a]	169.26 ± 25.31	9.52	
<.001	One[b]	157.04 ± 26.68		a>c	

Variables	Categories	Null Model			Model I			Model II		
Coef.	SE	p	Coef.	SE	p	Coef.	SE	p	Fixed effects	
Individual level										
Age (yrs)	75–84				−8.27	3.01	.006	−8.37	2.99	.005

≥85				−16.26	3.56	<.001	−16.22	3.53	<.001	65–74[a]
									Marital status	Single/Divorced
			−0.93	8.63	.914	−2.55	8.64	.768	Widowed	
		1.61	3.18	.613	1.63	3.16	.606	Married[a]		
							Living	Alone		
	−3.01	3.10	.331	−2.27	3.08	.378	With family[a]			
						Education	Elementary school			
2.35	3.18	.460	2.70	3.17	.394	Middle school				8.90
3.58	.013	8.95	3.56	.012	≥High school				12.96	3.52
<.001	12.40	3.52	<.001	None[a]						
			Monthly income (10,000 KRW)	<50				0.41	3.66	.910
0.27	3.64	.942	50–<150				3.00	3.82	.433	2.94

3.80	.439	≥150				16.49	4.56	<.001	16.95	4.53
<.001	None[a]									
Presence of chronic disease	One				−5.23	4.09	.201	−5.38	4.08	.187
Two or more				−4.23	3.90	.278	−4.55	3.90	.243	No[a]
									Community capacity individual level	
		0.54	0.05	<.001	0.54	0.05	<.001	Community capacity community level		
								Resource		
				−1.56	1.26	.217	Shared interests &collaboration context			
				2.80	1.27	.027	Random effects			
LR[b] test vs. linear regression										
Log likelihood		−1798.42			−1683.60			−1681.37		
X^2 (p-value)		8.08 (.002)			4.93 (.013)			2.31 (.064)		
Variance (SE)										
Community level		59.99	30.34		26.69	16.05		16.93	13.63	
ICC[c]										
Community level		.078			.064			.041		

DETAILS

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Low Body Mass Index for Early Screening of Adolescent Idiopathic Scoliosis: A Comparison Based on Standardized Body Mass Index Classifications

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ABSTRACT (ENGLISH)

Purpose

Scoliosis is a common musculoskeletal problem in adolescents. This study aimed to identify the prevalence of adolescent idiopathic scoliosis (AIS) and its associated factors among Korean adolescents. The prevalence of thin individuals among students with AIS was compared based on body mass index (BMI) classifications.

Methods

This study was a secondary data analysis and used the 2016 Korean National Health Examination for School Students data. Data from 16,412 students were analyzed using descriptive statistics, Chi-square tests, and logistic regression analysis.

Results

The prevalence of AIS was higher in women (3.8%) than in men (1.6%), and a higher school year was a risk factor for AIS in both sexes. In woman adolescents, scoliosis was associated with thinness; however, the risk of AIS was inversely associated with overweight/obesity in both sexes. The prevalence of thin woman students with scoliosis differed based on the criteria used: 3.3% by the World Health Organization criteria and 14.3% by the International Obesity Task Force criteria.

Conclusion

The prevalence of thin students with scoliosis could increase by up to four times depending on the BMI criteria. For early screening of thin people at risk of AIS among female students, the criterion of International Obesity Task Force should be used as it is more permissive of thinness. This is also because of the underestimation of AIS prevalence when using the BMI Z score of the World Health Organization cutoff.

FULL TEXT

DETAILS

Subject: Students; Body mass index; Teenagers; Obesity

Location:	United States--US
Company / organization:	Name: World Health Organization; NAICS: 923120; Name: Centers for Disease Control &Prevention--CDC; NAICS: 923120
Identifier / keyword:	adolescent; body mass index; scoliosis; thinness
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Effect of Enhanced Recovery After Surgery Protocol on Patients Who Underwent Off-Pump Coronary Artery Bypass Graft

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ABSTRACT (ENGLISH)

Purpose

Enhanced recovery after surgery (ERAS) is an evidence-based perioperative measure to improve outcomes. Although the benefits of ERAS are well proven for other surgeries, little is known about its effect on off-pump coronary artery bypass graft (OPCABG) surgery. Thus, this study aimed to explore the effect of an ERAS protocol in patients who underwent OPCABG surgery.

Methods

This quasi-experimental study included 94 participants (traditional care group = 47 vs ERAS group = 47). An ERAS protocol was established by a multidisciplinary team. Knowledge of coronary artery disease, fasting time, water deprivation time, extubation time of the tracheal tube and pericardial and mediastinal drainage tube, off-bed activity participation rate, length of hospital stay, hours of intensive care unit (ICU) stay, expenses in ICU, incidence rates of ICU delirium and postoperative nausea and vomiting, and the 6-Minute Walk Test on postoperative day 7 were recorded and calculated between the groups.

Results

Demographics, lifestyle, and disease severity showed no significant difference between the two groups ($p > .05$). The ERAS group patients had improved understanding of coronary artery disease ($t = -3.89$, $p < .01$), shorter fasting time ($t = 7.98$, $p < .01$), shorter water deprivation time ($t = 9.29$, $p < .01$), increased off-bed activity participation ($t = 17.67$, $p < .01$), and the improved 6-Minute Walk Test on postoperative day 7 ($t = -3.23$, $p < .01$).

Conclusions

The ERAS protocol is safe and effective for patients undergoing OPCABG surgery.

FULL TEXT

DETAILS

Subject:	Ventilators; Recovery (Medical); Heart surgery; Coronary vessels; Physicians; Questionnaires; Cardiovascular disease; Hospitals; Pain; Delirium; Consciousness; Performance evaluation; Fasting; Nurses; Patient satisfaction; Analgesics
Identifier / keyword:	coronary artery bypass; early ambulation; thoracic surgery; walk test

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Reliability and Validity of the Behavioral Regulation in Exercise Questionnaire-2 for Nursing Home Residents in China

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ABSTRACT (ENGLISH)

Purpose

This study aimed to examine the reliability and validity of the Chinese-translated Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2) for nursing home residents.

Methods

A convenience sample of 204 nursing home residents were used for measuring the instrument performances. Demographics form and BREQ-2 developed by Markland were applied.

Results

The translated BREQ-2 model was a good fit for the results of confirmatory factor analysis, χ2 was 276.75, comparative fit index was .94, standardized root mean square residual was .05, and root mean square error of approximation was .07. Results in the BREQ-2 indicated good consistency, Cronbach's α coefficient of BREQ-2 was .78, and each of the five subscales were ranged from .78 to .83. The test–retest was valued .84, and the five subscales ranged from .75 to .89, which supporting the stability of instrument.

Conclusion

This study provided psychometric evidence for the application of BREQ-2 among nursing home residents in China.

FULL TEXT

Introduction

Regular physical activity has been confirmed to counteract frailty and sarcopenia; lower risk for many chronic diseases such as coronary heart disease, hypertension, osteoporosis, and type 2 diabetes; reduce the incidence of depression and dementia; and improve general well-being [1–7]. Although the advantages of physical activity for older adults are well documented, investigations of nursing home residents in the United States, Australia, Canada, France, and Norway [8–11] have shown that physical activity level barely meets the World Health Organization recommendations for older adults. Owing to the lack of physical activity data among the nursing home residents in Mainland China, researchers conducted a survey which using the pedometer to measure the physical activity among the nursing home residents. The study indicated that most of the nursing home residents were in the sedentary (85.7%) or low active (4.7%).

There are many barriers to physical activity within nursing homes that have been summarized into three categories [12,13]: individual, organizational, and environmental. At the individual factor level, motivation is deemed as the most important factor for initiation and maintenance of physical activity [14]. As a form of motivation, self-determination theory (SDT) has received increased attention and has been applied to research of physical activity [15,16]. Motivation in SDT is described as a continuum which moving back and forth between non-self-determined and self-determined regulation, and the six forms of regulation are amotivation, external, introjection, identification, integration, and

intrinsic [17]. Amotivation means no intention to engage in any physical activity. External regulation is close to amotivation, it occurs when behaviors are only performed after external pressures or to achieve a reward. Introjection involves the internalization of external pressures, and people perform it to avoid guilt and to attain self-esteem or feeling of worth. Identified regulation exists when a conscious acceptance of the behavior as being personally important for the sake of achieve the valued outcomes. Integrated regulation occurs when behavior is coordinated with people's other needs, values, and is fully self-determined. Intrinsic regulation exists when behaviors are performed for the satisfaction or enjoyment of engaging in the activity itself [17].

Several questionnaires have been developed to measure the motivational continuum of STD in the field of exercise, sport, and physical education, for instance, the Sport Motivation Scale (SMS) [18], Exercise Motivation Scale (EMS) [19], and Behavioral Regulation in Sport Questionnaire (BRSQ) [20]. SMS is a 28-item self-report measure, and it is made up seven subscales, which includes three types of intrinsic motivation (to know, to accomplish things, and to experience stimulation), three types of extrinsic motivation (identified, introjected, and external regulation), and amotivation. It is used to measure self-determination motivation in competitive sports [18]. BRSQ is used to measure amotivation, intrinsic motivation, and extrinsic motivation with respect to competitive sports. Both two questionnaires are used in the context of competitive sports and may not be suitable for assessing the motivation in regards to physical education or physical activity [20]. EMS is a 31-item self-report measure, and it made up eight subscales, which include intrinsic motivation to sensations, intrinsic motivation to accomplish, intrinsic motivation to learn, integrated regulation, identified regulation, introjected regulation, external regulation, and amotivation. It is used to measure self-determination motivation in the context of exercise [19]. EMS assesses three types of intrinsic motivation, which is different from Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2) in that BREQ-2 assesses a general intrinsic motivation.

Based on the literature review, BREQ/BREQ-2 was the most widely used instrument to measure the SDT motivation in the field of exercise or physical activity. BREQ was developed by Mullan et al. [21] to measure the motivational continuum of SDT in the exercise domain, which is a 15-item self-report scale included external, introjected, identified, and intrinsic regulations. Markland et al. [22] revised and completed BREQ-2 by adding amotivation. Hence, BREQ-2 comprises five factors: amotivation, external, introjected, identified, and intrinsic regulation, with 19 items. BREQ and BREQ-2 are regarded as a means for extending the application of SDT worldwide [23], and the validity and reliability of BREQ and BREQ-2 have been examined in different countries, which provided good psychometric measurements [22–26]. For instance, the results of the confirmatory factor analysis (CFA) revealed the 5-factor structure of the BREQ-2 among the Portuguese people with schizophrenia, the Iranian university students, the Hongkong public university students in China [26–28]. Cronbach α (from .48 to .88) which is used for assessing internal consistency across five subscales were accepted [23,26]. Discriminant validity analysis reveals the separability of the five factors of BREQ-2 responses [22,23]. According to the above data, BREQ-2 can be used to measure physical activity motivation.

Although the psychometric properties of BREQ-2 have been examined in university students and adolescents in China [24,27], application among nursing home residents has not been investigated. The purpose of this study was to access psychometric properties of the Chinese-translated BREQ-2 among nursing home residents in China.

Methods Study design

This cross-sectional survey was designed to validate the reliability and validity of BREQ-2 to determine the adequacy of the scale for conducting research in measuring physical activity motivation within SDT among nursing home residents in Shenyang.

Setting and sample

The study was conducted from February to March 2018 among 204 nursing home residents (123 women and 81 men) from 102 nursing homes in Shenyang of China. According to the recommendations from Costello and Osborne for determining sample sizes of confirmatory factor analysis, the item ratio of 20:1 sample has a higher accuracy (70%) compared with the 10:1 (60%) and the 5:1 (40%) [29], and because of the constraints of expenditure, the item ratio of 10:1 sample was used. Hence, 238 samples were needed based on 19 items and a dropout rate of 20.0%.

All the participants met the following inclusion criteria: (1) aged ≥ 60 years; (2) residing in the nursing home for > 6 months; (3) acting independently; (4) no signs of cognitive impairment (the score of the Chinese adapted Mini Mental State Examination > 20) [30]; (5) able to communicate; and (6) no severe disease.

Instruments

BREQ-2 comprised (1) amotivation (4 items); (2) external regulation (4 items); (3) introjected regulation (3 items); (4) identified regulation (4 items); and (5) intrinsic regulation (4 items). All the 19 items were positive scored, and it was rated on a five-point for each item from 0 (not true for me) to 4 (very true for me) to identify what the participants felt about exercise [22]. The relative autonomy index (RAI) is a single score derived from the subscales that gives an index of the degree to which respondents feel self-determined. The index is obtained by applying a weighting to each subscale and then summing these weighted scores. In other words, each subscale score is multiplied by its weighting, and then these weighted scores are summed. It should be borne in mind that a RAI score only makes sense if the subscales do reflect a continuum of ordered variations in self-determination.

To keep the experiential equivalence of items in BREQ-2 for the nursing home residents, some items need to be revised, such as item 17 ″I feel ashamed when I miss an exercise session". Most of the nursing homes in China do not understand the meaning of "exercise session"; hence, "exercise item" was used instead of "exercise session" in our study.

A panel of six judges included one nurse specialized in geriatric nursing, two nurses specialized in dementia and cognition, one professor who had studied motivation and emotion, and one associate professor who worked in sport psychology reviewed BREQ-2 for content validity.

Ethical considerations

Informed consent was signed by all the participants. Ethical approval was attained from the Research Ethics Committee of the Peking Union Medical College (Approval no. [2016]02).

Data collection

Among the 250 participants who were eligible based on the study criteria, 223 agreed to an interview of whom 204 provided data of physical activity that were valid and included in the analysis. All the participants signed an informed consent.

Data were collected by face-to-face interviews using the self-designed questionnaire for sociodemographic information containing age and gender, the adjusted BREQ-2, and carried out by our team. The members in this team were trained before collecting data, such as unified and standard instructions during the process of interviews, how to control the time of interviews, and check the questionnaire after finished. Twenty minutes was needed to complete these questionnaires.

BREQ-2 was readministered 7 days later to evaluate the test–retest reliability with the same participants [31]. The number of nursing home residents participated the test–retest interview was 30.

Data analysis

Content validity of instruments was examined by computing a content validity index (CVI) on the basis of six experts' ratings of item relevance [32]. Each item of BREQ-2 was evaluated by expert panel for content equivalence by using a 4-point rating scale: 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant. Then, the number of experts who giving a score of either 3 or 4 divided by the number of all the experts was calculated. According to the recommended, there could be one “not relevant” rating with six experts (I-CVI = .83) [32]. According to the criteria recommended in Polit and Beck [33], a minimum I-CVI of .83 and S-CVI of .80 can be accepted.

CFA method was used for express construct validity and analyzed in AMOS, version 23.0, software [34]. Maximum likelihood estimate was used for CFA coupled with bootstrapping approach. In line with the recommendations of Hoyle and Panter [35], the model assessment was evaluated using multiple goodness-of-fit indexes including the χ^2 value, comparative fit index (CFI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA) accompanied by its 90% confidence interval. It is commonly accepted that thresholds of > .90 [36] close to (or less than) .08 [37] and up to .08 [38] for CFI, SRMR, and RMSEA, respectively, are indicative of acceptable model fit.

Internal consistency reliabilities of BREQ-2 was analyzed by Cronbach α coefficient of > .70 was considered satisfactory [39]. Test–retest reliability of BREQ-2 was assessed by using intraclass correlation. The results with an intraclass correlation greater than .70 are acceptable [39]. Item analysis was assessed using critical ration, independent sample t test was used for comparing the score of high score group (27%) and low score group (27%), then delete the item which CR does not reach 3 [40]. Convergent validity was performed to analyze the average variance extracted of > .50 [31].

SPSS software of version 12.0 and AMOS 23.0 (IBM Corp., Armonk, NY, USA) were used for data inputting, cleaning, and analyzing. Sociodemographic information was expressed by descriptive statistics. *p*

Results

Demographics

The mean age of all the 204 participants was 79.61 ± 8.73 years (range 61–94 years), 74.57 ± 5.17 years for 91 men, and 82.63 ± 9.49 years in 113 women. About 61.3% were older than 80 years, 67.2% had normal weight, and 76.0% were single (Table 1).

Content validity

I-CVI of 19 items ranged from .83 to 1.00, and S-CVI of BREQ-2 was .97. According to the criteria recommended in Polit and Beck [33], a minimum I-CVI of .83 and S-CVI of .80 can be accepted; hence, BREQ-2 can be judged as having excellent content validity.

Item analysis

Item analysis was assessed using critical ration, all the items of CR reached 3 and the 95% confidence interval with value were not including ± 1 (Table 2).

Validity

The translated BREQ-2 model was a good fit for the CFA results as χ^2 = 276.75, df = 142, CFI = .94, SRMR = .05, and RMSEA = .07. Factor loading of the 19 items ranging from .63 to .90 indicated that all factors were statistically significant ($p \leq .05$) (Table 3). Convergent validity was performed to analyze the average variance extracted value of > .50, and was good for the five subscales ranged from .59 to .72 (Table 3).

Reliability

Internal consistency reliability was estimated using Cronbach α coefficient. Results in the BREQ-2 indicated good consistency, and the Cronbach α coefficient of BREQ-2 was .78, and each of the five subscales ranged from .78 to .83. The test–rest reliability was assessed to measure the intraclass correlation (Table 4) and was good for the scale value .84, and the five subscales ranged from .75 to .89.

Discussion

BREQ-2 was designed to measure self-determined motivation in the domain of sport, exercise, and physical activity, and it can help to explore the reasons why people engage or not in physical activity. Hence, a valid instrument is needed for nursing home residents in China. The purpose of this study was to access psychometric properties of the Chinese-translated BREQ-2 among nursing home residents in China.

The five-factor model was confirmed by CFA, and coefficients in this factor analysis were similar to the study results of Markland et al. [22]. A self-determination continuum also existed in the Chinese context. However, the results differed from a previous study in Hong Kong [24], which removed item 17 because of cross-loading on an unintended factor. It is considered that identified regulation items reflect the importance of physical activity, whereas amotivation items are related to a lack of such importance; hence, it might be a little ambiguous to understand the importance or value of physical activity for respondents [24]. Furthermore, item 17 is a double-negative sentence. Compared with the populations in the previous research, the present study comprised the elderly living in the nursing home, and face-to-face interview was used to fill in the BERQ-2 to reduce missing data, and also it can help the elderly have a better understanding about the items. For instance, our research member stated the item 17 with the positive sentence to the elderly. Furthermore, the physical activity of elderly is motivated by the medical advices or the knowledge that they could get the benefits from exercise other than the interests. Amotivation means no intention to engage in any physical activity, and identification regulation means an action is motivated by its value or importance, and it is not difficult to distinguish the identification and amotivation regulation. Discriminant validity was also

examined by CFA method and was supported in the current study, and it was similar to the study results of Chung [27].

Internal consistency reliabilities of BREQ-2 was assessed by using the Cronbach α coefficient. BREQ-2 and each of the five subscales in the present study indicated good internal consistency (Cronbach α coefficient was from .78 to .83) and were similar to the study results of Murcia et al [41].

The present study has provided empirical support for the first applicability of the Chinese version BREQ-2 using in the nursing home residents. Compared with the seniors living in the community, nursing home residents have poor physical and mental health and higher readmission rates [42,43]. They cannot lead self-determined, active, and stimulating lives [43] and have a lower level of physical activity [44]. BREQ-2 can provide greater insight into the mechanisms which impacted the physical activity among the nursing home residents and understand the reasons why the seniors decide to engage or not in physical activity and also provide evidences for the motivational intervention in the future research.

Owing to the constraints of expenditure, 10:1 sample to item ratio was used at this study. According to the recommendations of confirmatory factor analysis, sample size should be enlarged in the future research.

Conclusion

The findings of this study provided psychometric evidence for the application of BREQ-2 among nursing home residents in China. Assessing the motivation of physical activity is important for research. It can help researchers to identify the motivational process, namely, which forms of regulation such as amotivation, external, introjection, identification, integration, and intrinsic the seniors be. Then, researchers can make the interventions according to the type of motivation.

Further study is to facilitate more research on SDT with physical activity in the Chinese context, especially some investigations of the antecedents and consequences of motivation in physical activity domain.

Conflicts of interest

The authors have no conflicts of interest in relation to this study.

Acknowledgments

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Characteristics		Total (N = 204) n (%)	Men (n = 91) n (%)	Women (n = 113) n (%)
Age (yrs)	60~69	6 (2.9)	4 (4.4)	2 (1.8)
70~79	73 (35.8)	36 (39.6)	37 (32.7)	≥80
125 (61.3)	51 (56.0)	74 (65.5)	BMI	Underweight

5 (2.4)	2 (2.2)	3 (2.6)	Normal weight	137 (67.2)
65 (71.4)	72 (63.8)	Overweight	48 (23.5)	18 (19.8)
30 (26.5)	Obese	14 (6.9)	6 (6.6)	8 (7.1)
Educational level	Elementary or lower	125 (61.3)	46 (50.5)	79 (69.9)
Junior high	52 (25.5)	29 (31.9)	23 (20.4)	Senior high
23 (11.3)	13 (14.3)	10 (8.8)	College or higher	4 (1.9)
3 (3.3)	1 (0.9)	Marital status	Married	49 (24.0)
28 (30.8)	21 (18.6)	Single (unmarried, widowed, or divorced)	155 (76.0)	63 (69.2)

Item	CR (95% CI)
Amotivation	
5. I don't see why I should have to exercise	19.40 (2.23-2.73)
9. I can't see why I should bother exercising	18.55 (2.32-2.87)
12. I don't see the point in exercising	17.66 (2.00-2.51)
19. I think exercising is a waste of time	18.15 (2.11-2.62)
External regulation	
1. I exercise because other people say I should	25.10 (2.27-2.66)
6. I take part in exercise because my friends/family say I should	35.16 (2.33-2.61)
11. I exercise because others will not be pleased with me if I don't	26.10 (1.79-2.08)
16. I feel under pressure from my friends/family to exercise	26.76 (1.96-2.27)

Introjected regulation	
2. I feel guilty when I don't exercise	11.92 (1.06-1.48)
7. I feel ashamed when I miss an exercise session	11.62 (1.13-1.60)
13. I feel like a failure when I haven't exercised in a while	10.34 (1.01-1.49)
Identified regulation	
3. I value the benefits of exercise	23.49 (1.87-2.21)
8. It's important to me to exercise regularly	26.78 (2.44-2.82)
14. I think it is important to make the effort to exercise regularly	19.98 (2.04-2.48)
17. I get restless if I don't exercise regularly	15.76 (1.24-1.60)
Intrinsic regulation	
4. I exercise because it's fun	24.10 (2.45-2.88)
10. I enjoy my exercise sessions	28.51 (2.62-3.01)
15. I find exercise a pleasurable activity	14.03 (1.81-2.41)
18. I get pleasure and satisfaction from participating in exercise	28.85 (2.64-3.03)

Item	M	SD	FL	AVE
Amotivation				
5. I don't see why I should have to exercise	0.90	0.95	.76	.62
9. I can't see why I should bother exercising	0.89	1.02	.77	12. I don't see the point in exercising

0.85	0.98	.77	19. I think exercising is a waste of time	0.71
0.95	.85	External regulation		
1. I exercise because other people say I should	1.64	1.22	.84	.67
6. I take part in exercise because my friends/family say I should	1.61	1.10	.88	11. I exercise because others will not be pleased with me if I don't
1.60	1.18	.81	16. I feel under pressure from my friends/family to exercise	1.69
1.13	.78	Introjected regulation		
2. I feel guilty when I don't exercise	2.23	1.05	.78	.63

7. I feel ashamed when I miss an exercise session	2.17	1.04	.72	13. I feel like a failure when I haven't exercised in a while
2.27	1.02	.87	Identified regulation	
3. I value the benefits of exercise	3.14	0.76	.83	.59
8. It's important to me to exercise regularly	3.11	0.85	.81	14. I think it is important to make the effort to exercise regularly
3.03	0.92	.78	17. I get restless if I don't exercise regularly	2.93
0.91	.63	Intrinsic regulation		
4. I exercise because it's fun	2.91	1.03	.73	.72

10. I enjoy my exercise sessions	3.05	0.99	.90	15. I find exercise a pleasurable activity
2.97	1.08	.84	18. I get pleasure and satisfaction from participating in exercise	3.00

Item	ICC (95% CI)
Amotivation	.87 (.74- .93)
External regulation	.78 (.59- .89)
Introjected regulation	.89 (.79- .95)
Identified regulation	.77 (.58- .89)
Intrinsic regulation	.75 (.54- .87)

DETAILS

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Effects of Exercise on Sleep Quality in Pregnant Women: A Systematic Review and Meta-analysis of

Randomized Controlled Trials

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ABSTRACT (ENGLISH)

Summary

Purpose: Sleep quality was considered a priority concern facing pregnant women. Conventional wisdom argues that good sleep quality benefits pregnant women and their fetuses. The aim of this study is to assess the effects of a specific exercise program on the sleep quality in pregnant women.

Methods: Searches were executed in seven databases since their inceptions until February 28, 2019, for randomized controlled trials evaluating the effects of an exercise program on the sleep quality and insomnia in pregnant women. A random-effects model was applied for meta-analysis, and odds ratio, mean differences (MDs), and 95% confidence intervals (CIs) are shown as parts of outcomes.

Results: Seven studies were included for meta-analysis. Compared with their not-exercising counterparts, analyses showed that regularly exercising women had significantly enhanced sleep quality, with an odds ratio of 6.21 (95% CI, 2.02–19.11;p = .001; I2 = 80.2%), with a standardized MD of −0.93 (95% CI, −1.19 to −0.67; p <.001; I2 = 30.0%). However, exercising women showed no significant insomnia improvement, with an standardized MD of −2.85 (95% CI, −7.67 to 1.98; p = .250; I2 = 97.0%), relative to their not-exercising counterparts.

Conclusion: This research indicated that exercise has a positive impact on the sleep quality of pregnant women. Despite the aforementioned positive impact on sleep quality, the present study did not find evidence to support that exercise may also improve insomnia for pregnant women.

FULL TEXT

Introduction

Sleep disturbance is quite common in pregnant women. About 76% of pregnant women experienced poor sleep quality throughout all trimesters, and 57.3% of pregnant women experience subthreshold insomnia throughout all trimesters [1]. Longitudinal studies indicated that sleep quality decreased from the second to third trimester [2]. Many pregnant women experience frequent poor sleep quality, nighttime awakening, insomnia, insufficient nighttime sleep, and significant daytime sleepiness during their pregnancy [1].

Sleep disturbances have been correlated with the increased risk of adverse pregnancy outcomes including emergency cesarean sections [3,4], preterm births [4], development of depressive symptoms [5–7], glucose intolerance [8,9], and gestational hypertension [3,10]. Based on these associations, the authors believe that the improvement in sleep could presumably result in better pregnancy outcomes. Furthermore, an insomnia drug therapy has several side effects: preterm birth, preterm deliveries, cesarean deliveries, low birth weight, and even delivery of small-for-gestational-age infants [11].

Exercise has been suggested as one of the several nonpharmacological alternatives to enhance sleep quality [12]. Exercise has been considered to enhance sleep quality and improve insomnia and anxiety [13–16]. Women with uncomplicated pregnancies should be encouraged to engage in aerobic and strength-conditioning exercises during pregnancy [17]. For healthy pregnant women, the guidelines recommend at least 150 minutes per week of moderate-

intensity aerobic activity [18]. Some studies have shown that water exercise and relaxation exercise can improve the sleep quality of pregnant women [19,20], but one study has shown that tai chi/yoga does not improve the sleep disturbances of pregnant women [21]. When reviewing individual studies, the effect of physical activity or exercise on sleep quality and insomnia during pregnancy is inconclusive. Therefore, the authors conducted a systematic review and meta-analysis of randomized controlled trials (RCTs) to assess and validate the effects of exercise programs on quality of sleep and insomnia.

Methods

This study used Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols 2015 statements in constructing the structure of this review [22].

Search strategies

Electronic literature searches were conducted in seven databases MEDLINE, PubMed, Cumulative Index to Nursing and Allied Health Literature, Cochrane, Excerpta Medica database (Embase), Chinese National Knowledge Infrastructure, and Airiti Library since their inceptions through February 28, 2019. Corresponding Chinese terms were used for searching in Chinese databases (Chinese National Knowledge Infrastructure and Airiti Library). The search terms used were “pregnan*” or “gestation” or “prenatal” and “sleep” or “insomnia” and “exercise” or “sport” or “physical activity” or “yoga” or “tai chi.” Manual searches were also performed on retrieved articles for additional references.

Inclusion/exclusion criteria and study selection

A PICOS (Participants, Intervention, Comparison, Outcomes) tool, composed of participant, intervention, comparison, outcomes, and study setting, was used as selection criteria to develop an effective strategy [23]. As per the design, participants were pregnant women, and the intervention was exercise regardless of its types or forms (e.g., aerobic exercise, stretching and relaxation, yoga, or tai chi) versus nonactive intervention (e.g., education or usual care) as a comparison. Quality of sleep or insomnia was the outcome, and for the study setting, only RCTs were assessed.

The following studies were excluded: (1) prospective cohort studies, (2) numerical data not provided or specified on specific tools, and (3) studies with participants reported to have acute complications during the courses of exercises, such as vaginal bleeding, amniotic fluid leakage, or regular painful contractions.

Data extraction

To ensure the objectivity of literature screening, two reviewers (S.-Y.Y. and S.-H.L.) independently screened titles, abstracts, and full-text journal articles. Citations considered potentially relevant to literature with titles or abstracts containing insufficient information were retrieved and further assessed, via applying the PICOS tool, by two independent reviewers (S.-Y.Y. and S.-H.L.) to determine eligibility for inclusion. In cases of disagreement over eligibility for inclusion between the two independent reviewers (S.-Y.Y. and S.-H.L.), a consensus was achieved by discussing and consulting with a third reviewer (S.-J.L.). Two reviewers (S.-Y.Y. and S.-H.L.) independently extracted data from the included studies. The following information was extracted: authors, the year of publication, the number of participants, age of the participants, nationality, pregnant body mass index, gestational age, the information about characteristics of exercise programs, and the information about characteristics of the outcome measurement. A consensus was achieved by discussing and consulting with a third reviewer (S.-J.L.).

Quality assessment of selected studies

The methodological quality of the selected RCTs was evaluated against the Cochrane risk of bias tool. Higgins et al. states that “the risk of bias tool covers six domains of bias: selection bias, performance bias, detection bias, attrition bias, reporting bias, and other bias.” In evaluating any RCTs, each item was depicted as having either a low risk of bias, a high risk of bias, or an unclear risk of bias. The risk of bias was independently evaluated by two authors (S.-Y.Y. and S.-J.L.) by applying the Cochrane risk of bias tool [24].

Meta-analytical and statistical methods

The reviewers extracted data in connection with the study characteristics (PICOS criteria) by using the data form. Once verified for their exactness and completeness, the results were then analyzed by applying the Cochrane

Collaboration Review Manager (RevMan) software program version 5.4 (Cochrane, London, UK). As for data synthesis of continuous variables, results of the individual studies were calculated as mean difference (MD) or standardized MD (SMD), with 95% confidence intervals (CIs). When the pooled trials used different rating scales, the absolute MD divided by the SMD was applied. For dichotomous variables, results of the individual studies were calculated as odds ratios (ORs), with 95% CIs [25]. The researchers deemed only randomized trials demonstrating clinical homogeneity to be potentially eligible for meta-analysis. As for pooled effects, heterogeneity was tested applying the Breslow–Day test, with p 2 analysis is a useful statistic to quantify inconsistency: $I^2 = [(Q - df)/Q] \times 100\%$, where Q is the χ^2 statistic and df is its degrees of freedom [23,26]. The χ^2 test was further applied to evaluate and quantify statistical heterogeneity across trials by using the I^2 statistic (small, $I^2$2 between 26% and 74%; and high, $I^2 \geq 75\%$) [25]. If heterogeneity was observed (the value of heterogeneity being higher than or equal to 25%), the authors then applied a random-effects model. If the value of heterogeneity was lower than 25%, the authors applied a fixed-effects model [27]. To assess the possibility of publication bias, we also applied Egger's regression test, and the Begg adjusted rank correlation test [28,29].

Results Literature search

A flow chart describing the literature extraction process as well as the criteria for inclusion and exclusion can be seen in Figure 1. As per initial search results, 461 records were identified from relevant databases and their reference lists, with 137 duplicate references being removed. Among the remaining 324 potentially eligible articles, 273 were excluded after screening their titles and abstracts, and in addition, four more non–full-text articles were further removed. During the eligibility screening stage, 40 of 47 full-text articles were excluded for not meeting the inclusion criteria. These remaining seven articles were included for meta-analysis [19–21,30–33].

Characteristics of the selected studies Participants

A total of 688 pregnant women were included as participants in seven RCTs. All studies focused on pregnant women without physical complications reported during pregnancy. Participants in one study were pregnant women with depression, whereas another study has involved pregnant women with complaints of insomnia or fatigue. The mean age for participants was around 26.00–32.12 years, with their pregnancy stages covering the first, second, and third trimesters. Of the seven studies included for analyses, three were conducted in China, one in the USA, one in Spain, one in Turkey, and the remaining one in Nigeria (Table 1).

Intervention

Among studies included for meta-analysis, participants of three studies practiced yoga, whereas participants in the other four studies practiced multiple forms of exercise, including aerobic exercise, gymnastics training, tai chi, and relaxation exercise. The duration of exercise was between 4 and 16 weeks, with its frequency ranging from 1 to 3 sessions per week and duration for each session lasting as long as 20–60 minutes. In addition to the regular programmed exercise, participants of four studies also performed self-initiated exercise by themselves at home on a daily basis (Table 2).

Comparison

The control group of one study was allocated to a waitlist childcare transportation and that of five studies was implemented with education and another one was in routine care (Table 1).

Outcome

Four studies [19,20,31,32] reported sleep quality by applying the Pittsburgh Sleep Quality Index (PSQI), one study [28] reported sleep quality by applying the Self-Rating Scale of Sleep, and the other two studies [21,30] adopted the Verran and Snyder-Holpern Sleep Scale and the Insomnia Severity Index scale to report participants' insomnia condition. Six studies [19,20,30–33] reported that the quality of sleep or insomnia conditions in the exercise group was better than that of the counterpart group. One study [21] reported no difference in insomnia conditions among participants in both the exercise and the no-exercise control group. The characteristics of the included articles are summarized in Table 2.

Risk of bias assessment

Risk of bias assessment is illustrated in Figure 2. The methodological quality of all the included studies was judged to be “moderate” based on the distribution for each item assessed for risk of bias. Publication bias was calculated as

Begg and Egger tests (Begg test, $p = .042$; Egger test, $p = .029$).

Summary of the results

Four studies reported the sleep quality of participants by using the PSQI, with the results of dichotomous variables revealing that the participants in the exercise group showed an obvious sleep quality improvement (OR, 6.21; 95% CI, 2.20–19.11; $p = .001$; $I^2 = 82.0\%$). Two studies reporting the sleep quality of participants, with the results of continuous variables revealing that the participants in the exercise group demonstrated an obvious sleep quality improvement (SMD, −0.93; 95% CI, −1.19 to −0.67; p 2 = 30.0%) (Figure3).

Two studies reported participants' insomnia condition by using the Verran and Snyder-Holpern Sleep Scale and PSQI, with the results of continuous variables revealing no significant difference among the participants in either the exercise group or the no-exercise counterpart group (SMD, −2.85; 95% CI, −7.67 to 1.98; $p = .250$; $I^2 = 97.0\%$) (Figure 3).

Of the two studies that conducted integrated analyses on the participants who practiced aerobic exercise, the results of the dichotomous variables showed that the participants in the exercise group also had significant improvement in sleep quality (OR, 4.26; 95% CI, 2.23–8.11; p 2 = 16.0%) (Figure 3).

Discussion

A previous meta-analysis examining the effects of aerobic exercise was found to have improved the sleep quality of middle-aged women [34]. Similarly, findings derived from our meta-analysis also showed that programmed aerobic exercise can improve the sleep quality of pregnant women. This study has found that the effectiveness of aerobic exercise, when compared with overall exercises, on sleep improvement was least effective. However, opposite results were also discovered when research participants were middle-aged pregnant women [34]. Whether or not exercises of lower intensity such as yoga, tai chi, and relaxation exercise are more effective in improving sleep quality of pregnant women is an interesting topic and warrants further studies to explore and clarify their effectiveness.

Because of different statistical value representations (continuous variables and dichotomous variables) and distinct outcomes used, three articles exploring the effectiveness of practicing yoga on improving the sleep quality and insomnia conditions in pregnant women were included in the meta-analysis. The results of our review cannot conclusively determine the effectiveness of practicing yoga on improving the sleep quality or insomnia conditions in pregnant women. Conventional wisdom has nevertheless endorsed yoga and considered it beneficial in indirectly facilitating a better sleep, as well as a viable intervention in reducing pain, discomfort, and depression in pregnant women [31,33,35,36]. Relaxation exercise was found to ameliorate the sleep quality for inpatient patients during hospitalization [37]. As in our meta-analysis, only one small study (n = 82), addressed the effects of relaxation exercise on sleep quality. The results derived from our analyses could neither substantiate nor repudiate the proposition that relaxation exercise can actually improve the sleep quality of pregnant women. Accordingly, more relevant studies are warranted and encouraged to validate the presumed beneficial effects of yoga and relaxation exercise on improving the sleep quality and insomnia conditions in pregnant women.

According to the meta-analysis, exercise from the second trimester can effectively improve sleep (only one study started exercise from the first trimester) [19–21,30–33]. However, the effect of exercise type and intensity on improving pregnant women's sleep is still not clear in the analysis. Further studies on the impact of exercise type and intensity on sleep in pregnant women at different trimesters are recommended. The results of this study showed that exercise intervention is an assistive way to improve pregnant women's quality of sleep. Moreover, according to the meta-analysis, three studies pointed out that pregnant woman can do yoga, relaxation exercise, and gymnastic exercise at home by themselves. If the researchers can design more exercises that are suitable and safe for pregnant women to do at home, it can improve the pregnant women's quality of sleep more conveniently and effectively.

Exercise has long been claimed to have a positive impact on sleep quality in many RCT-based studies [12]. Putative mechanisms suggested that generally exercise has a positive impact on physiological functions, including depression, anxiety, immune function, body restoration, circadian phase shifting, cytokine concentration, adenosine release, and thermoregulation [15].

Diabetes, obesity, and hypertension are generally considered contraindications for pregnant women to practice aerobic exercise [17]. Furthermore, pregnant women with comorbidities tend to have more sleep problems than healthy ones [38,39]. As, unfortunately, there are no related studies conducted to determine whether and how exercise benefits pregnant women with comorbidities, interested researchers are encouraged to delve more broadly and deeply into studies designed to explore and determine the exact types or forms of exercise that may improve the sleep quality in women with other clinical conditions.

One previous meta-analysis study addressing relationships between exercise and insomnia in middle-aged women has found that exercise has a nonsignificant decrease in insomnia severity in pregnant women [34]. Similarly, findings from our meta-analysis also showed that programmed exercise during pregnancy has a nonsignificant decrease in insomnia severity in pregnant women. Insomnia is a very complex medical condition subjected to influences from a multitude of factors, e.g., comorbid status, medical therapies, negative life events, family status, social relationship problems, and employment conditions, among other factors. Exercise during pregnancy alone may not be enough to neutralize or counterbalance other negative factors contributing to insomnia [40–42]. In this meta-analysis, only two studies included pregnancy exercise, one study combined yoga and tai chi as pregnancy exercise, and the other practiced aerobic exercise. More studies are warranted in the future, for example, studies adopting new approaches to measure the effectiveness of exercise on insomnia, potential confounding factors, and specific quantitative assessment such as polysomnography.

Of the seven studies included, only one research study has addressed the issues of exercise intensity and warning signs for pregnant women to discontinue exercise. Pregnant women are advised to adhere to those exercise guidelines strictly to ensure their safety during the courses of exercising. The American College of Obstetrics and Gynecology recommends that all women with uncomplicated pregnancies should, after consulting with their providers, routinely engage them in aerobic and strength-conditioning exercise. An exercise program of moderate intensity aimed at achieving optimal effectiveness should be for at least 20–30 minutes per day on most days, if not every day of the week [17]. Safe exercise includes stationary cycling, low-impact aerobics, swimming, walking, yoga, and Pilates during pregnancy [17,18]. After consultation with and evaluation by an obstetrician, racquet sports, strength training, and running or jogging may be safe for pregnant women who practiced these exercises regularly before pregnancy [17,18]. For moderate-intensity exercise, perceived exertion should be rated, 13–14 (“somewhat hard” but not reaching the “hard” scale) on the Borg Scale of Perceived Exertion. Applying the “talk test” is another effective way to evaluate exertion. As long as a woman can have a conversation while exercising, there is no overexerting exercise [17].

Of all studies included in the meta-analysis, only two articles addressed body weight changes in the pregnancy process. A study by Rodriguez-Blanque et al. [19] has shown that sleep quality was better for the exercising pregnant women with a normal body weight during their pregnancy, yet it was not statistically significant when compared with their obese counterparts in the control group. As most studies did not monitor body weight changes throughout the entire courses of pregnancy, the question of whether or not an abnormal body weight increase during pregnancy may influence sleep quality and insomnia is still unknown. As such, future researchers are recommended to address the factor of body weight increase during pregnancy in their studies, hopefully to explore the relationships between exercise during pregnancy and the degree of sleep quality improvement more clearly.

Conclusions

This systematic review study attempted to assess and validate effects of exercise on pregnant women. Seven studies involving 688 participants were included in our study for systematic review and meta-analysis. The findings from our study showed that exercise of 4–16 weeks in duration significantly improved the sleep quality in pregnant women. Most of the studies included in the reviews and analyses were of low quality in terms of evidence strength owing to a lack of participants or blinding of personnel. Heterogeneity of effects was high across these studies. The high heterogeneity was caused in part by distinct exercise types pregnant women practiced during pregnancy, as shown by the results derived from subgroup analyses. Going forward, better-designed studies involving a greater number of participants are warranted to validate presumed benefits of exercise in pregnant

women in the future.

Although publication bias was detected across these studies, the fact that the OR value related to improved sleep quality as a result of exercise during pregnancy was as high as 6.21 allows the authors to infer that exercise indeed can contribute to sleep quality improvement in pregnant women. Ideally, the OR value should be lower than 6.21. Authors therefore expect more future studies, including invalidity studies, to be undertaken in a bid to mitigate publication bias of meta-analyses.

Clinical implications

The findings derived from this meta-analysis and the much broader systematic review confirm with certainty that exercise can be seen as a safe, nonpharmacological approach to improve the sleep quality in pregnant women. Positive findings from this study were nevertheless somewhat offset by the fact that few high-quality studies on this subject were currently available. To make more definitive conclusions regarding the potential effects of exercise in pregnant women and perhaps their actual mechanisms, more clearly defined and rigorously designed large-scale RCTs are warranted in the future.

Conflict of interest

The authors have no conflicts of interest to disclose.

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Author (year)	Site of the study, country	Type of the sample	Age (mean ± SD)	Pregnant BMI (mean ± SD)	Gestational age	Type of exercise	N	Duration (weeks/study)

Pre-test	Post-test	Tella et al.(2011) [30]	Nigeria	Pregnant women with complaint of insomnia and fatigue	IG: 31.8 ± 7.7	37.8 ± 3.5	----	Third trimester	Aerobic exercise
16	6	CG: 31.0 ± 7.1	36.7 ± 3.4	----	Third trimester	CG: sleeping education	14	6	Li (2011) [31]
China	Uncomplicated pregnancy	IG: 27.8 ± 6.3	Normal	3.8% abnormal	20 weeks	Yoga	80	16	CG: 27.8 ± 6.3

Normal	11.3% abnormal		CG: routine care	80	16	Field et al.(2013) [21]	USA	Clinically depressed pregnant woman	IG: 24.4 ± 4.7
----	----	Second and third trimester	Yoga/tai chi	37	12	Uncomplicated pregnancy with no medical illness	CG: 26.0 ± 5.6	----	----
Second and third trimester	CG (waitlist)	38	12	Rodriguez-Blanque et al.(2018) [19]	Spain	Pregnant women	IG: 32.12 ± 4.43	23.89	27.76 ± 4.03
20 weeks	Aerobic exercise in water	67	16	CG: 30.58 ± 4.75	24.01	29.03 ± 4.45	20 weeks	CG: sleep education	67
16	Liu (2018) [32]	China	Uncomplicated pregnancy	IG: 27 ± 5.13	21.5 ± 3.2	----	25 weeks	Gymnastics training	50

11	CG: 26 ± 4.3	23.1 ± 2.5	----		CG: education	50	11	Ozkan and Rathfisch (2018) [20]	Turkey
Normal pregnancy	IG: 27.93 ± 4.56	22.10 (pregravid)	----	Third trimester	Relaxation exercise	42	4	CG: 27.79 ± 3.90	21.94 (pregravid)
----	Third trimester	CG: education	42	4	Shu et al. (2018) [33]	China	Uncomplicated pregnancy	IG: 29.29 ± 4.80	----
----	First to third trimester	Mindfulness yoga	55	4	CG: 29.16 ± 4.46	----	-----	First to third trimester	CG: education

Author (year)	Type of exercise	Exercise content	Exercise intensity	Exercise frequency (sessions/week)	Session length (min)	Duration (weeks/study)	Basal score		Poster scale		Tool/result
Sleep quality mean ± SD or good sleep quality (%)	Insomnia mean ± SD	Sleep quality mean ± SD or good sleep quality (%)	Insomnia mean ± SD	Tella et al. (2011) [30]	Aerobic exercise	Walk, stair climbing, mild jogging, ball throwing, sitting on a chair	Moderate	1	20	6	
18.4 ± 7.9		2.9 ± 0.4	ISI/the IG reported significant reduction in the insomnia level ($p < .001$)	CG							15.8 ± 7.0
	9.5 ± 1.7										

	p < .001		Li (2011) [31]	Yoga	Bulletin board yoga training; self-practice at home every day	Low	2	60	16	88.7%	
81.2%		PSQI/the IG reported significantly better sleep quality (p < .05)		CG						85.0%	
65.0%									p > .05		p < .05
	Field et al .(2013) [21]	Yoga/tai chi	Yoga and tai chi combined	Low	1	20	12		56.6 ± 20.1		53.5 ± 19.5
VSH/the IG reported lower sleep disturbances (p = .05)	CG						54.4 ± 19.7		62.1 ± 18.4		

								p = .05	Rodriguez-Blanque et al. (2018) [19]	Aerobic exercise	Aerobic exercise, force, resistance exercise, stretching, relaxation exercise in water
Moderate (Borg scale higher than 14)	3	60	16	6.51 ± 3.74 55.71%		6.84 ± 2.86 34.32%		PSQI/the IG reported significantly better sleep quality (p < .05)		CG	

				6.81 ± 3.72 56.72%		10.10 ± 3.12 7.46%					
				p > .05		p < .05			Liu (2018) [32]	Gymnastic training	Lifting the anus (Kegel exercise), foot movement, sitting cross-legged, waist twisting exercise, and self-practice at home 1 h every day

Moderate (mild shortness of breath, mild sweat)	2	60	11	82.0%		74.0 %		PSQI/the IG reported significantly better sleep quality (p = .007)		CG	
				76.0%		48.0 %					

				p = .617		p = .007			Ozkan and Rathfisch (2018) [20]	Relaxation exercise	Relaxation exercise: 30-min relaxation exercise, 30-min relaxation music, and self-practice at home 1 h every day with CD before sleep

Low	1	60	4	40.5%		83.3%		PSQI/the IG reported significantly better sleep quality (p=.001)		CG	

				38.1% p = 1.000		9.5 % p = .001			Shu et al. (2018) [33]	Mindfulness yoga	Guide breathing to body, meditation, yoga for posture, mindfulness walking; and self-practice at home 20mins every morning and evening

Low	1	60	4	28.44 ± 5.71		25.29 ± 4.34		SRSS/the IG reported significantly better sleep quality ($p < .001$)		CG	
				28.00 ± 4.40		28.58 ± 4.24					

DETAILS

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The Influence of Resilience on the Coping Strategies in Patients with Primary Brain Tumors

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ABSTRACT (ENGLISH)

Purpose

The purpose of this study was to assess the amount of variance in the coping strategies of patients with brain tumors that could be accounted for by resilience.

Methods

This cross-sectional survey involved 95 patients who had experienced surgical, chemotherapy, or radiotherapy therapies for their brain tumors at least 1 month before data collection. The investigator collected data using the scales of the Ways of Coping Checklist-Revised and Resilience Scale. Data were analyzed using descriptive statistics, t tests, analysis of variance, Pearson product–moment correlation, and hierarchical multiple regression.

Results

The results revealed that resilience was significantly positively associated with patients' problem-focused coping ($r = .65$, $p < .001$) and total coping ($r = .49$, $p < .001$). In addition, resilience accounted for 27% (R2inc = .27, $p < .001$) and 16% (R2inc = .16, $p < .001$) of the distinct variances in predicting patients' problem-focused coping and total coping.

Conclusion

The current results provide evidence to support the importance of resilience in shaping the coping strategies of relevant patients. As resilience shows a crucial element in patient coping with brain tumors, health team members should develop and employ appropriate strategies to improve the resilience of patients with brain tumors.

FULL TEXT

Introduction

Primary brain tumors comprise around 3% of all adult cancer diagnoses [1]. Patients with brain tumors commonly experience symptoms that relate to neurological impairment such as visual-perceptual deficits, weakness, and impaired cognition [2]. In addition, treatment for brain tumors usually incorporates surgery, chemotherapy, and radiotherapy. The complications of cancer treatment and concerns over disease recurrence often interfere with the somatic and emotional well-being of patients [3]. Recognizing the coping strategies that patients use to deal with life-threatening illnesses is vital for health professionals to effectively assist brain tumor patients to cope with the complex situation related to this disease and its treatment.

Researches reveal that patients with brain tumor at their first diagnosis and at recurrence stage often use positive coping strategies; for example, they look for support and hope to employ problem-solving coping [4]. Patients most frequently use optimistic coping strategies to achieve less anxiety and better psychosocial well-being [5]. Most of the brain tumor patients adopt coping strategies to help with their emotional adjustment [5–7]. However, numerous patients use a negative pattern of thought which is deleterious for their emotional well-being [5]. For example, impaired physical functioning due to brain tumor may affect daily activities of living and ability to adopt effective

coping strategies [4].

Coping is a process that employs both cognitive and behavioral efforts to control a stressful situation and to regulate the related emotions [8]. Coping comprises two main categories: managing the problem that is the cause of the distress (problem-focused coping) and controlling related, stressful emotions (emotion-focused coping) [9]. In problem-focused coping, individuals may search for social support or take actions to work through a difficulty. In emotion-focused coping, individuals may seek a more positive reappraisal of their situation or become involved in distracting activities [8]. Effective adjustment to the brain tumor experience requires that a patient successfully manage his or her behavior and emotions and maintain cognitive flexibility toward the illness to modify the stressful situation, for example, via resilience [10].

Resilience refers to the means and ability for effective adjustment [11]. Resilience helps an individual perceive that he or she may acquire the means and ability to adjust to both positive and negative events. The function of resilience infers that a person may overcome difficulties and be able to adapt better when he or she uses inner/internal strengths and abilities [11, 12]. As a result, resilience helps to insulate individuals from distress during stressful situations and maintain their beliefs [13–15].

In regard to stress and coping [8], stress is an operation between the individual and environment. Individuals evaluate environmental requirements while weighing their abilities to experience these requirements. Resilience is the ability to help individuals to recover rapidly from interruptions in functioning that arise from stress evaluation and to return to the prior level of functioning [11]. Resilience relates to hope and to the problem-solving style, goal focus, and flexible coping capabilities of the individual [11, 12, 16]. Higher levels of resilience have been associated with higher adoption of task-oriented coping [12, 17, 18] and to lower adoption of emotion-oriented coping in young adults [12]. While the importance of resilience to the maintenance and restoration of somatic and emotional well-being in patients with chronic illness has been reported [10, 14], little research has been done to explore how resilience helps brain tumor patients cope with their disease. Understanding the factors that influence coping strategies in patients with brain tumor will provide empirical evidence to help clinicians tailor health care to match individual needs. This study was designed to assess how much of the variance in the coping strategies of patients with brain tumors could be accounted for by resilience (see Figure 1).

Methods Study design

This study involved a cross-sectional design with a convenience sample to measure how much of the variance in the coping strategies of patients with brain tumors could be accounted for by resilience.

Setting and sample

The sample consisted of 95 patients recruited from one teaching hospital in Taipei City. The sample size was calculated using G-power 3.1 based on a significance level of .05, a power of .80, a confidence interval of .95, and a medium effect size of .20 [19]. Data were collected at the outpatient department of the neurosurgery unit. All of the patients who met the following eligibility criteria were invited to participate: (1) diagnosed with primary brain tumor, (2) had undergone surgery, radiotherapy, or chemotherapy to treat the tumor; (3) at least 1 month since the final treatment; and (4) at least 20 years of age. The exclusion criteria included patients who had cognitive deficits or their physical status that impeded their ability to self-report. After the initial screen by the clinicians, eligible patients were referred to the investigator for this study.

Ethical considerations

This study acquired approval from the research ethics committee of Taipei Veterans General Hospital (Approval no. 2014-09-007AC). Researchers explained the purpose and voluntary nature of the study, patients' confidentiality and anonymity, and patients' right to withdraw at any time. For example, the researchers just show the number instead of patients' name or any identifiable information on the questionnaires. Any publication of this study will not show patients' identifiable information. Informed consent was signed by all the patients after they understood the purpose of this study and agreed to participate in this study.

Measurements Sociodemographic variables

Sociodemographic variables were measured, including gender, age, marital status, education level, household

income, and financial means. Medical variables included tumor malignancy, treatment undertaken, and tumor recurrence. To evaluate the physical ability of patients, the Karnofsky Performance Status scale (KPS) was employed, with scores ranging from 0 (dead) to 100 (normal) [20]. Details of the sample in this study have been reported elsewhere [21,22]. For the purposes of this article, data obtained using the following instruments were analyzed. It took about 25 to 30 minutes to patients to complete the following instruments:

Coping scale (Ways of Coping Checklist-Revised)

Coping strategies were measured with the Chinese version of the coping scale [23] and a 42-item inventory consisting of problem-focused coping and emotion-focused coping. This scale originated from the Ways of Coping Checklist created by Lazarus and Folkman [8]. The construct validity of the Ways of Coping Checklist, Revised was verified by Vitaliano et al [24]. The Cronbach α for the Ways of Coping Checklist, Revised ranged from .74 to .88 [24] and was .80 for the Chinese version [23]. In this study, the Cronbach α was .89 for the total scale, .86 for problem-focused coping, and .84 for emotion-focused coping. Patients were asked to give scores on a four-point Likert-type scale with 0 = does not apply and or not used, 1 = used somewhat, 2 = used quite a bit, and 3 = used a great deal. Higher scores indicated that the related coping strategy was used more frequently.

Resilience Scale

Resilience was measured using the Chinese version of the Resilience Scale [25], a 25-item inventory consisting of two domains: personal competence and acceptance of self and life. The two dimensional structure was previously verified using factor analysis [25]. Yang's research verified the concurrent validity of the Resilience Scale and revealed a significant and positive correlation with life satisfaction (r = .30) [26]. Internal consistency was confirmed with a Cronbach α of .95 [27]. Patients were asked to reply using a seven-point Likert-type scale, with a total possible score range of 25–175; higher scores indicating greater resilience. Scores ≥147 were defined as high resilience, scores from 121 to 146 were defined as mid-range resilience, and scores

Data collection

The data were collected from November 2014 to May 2015. When patients finished their visit with the doctors, eligible patients were invited to participate in this study and directed to a quiet room for the questionnaires responses. The patient replied to the scale items on his/her own in writing or orally to items read by the investigator. Adequate time made available for patients to complete the questionnaires. After patients had completed the self-administered questionnaires, the investigator checked the questionnaires for any missing responses. Patients were asked to complete the items they had missed. The investigator collected sociodemographic data from the patients' medical charts.

Data analysis

The SPSS (IBM Corp., Armonk, NY, USA) 18.0 for Windows statistical program was used to perform all of the data analysis. Descriptive statistics, including mean, SD, frequency, and percentage, was used to identify the sociodemographic and medical variables of the patients. The associations among the sociodemographic variables, medical characteristics, and coping strategy were tested using analysis of variance and *t* test. In addition, the association between resilience and coping strategies was examined using the Pearson product-moment correlation. Hierarchical multiple regression was used to assess the degree to which resilience contributed to the variance in coping strategy.

Results Demographics, medical characteristics, KPS, resilience, and coping strategies

The sample used in the present study included 95 outpatients with brain tumors. Most of the patients were female (61.1%), married (57.9%), holding a diploma, bachelor or higher level of education (62.1%), not employed (56.8%), relying on others for their financial means (58.9%), and having a monthly family income of NT$ 40,000-80,000. Patients ranged in age from 21 to 68 years old, with a mean age of 47.74 (SD = 12.15) years. Around half had received a benign brain tumor diagnosis (51.6%), 35.8% had a diagnosis of tumor recurrence, and 55.8% had received surgery only. The mean KPS scores of patients were 90.32 (SD = 11.71, range = 60–100). The patients had a mean score for total resilience of 125.48 (SD = 28.53, range = 31–175). The mean scores were 2.79 (SD = 0.52, range = 1.14–3.95) for problem-focused coping, 2.07 (SD = 0.58, range = 0.62–3.57) for emotion-focused coping, and 2.43 (SD = 0.45, range = 1.19–3.48) for total coping strategy.

Relationships among demographic/medical characteristics, KPS, resilience, and coping strategy

Analysis of variances or independent-sample t tests were employed to analyze the differences in coping strategy among particular medical and demographic groups. The results revealed significant differences in the total coping strategy for patients who had/had not experienced tumor recurrence (t = −1.98, *p* = .050). Patients with no tumor recurrence indicated a significantly higher score in total coping strategy. Besides, there were significant differences in the problem-focused coping levels of patients based on gender (t = −2.04, *p* = .044), treatment received (t = 2.04, *p* = .044), and tumor recurrence (t = −2.64, *p* = .011). Female patients, patients who had received surgery only, and patients who had experienced no tumor recurrence had significantly higher problem-focused coping scores in comparison with those in the opposite categories (see Table 1).

Pearson's correlation was used to analyze the relationships between coping strategy and the patients' KPS and resilience. KPS was found to correlate significantly and positively with total coping strategy (r = .28, *p* = .007) and problem-focused coping (r = .37, *p* p p Table 2). These results suggest that greater perceived KPS and resilience are associated with higher total coping strategy and problem-focused coping.

Demographic/medical characteristics, KPS, and resilience as predictors of coping strategy

Two hierarchical multiple regression analyses were employed to verify how much variance in the two evaluations of coping strategy (total coping strategy and problem-focused coping) could be attributed to the factors of gender, treatment received, tumor recurrence, KPS, and resilience; these were moved into the hierarchical multiple regression analysis to predict the total coping strategy and problem-focused coping of patients. All of the variables were selected because of the outcomes of an earlier analysis, which indicated a significant relationship with coping strategy (total coping strategy and problem-focused coping). For the first rung, we submitted gender, treatment received, and tumor recurrence as predictors. For rung two, we submitted KPS as the predictor. Finally, for rung three, we submitted resilience as the predictor. Aiming at total coping strategy, the results showed that the model was significant (F = 10.37, *p* 2_{inc} = .16, *p* , p p = .030) and resilience (R^2_{inc} = .27, *p* Table 3), with resilience accounting for 27% of the variance in problem-focused coping strategy.

Discussion

This study explored the correlation between resilience and coping strategy and assessed the degree to which resilience accounted for the variance in coping strategies used by patients with brain tumors. The results show significant associations between resilience and total coping strategy and between resilience and problem-focused coping. Importantly, our findings support that resilience significantly predicts the total coping strategy and the problem-focused coping of patients with brain tumors. The present study improves scholarly knowledge regarding resilience in terms of recognizing resilience as an important factor used by patients with brain tumor to cope with their disease.

The present study revealed that the average scores for problem-focused coping were higher than those for emotion-focused coping. The high mean score for KPS in the present study indicates that pursuing normal activities or having relatively minor health complaints [28] contribute to patients tending to choose problem-focused coping strategies; Lazarus and Folkman [8] assert that problem-focused coping tends to be the norm when the stressful context is under control.

The results show that females reported higher mean scores than did males in problem-focused coping. Gender was noted as a significant predictor of problem-focused coping. These findings correspond to those of a previous study [29] and support that gender is a factor that influences the coping strategy adopted by cancer patients. However, our finding contradicts other studies that found that men are more likely to choose problem-focused coping, and women are more likely to choose emotion-focused coping [30,31]. The difference in the tumor status and treatment undertaken by male and female patients might affect the results. As stress situations often accompany the cancer stage or treatment, Carver, Scheier, and Weintraub [32] assert, differing evaluations of comparable stress situations may lead to different coping choices between men and women. Gender may be a crucial issue to consider in building an understanding of the dynamics of the coping process of patients with brain tumor.

Patients with higher resilience reported higher scores for total coping strategy and problem-focused coping. Higher

resilience was identified as a predictor of higher total coping strategy as well as higher problem-focused coping. This finding echoes the findings of earlier studies [12,33] and further supports the important impact of resilience on the coping strategies adopted by patients suffering from brain tumors.

Resilience is defined as positive adaption to settle a stressful situation [11]. Coping does not mean a successful resolution beyond efforts to change a stressful situation. However, problem-focused coping is used more often in stressful situations appraised as changeable to achieve problem solving [9]. Resilience may be an important factor to consider for understanding the process of problem-focused coping for patients.

Additionally, our findings correspond to the assertion of previous researchers that resilient individuals are active and effective problem solvers [12]. Resilient individuals are likely to have access to social support, to reflect hope and a capacity to make sense of things, and to possess personal resourcefulness in terms of flexibility, bravery, and persistence [12,16]. These attributes may trigger individuals to use problem-focused coping strategies when encountering a stressful event such as the identification and treatment of a brain tumor.

The current study shows that resilience was not identified as a significant predictor of emotion-focused coping, unlike prior research [12]. Many researches however show that resilience is not significantly correlated with patient's negative coping strategies [34,35]. Emotion-focused coping is likely to be adopted under an unchangeable stress appraisal [9]. Resilience is viewed as a positive adaptation in response to stress [11]. Use of resilience might not be as critical for patients under an unchangeable stress situation.

The significance of the current findings is supported by prior research that found a relationship between higher ranks of resilience and higher ranks of coping and problem-focused coping [12,17]. It is vitally important that health professionals evaluate the resilience-related status of their patients to use this factor to facilitate the development of a problem-focused strategy, if necessary.

There are some limitations of the present study. As this study used a cross-sectional design, the results do not clarify the direction of causality within the relationships among coping strategy, resilience, and demographic characteristics. Moreover, patients were recruited from a teaching hospital only, which consisted of a convenience sample of patients with brain tumor, which may further limit the generalizability of the findings to other population.

Conclusion

The present study supports the view that resilience significantly improves problem-focused coping strategy and total coping strategy of patients. This result presents empirical evidences to assist health professionals to adapt appropriate approaches to support individuals' coping strategy. This result supports that resilience contributes to coping strategies in patients with brain tumor. Interventions to enhance resilience have been suggested as an effective approach to help patients' stressful experience [14]. Resilience can provide a basis for possibly valuable intervention to strengthen patients' problem coping strategies. Enhancing resilience may strengthen the coping strategy of patients suffering from brain tumors. For nursing practice, health team members should target strategies that increase the resilience of their patients to enhance the efficacy of their problem-focused coping and total coping strategy. For further research, it is necessary to clarify the particular relationship between resilience and patients' emotional focused coping, mainly the role of resilience in an unchangeable stress situation. Integrating a theoretical model of resilience in nursing education may assist students and health professionals to possess the knowledge and practice to train the resilience of patients and benefit the outcome of patient care.

Conflict of interest

There is no conflicting interest declared.

Variable	Group	n (%)	Total coping strategy	Problem-focused coping	Emotion-focused coping

M ± SD	t or F	p	M ± SD	t or F	p	M ± SD	t or F	p	Gender	Men	37 (38.9)
2.36 ± 0.39	t = −1.21	.231	2.66 ± 0.38	t = −2.04	.044	2.05 ± 0.58	t = −0.22	.826	Women	58 (61.1)	2.47 ± 0.49
		2.87 ± 0.58			2.08 ± 0.59			Age (yrs)	<40	31 (32.6)	2.45 ± 0.33
F = 0.88	.457	2.79 ± 0.42	F = 0.26	.852	2.10 ± 0.38	F = 1.00	.397		40–49	30 (31.6)	2.52 ± 0.45
		2.84 ± 0.49			2.19 ± 0.63				50–59	20 (21.1)	2.35 ± 0.60
		2.75 ± 0.63			1.95 ± 0.69				≥60	14 (14.7)	2.32 ± 0.47
		2.71 ± 0.65			1.93 ± 0.69			Married	No	28 (29.5)	2.43 ± 0.46
F = 0.19	.826	2.76 ± 0.50	F = 0.14	.871	2.09 ± 0.58	F = 0.19	.826	Yes	55 (57.9)	2.41 ± 0.41	

	2.79 ± 0.48			2.04 ± 0.59				Other	12 (12.6)	2.50 ± 0.62	
	2.86 ± 0.78			2.15 ± 0.58			Education level	Senior high school or below	36 (37.9)	2.40 ± 0.49	t = −0.45
.653	2.78 ± 0.59	t = −0.05	.964	2.02 ± 0.63	t = −0.66	.511	Diploma/Bachelor or above	59 (62.1)	2.45 ± 0.43		
2.79 ± 0.48			2.10 ± 0.56			Employment status	Employed	41 (43.2)	2.44 ± 0.43	t = 0.23	.820
2.80 ± 0.48	t = 0.24	.807	2.08 ± 0.56	t = 0.14	.891		Unemployed	54 (56.8)	2.42 ± 0.47		
2.78 ± 0.56			2.06 ± 0.61			Household income (NTD)	< 40,000	26 (27.4)	2.37 ± 0.60	F = 0.35	.707
2.76 ± 0.65	F = 0.09	.918	1.97 ± 0.74	F = 0.58	.562	40,000-80,000	40 (42.1)	2.45 ± 0.37			2.81 ± 0.50
		2.09 ± 0.47			> 80,000	29 (30.5)	2.45 ± 0.42			2.78 ± 0.44	

	2.13 ± 0.57			Financial means	Self-supporting	39 (41.1)	2.45 ± 0.44	t = 0.42	.678	2.79 ± 0.49	t = 0.08
.939	2.11 ± 0.58	t = 0.58	.565		Supported by others	56 (58.9)	2.41 ± 0.46			2.78 ± 0.54	
	2.04 ± 0.59			Tumor malignancy	Benign	49 (51.6)	2.43 ± 0.40	t = −0.04	.966	2.77 ± 0.47	t = −0.32
.748	2.08 ± 0.57	t = 0.22	.826	Malignant	46 (48.4)	2.43 ± 0.51			2.81 ± 0.57		
2.06 ± 0.61			Treatment undertaken	Surgery only	53 (55.8)	2.48 ± 0.45	t = 1.27	.206	2.88 ± 0.54	t = 2.04	.044
2.08 ± 0.55	t = 0.17	.863	Surgery plus CTx or RTx or both	42 (44.2)	2.36 ± 0.45			2.67 ± 0.48			2.06 ± 0.63
		Tumor recurrence	Yes	34 (35.8)	2.31 ± 0.51	t = −1.98	.050	2.59 ± 0.60	t = −2.64	.011	2.03 ± 0.69
t = −0.51	.615		No	61 (64.2)	2.50 ± 0.40			2.90 ± 0.44			2.10 ± 0.52

Variable	Total coping strategy	Problem-focused coping	Emotion-focused coping

	r	p	r	p	R	p
KPS	.28	.007	.37	<.001	.10	.359
Resilience	.49	<.001	.65	<.001	.19	.069

Variable	B	SE B	β	p	R^2	R^2 increment	F increment	p
Criterion: Total coping strategy								
Step 1: Tumor recurrence	.09	.09	.10	.292	.04	.04	3.93	.050
Step 2: KPS	.00	.00	.02	.864	.09	.05	5.22	.025
Step 3: Resilience	.07	.00	.46	<.001	.26	.16	19.87	<.001
Overall model		R^2 = .26 [F (3, 91) = 10.37, p < .001]						
Criterion: Problem-focused coping								
Step 1: Demographic characteristics					.12	.12	4.10	.009
Gender	.19	.08	.17	.030				
Treatment undertaken	.03	.09	.03	.733				
Tumor recurrence	.17	.09	.16	.064				
Step 2: KPS	.00	.00	.03	.743	.20	.08	9.22	.003
Step 3: Resilience	.01	.00	.60	<.001	.48	.27	46.51	<.001
Overall model		R^2 = .48 [F (5, 89) = 16.12, p < .001]						

DETAILS

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Transitional Percentage of Minute Volume as a Novel Predictor of Weaning from Mechanical Ventilation in Patients with Chronic Respiratory Failure

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ABSTRACT (ENGLISH)

Purpose

Some patients with respiratory failure fail initial weaning attempts and need prolonged mechanical ventilation (MV). Prolonged MV is associated with many complications and consumption of heathcare resources. Objective weaning indices help staffs to identify high-potential patients for weaning from the MV. Traditional weaning indices are not reliable in clinical practice. Transitional percentage of minute volume (TMV%) is a new index of the work of breathing. This study aimed to investigate the utility of TMV% in the prediction of weaning potential.

Methods

This study was prospectively performed including all patients with prolonged MV. Researchers recorded their demographics, TMV%, respiratory parameters, Acute Physiology and Chronic Health Evaluation II score, and laboratory data upon arrival at the respiratory care center. The factors associated with successful weaning were analyzed.

Results

Out of the 120 patients included, 84 (70.0%) were successfully weaned from MV. Traditional weaning indices such as rapid shallow breathing index could not predict the weaning outcome. TMV% was a valuable parameter as patients with a lower TMV%, higher tidal volume, higher hemoglobin, lower blood urea nitrogen, and lower Acute Physiology and Chronic Health Evaluation II scores had a higher rate of successful weaning. TMV%, tidal volume, and HCO3- levels were independent predictors of successful weaning, and the area under the curve was .79 in the logistic regression model.

Conclusion

TMV% is a novel and effective predictor of successful weaning. Patients with lower TMV% had a higher MV weaning outcome. Once patients with a high potential for successful weaning are identified, they should be aggressively weaned from MV as soon as possible.

Clinical Trials Government Identifier

NCT033480.

FULL TEXT

Introduction

Patients with respiratory failure often need mechanical ventilation (MV) to maintain adequate ventilation and oxygenation [1]. In patients with respiratory failure, there are approximately 20% of the patients who failed the initial weaning from MV at the intensive care units (ICUs) [2]. Therefore, some patients with respiratory failure need long-term MV, and the definition of prolonged MV (PMV) is the requirement of MV more than 21 days [3].

Patients with PMV have great impact on ICUs that they often consume much healthcare resources [4]. Besides, PMV often results in many complications, including ventilator-related lung infection [5], ventilator-related diaphragmatic fatigue [6], and critical illness–related polyneuropathy [7]. Therefore, weaning programs to help patient weaning from MV should be performed as early as possible. However, patients with PMV often have complex comorbidities and slower recovery of respiratory function, making it difficult to early weaning from MV [8]. Because PMV has great impact on healthcare resources and leads to many complications of patients, it is important to identify the patients with potential for successful weaning [9]. For patients with high potential of weaning, clinical staffs should try to wean them at the earliest [3]. For patients with low potential of weaning, clinical staffs should plan other management such as tracheostomy to prevent complications and transfer patients to long-term care institution [3].

Clinical judgment to treat patients by nursing staffs, attending physicians, and respiratory therapists may have an impact on prognosis in patients with respiratory failure [10]. Nurses are one of the vital members in critical care [10]. In a previous study, a nurse-driven weaning program began earlier initiation of weaning and resulted in a shorter duration of MV and decreased length of stay at the ICUs [10]. Therefore, nursing care can have a tremendous impact on weaning outcome of patients with respiratory failure [10]. However, the causes for PMV are multiple factors including nutritional status, respiratory muscle strength, and lung mechanics [11]. The clinical situation is often complex, and it is sometimes difficult to determine whether to start weaning [11]. To avoid judgement factors leading to delayed weaning, objective indices are therefore critical to help clinical staffs assess readiness for weaning [12]. Various weaning indices have been established for this process, including the rapid shallow breathing index (RSBI) and the maximal inspiratory negative pressure (PImax) [12]. RSBI and these weaning indices were widely used to predict weaning outcomes among patients with respiratory failure at the ICUs [12]. However, many limitations of these weaning indices have been demonstrated in the past years, and these weaning indices are not useful in patients on PMV [13,14] Besides, the measurement of these traditional weaning indices requires patients to temporarily leave the ventilator and increase the risk of respiratory distress during measurement [13,14]. Therefore, it is necessary to develop new and safe weaning indices for patients with PMV.

The transitional percentage of minute volume (TMV%) is a new respiratory parameters found in the adaptive support ventilation (ASV) mode [15,16]. ASV is a mode of MV that is closed-loop controlled and automatically adjusted based on the patient's requirements of patients. It is a pressure-controlled ventilation based on respiratory rate (RR) and tidal volume (V_T). It adapts ventilatory support according to respiratory mechanics with control schemes for minute volume (V_E), which is composed of RR and V_T. It can adjust the inspiratory pressure and mandatory RR to achieve the target V_E. By setting target, the percentage of minute ventilation (%MinVol), breathing pattern, RR, and V_T are automatically determined by ASV to achieve the minimum work of breathing (WOB) of patients during MV [15,16]. Wu et al found there exists a V_E to deliver a mandatory breath by the mechanical ventilator [15]. Machine triggering occurs if the spontaneous RR falls below the optimum RR. The percentage of V_E at this point is called TMV%, indicating the transition from spontaneous to mandatory breathing. TMV% marks the transition from spontaneous breathing with pressure support to mandatory ventilation [15]. In a previous study, when target %MinVol exceed the TMV%, the WOB of patients has a prominent decrease [17]. Peng et al also suggested that TMV% indicates the WOB of patients during spontaneous breathing under MV, a higher TMV% indicates higher WOB during MV [16].

It is important to help patients with respiratory failure to wean from MV as early as possible [5–7]. Judgement of clinical staffs to determine the timing of weaning is important for early weaning from MV [10]. Objective weaning indices can help clinical staffs to identify patients with the potential to wean from MV [10]. TMV% is a new concept and a new parameter of ventilation which reflects the WOB of patients during MV [15]. Because TMV% reflects WOB of patients [16], we hypothesized that it could be used as a weaning index of patients with respiratory failure.

Therefore, we conducted the current study to define the utility of TMV% in predicting weaning outcome in patients on PMV.

Methods Study design

This prospective study was conducted from January 2017 to December 2017 in a 12-bedded respiratory care center (RCC) in Taipei Tzu-chi hospital. The purpose of RCC is to manage patients with PMV but in stable hemodynamic condition. It requires specialized respiratory care, but no longer needs intensive monitoring. All patients with PMV admitted to the RCC were enrolled in the study.

The weaning process was gradual increasing periods of spontaneous breathing or a gradual reduction in level of pressure support [18]. If patients were without respiratory distress, researchers gradually reduced the pressure support level. When the pressure support level was down to 8 cm H2O, the researchers began performing T-piece trials for these patients. Assessment during the T-piece trial included continuous monitoring of vital signs [SpO_2, RR, heart rate (HR), and blood pressure], respiratory pattern, and level of consciousness. The T-piece trial was terminated if any of the following was observed: agitation; changed mental status; diaphoresis; cyanosis; increased accessory muscle contraction; SpO_2 35 breaths/min or a 50% increase of RR; HR > 140 beats/min or a 20% increase of HR; and systolic blood pressure > 180 mm Hg; or a 20% increase of systolic blood pressure. If patients passed the spontaneous breathing trial, mechanical ventilator would be removed [18]. Successful weaning was defined as removal of the mechanical ventilator for 7 consecutive days [13].

Setting and sample

The RCC was established for the transfer and care of ICU patients with PMV, defined by usage of MV longer than 21 days [3]. Criteria for RCC admission was decided according to the policies of the National Health Insurance of Taiwan, including respiratory failure requiring MV for more than 3 weeks; stable for hemodynamics without vasoactive drug requirement; stable oxygen condition and under fraction of inspired oxygen concentration (FiO_2) less than 40%; positive end expiratory pressure less than 10 cm H_2O; and no acute renal or hepatic failure [3]. These patients were in stable condition but could not wean from MV at the ICUs. The nurse-to-patient ratio was 1:4, and the respiratory therapist-to-patient ratio was 1:10 at our RCC. There was a specialist in critical care medicine caring for all of the patients.

All patients (n = 132) admitted to the RCC were enrolled for this study. Terminal cancer patients (n = 2) were excluded from this study because of their short life expectancy and their families' preference against aggressive management. Patients with unstable hemodynamic condition (n = 7) or those with families unwilling of their participation in this study (n = 3) were also excluded [13].

The sample size was determined using a two sample t test power calculation. The TMV% level was defined as a significant difference between two samples. Effect size (d = .63) was obtained using two parameters including difference and standard deviation. The power and significance levels were set as .8 and .05, respectively. The sample size was calculated as 41 in each group. In addition, it is expected there could be a drop rate as high as 10% in each group (i.e., case and control groups). Hence, the total sample size would be at least as 82*1.1 = 90 in this clinical study [19].

Ethical consideration

The study was approved by the research ethics committee of the Taipei Tzu-chi Hospital (Approval no. TCRD-TPE-105-08). All consent forms for this study were obtained within 24 hours after transferring to the RCC. Because most patients were very weak and they were all with endotracheal tube or tracheostomy tube, all consent forms were signed by the family after our explanation.

Measurements

ASV (Galileo GOLD; Hamilton Medical AG, Bonaduz, Switzerland) is a pressure control mode, closed-loop ventilator, which provides automated selection of V_T and RR based on the lung mechanics and WOB of patients [15, 16]. It can ensure delivery of targeted %MinVol. The clinician sets a target %MinVol according to the patient's ideal body weight. Mandatory breaths are machine-triggered and time-cycled; they occur if the spontaneous RR falls below the optimum RR. The optimum RR is calculated based on estimates of the ratio of dead space to V_T and the

expiratory time constant, according to the equation of Otis [17]. Spontaneous breaths are patient-triggered and flow-cycled; the pressure target is automatically adjusted to deliver the same volume target as mandatory breaths. The RR is controlled by the patient during spontaneous breaths [15, 16].

Measurement of TMV%

TMV% was measured by adapting %MinVol within 48 hours after admission to the RCC. If there were spontaneous breaths, we gradually increased the %MinVol to achieve mandatory breaths. The %MinVol was increased by 10% every 5 minutes until a mandatory RR appeared. This level of %MinVol was defined as the TMV%. At the point of TMV%, WOB of patients was decreased significantly [15, 16].

Data collection

The following parameters were recorded in all enrolled patients within 24 hours of transfer to the RCC: baseline characteristics, etiology of respiratory failure, Acute Physiology and Chronic Health Evaluation II (APACHE II) score, tube for MV (endotracheal tube or tracheotomy), serum albumin level, blood urea nitrogen (BUN) level, and arterial blood gas. These parameters are important parameters for caring patients [13]. The researchers also measured traditional respiratory weaning parameters such as RSBI, RR, V_T, and PImax. The researchers measured PImax by using Boehringer Inspiratory Force Meter (Boehringer Laboratories, Phoenixville, PA, USA) and RSBI, RR, and V_T by using FERRARIS respiratory Haloscale Standard Respiratory Analyzer (NSpire Health Ltd., Hertford, UK) Traditional respiratory weaning parameters were widely in patients with MV [13]. The researchers recorded the respiratory system compliance and airway resistance by ventilator. These lung mechanics indicate the condition of lung and airway [13]. The researchers comprehensively collected these parameters to analyze the predictive factor of weaning outcomes.

Quality control for measurement

All participants, including the nurses, doctor, and respiratory therapists understood the study protocol. All measurements were performed by two independent experienced respiratory therapists to maintain quality control of measurement. Before the test, both respiratory therapists were trained about measurement of the ventilator. The ventilators used in this study were produced by the same company (Galileo GOLD; Hamilton Medical AG, Bonaduz, Switzerland) in the same years.

Data analysis

Continuous data were expressed as the mean ± standard deviation and analyzed by Student t test [20]. Categorical data were expressed as percentages (%) and analyzed by Chi-square test. Patients were grouped by their ventilator status (successful vs. failed weaning from MV). Univariate logistic regression analysis was used to determine variables associated with successful weaning. Multiple stepwise logistic regression analysis was to determine variables predictive of successful weaning while controlling for confounding factors [21]. A model to predict successful weaning was then constructed using these variables. Receiver operating characteristic (ROC) curves were plotted for the developed model. The area under the ROC curve and the optimal cut-off points were determined by the Youden's index. Sensitivity, specificity, and area under the curve were calculated [21]. Data were analyzed using R free statistical software (3.4.3 version, R Core Team, Vienna, Austria), and a *p*

Results

Anthropometric characteristics of the subjects

There were 120 patients who met the inclusion criteria of this study. Among these patients, 84 patients (70.0%) were successfully weaned from MV; and 36 patients (30.0%) remained ventilator-dependent.

Baseline characteristics and underlying diseases are shown in Table 1. There were no significant differences in gender, age, history of sepsis, pulmonary diseases, and history of cardiopulmonary-cerebral resuscitation between the two groups. However, there was a higher successful weaning rate in patients with neurological disease related respiratory failure. Patients with lower APACHE II scores also had higher successful weaning rates.

Laboratory, arterial blood gas data, and respiratory parameters

Laboratory, arterial blood gas data, and respiratory parameters are shown in Table 2. Patients having higher hemoglobin and lower BUN levels had a higher successful weaning rate. The arterial pH, PaO_2, $PaCO_2$, and albumin levels were without significant differences between these two groups. Patients with a lower TMV% and higher V_T

had a higher successful weaning rate. There were no significant differences in other weaning parameters such as RSBI, respiratory system compliance, and airway resistance.

Univariate analysis

Univariate analysis with odds ratios (ORs) was performed to identify potential risk factors for failed weaning (Table 3). The potential risk factors identified included HCO_3^-, hemoglobin levels, TMV%, and V_T, which were consistent with the results shown in Tables 1 and 2.

Multiple stepwise logistic regression

Multiple regression analysis with ORs is presented in Table 4. Based on multiple regression analysis, TMV% (OR = 0.98, p = .006), V_T (OR = 1.01, p 3$^-$ levels (OR = 1.14, p = .022) were independent predictors of successful weaning and adjusted R^2 were calculated as 0.19. The researchers calculated R^2_{McF} = 1- ln(-57.92092)/ln(-73.30372) = 0.2098502 [21]. In the meantime, adjusted R2 also calculated as 0.2098502 -(1- 0.2098502)*(3/(120-3-1)) = 0.1894153 using p = 3 and n = 120. Figure 1 is the ROC curve representing prediction of successful weaning using HCO_3^- levels, TMV%, and V_T. The area under the ROC curve was .79 of this logistic regression model, with the best cut-off value of .61 or more (sensitivity, 84.5%; 1-specificity, 66.7%).

This study used a multiple stepwise logistic regression to investigate important factors between successful weaning and failed weaning groups. The variables with univariable analysis p 21]. Besides, the characteristics of patients with p Table 1) were considered as confounding factor, such as APACHE II score.

Discussion

In the current study, the researchers found that patients with lower TMV%, higher V_T, higher hemoglobin, and higher HCO_3^- levels had a higher rate of successful weaning. As demonstrated by multiple stepwise logistic regression analysis, TMV%, V_T, and HCO_3^- levels were the independent predictors of successful weaning. A major finding of this study is the potential usefulness of a new parameter, TMV% in predicting weaning outcomes in patients with PMV.

The traditional weaning parameters are not useful in patients with PMV [13,14]. The measurement of traditional weaning parameters requires patients to temporarily leave the ventilator and increases the risk of respiratory distress during measurement [13,14]. The measurement of TMV% does not require the patient to leave the ventilator, so TMV% is a safe and easily accessible parameter [16]. It can make clinical staffs monitor the patient's weaning situation at any time. According to the current study, TMV% is a good predictor of weaning and the measurement is safe.

Nurses play a major role in ventilator weaning [22]. Nurse-driven weaning could shorten the duration of MV and decrease length of stay at the ICUs [10]. According to the past study, establishing a complete weaning protocol and providing effectively weaning parameters can help nurses to accurately access patients and thereby reducing patient's ventilator usage time [22]. Providing the parameter of TMV% may help them to judge readiness of weaning. This study suggests that TMV% less than 151.5% predicts successful weaning and TMV% of higher then 173.7% have a poor weaning outcome. Identifying patients who have potential of successful weaning can help clinical staffs to be more aggressive and early wean the patients from MV [10,23].

For patients with poor potential of weaning, clinical staffs should provide the choice of tracheostomy [24,25]. Endotracheal tubes are often associated with a number of complications, such as airway trauma, sinusitis, pneumonia, and discomfort of patients [26,27]. Tracheotomy is often performed to replace endotracheal intubation for patients requiring long term MV [24,25]. Tracheotomy facilitates nursing care such as secretions suction, oral feeding, and patient communication [24]. However, the timing for tracheotomy in patients with MV is usually delayed for family's rejection of early tracheostomy [25]. By providing objective index about poor weaning outcome can help family deciding to do tracheostomy for patients. Tseng et al. found that early tracheotomy resulted in a higher rate of successful weaning and reduced the hospital stays [25]. The researchers suggested that when TMV% higher than 173.7% with poor successful weaning outcome, clinical staffs should strengthen the recommendation of tracheotomy in these patients.

Wu et al. found that by increasing the %MinVol setting until the mandatory rate began to occur, the TMV% is V_E with

the minimum breathing work [15]. Peng et al. revealed that patients with acute critical condition, TMV% of higher then 166% had higher mortality at the ICUs [16]. This study population was acute critical patients with unstable respiratory and hemodynamic conditions [15]. The study population is specific to patients with PMV in stable condition. This study suggests that TMV% higher than 173.7% have a poor weaning outcome.

TMV% indicates the overall condition of acute critical patients [16] and indicates WOB in patients with PMV under stable condition [15]. The causes of higher TMV% in patients with acute respiratory failure are multiple factors, such as infection, metabolic acidosis, higher dead space, hypoxemia, and among others [28,29]. High TMV% of patients in the acute stage of respiratory failure reflects the clinical condition need for high V_E and is related to the severity of acute illness [15,16]. This explains that patients with higher TMV% had a higher mortality rate at the ICUs [15,16]. For patients with PMV under stable condition, most etiologies of high TMV% in acute stage were under control. Therefore, TMV% reflects the WOB in patients with PMV. Higher TMV% indicates higher WOB and ventilatory demand of patients [15]. It stands the reason that patients with higher TMV% are more difficult to wean from MV [30].

This study also analyzed several important factors associated with weaning outcome. Patients with higher V_T had a higher successful weaning rate. This result is consistent with the findings of Corbellini et al [31]. This study also found that patients with higher HCO_3^- levels were also weaned more successfully. Compensatory hypoventilation, noted during metabolic alkalosis, leads to decreased WOB [32]. Hypoventilation and decreased WOB resulted in lower TMV% [15]. These can explain the benefits of higher HCO_3^- levels. The APACHE II score also predicted weaning outcomes in patients requiring PMV [13]. The APACHE II score indicates the overall severity of patients [13,16]. It is a predictor of mortality at ICUs [16] and also a predictor of weaning outcome at RCCs [13]. The same results were obtained in our study, the mean APACHE II of successful weaning group was 20.6 and failed weaning group was 22.7 (p = .045).

The researchers also observed that patients with a lower BUN level had a more successful weaning rate [13,33,34]. Elevated BUN levels may reflect impaired renal function, poor renal perfusion, and excessive protein catabolism [13]. BUN is, therefore, an important factor that influences successful weaning from PMV. In this study, weaning outcomes were observed to be better in patients with neurological disease-related respiratory failure. This result is consistent with a previous study of Wu et al [13]. Patients with neurological disorders who need PMV often have relatively normal lungs and a higher successful weaning rate [13].

Limitations of the study

This study has some limitations. First, all data were collected upon the RCC admission. Patients were transferred to the RCC for weaning from MV if they were in stable condition. Hence, TMV% in our study may predict weaning success only in patients on PMV in stable condition. The prediction of TMV% s may not be applicable to critically ill patients at the ICUs. Second, the sample size is relatively small in this study. It is difficult to analyze TMV% in subgroups of PMV. Further adequately powered studies are required to the prediction of TMV% in different etiologies of respiratory failure. Third, the use of sedative agents by patients might influence the measurement of TMV%. However, for the safety and comfort of patients, we did not stop sedative agents for measuring TMV% [16]. Therefore, the effects of sedative agents could not be fully excluded. However, the all the sedative agents were oral tranquilizers or hypnotics, and no intravenous tranquilizers were used in these patients. Besides, the oral sedative agents were used in the both groups of successful and failed weaning. The effect of sedative agents should not influence the result of the analysis. Fourth, TMV% reflects overall severity and WOB of patients [15,16]. We measured TMV% upon arriving our RCC. However, serial changes of TMV% may reflect changes of overall condition and WOB of patients. Further study about prediction of serial changes of TMV% is necessary.

Conclusion

Early weaning from MV is important to decrease heathcare resources and reduce complications of MV and endotracheal tube. Clinical judgement of timing for weaning can help patients to early weaning from MV. An objective weaning index helps nurses to identify high-potential patients for weaning from the MV. The prediction of traditional weaning indices is not adequately reliable in clinical practice in patients with PMV. TMV% is a new and effective predictor of successful weaning in patients with PMV. Based on our findings, the researchers recommend

using TMV% as a reference for weaning potential for patients with chronic respiratory failure. The researchers suggest that higher successful weaning rates are predicted in patients with lower TMV%, higher V_T, higher hemoglobin, and higher HCO_3^- levels. Once patients with a high potential for successful weaning are identified, they should be aggressively weaned from MV as soon as possible.

Conflict of interest

The authors claim no financial or other potential conflicts of interest.

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Characteristics	Total (N = 120)	Successful weaning (n = 84)	Failed weaning (n = 36)	p
n (%) or M ± SD			Age (yrs)	74.70 ± 14.60
73.90 ± 14.40	76.60 ± 15.30	.368	Gender	
Men	56 (46.7)	40 (47.6)	16 (44.4)	.905
Women	64 (53.3)	44 (52.4)	20 (55.6)	
Sepsis	11 (9.1)	9 (10.7)	2 (5.6)	.581
Pulmonary disease	69 (57.5)	45 (53.6)	24 (66.7)	.259
Neurologic diseases	21 (17.5)	19 (22.6)	2 (5.6)	.046*
CPCR	9 (7.5)	5 (6.0)	4 (11.1)	.545
APACHE II score	21.30 ± 5.80	20.60 ± 6.00	22.70 ± 4.80	.045*
Tube for ventilator (ET/tracheostomy)	92/28	68/16	24/12	.144
Hospital length of stay	73.42 ± 33.01	76.97 ± 35.76	65.13 ± 23.89	.381

Characteristic	Total (N = 120)	Successful weaning (n = 84)	Failed weaning (n = 36)	p

M ± SD			PH	7.43 ± 0.04
7.44 ± 0.04	7.43 ± 0.05	.292	PaO2	119.00 ± 37.20
122.50 ± 40.90	110.90 ± 25.30	.062	PaCO2	40.20 ± 7.60
40.90 ± 7.00	38.70 ± 8.80	.194	$HCO3^-$	26.80 ± 4.80
27.40 ± 4.60	25.40 ± 4.90	.040*	Albumin	2.30 ± 0.40
2.30 ± 0.40	2.20 ± 0.40	.075	Hb	10.00 ± 1.10
10.20 ± 1.00	9.60 ± 1.20	.013*	BUN	33.80 ± 23.30
31.50 ± 21.70	39.30 ± 26.10	.117	TMV%	158.20 ± 41.90
151.50 ± 36.00	173.70 ± 50.30	.020*	VT	308.80 ± 107.80
331.00 ± 99.80	257.00 ± 109.10	<.001	RR	27.30 ± 7.40
27.50 ± 6.90	26.70 ± 8.60	.631	RSBI	101.00 ± 49.70
96.90 ± 47.00	110.50 ± 54.90	.198	PImax	−24.40 ± 8.30
−25.10 ± 7.10	−22.80 ± 10.50	.249	Crs	38.50 ± 16.10
38.90 ± 15.50	37.60 ± 17.60	.715	Raw	14.60 ± 4.20

Characteristic	OR	95% CI	p
Age	0.99	0.96-1.02	.353
Gender	0.88	0.40-1.93	.749
Sepsis	2.04	0.42-9.95	.377
Pulmonary disease	0.58	0.26-1.30	.185
Neurologic diseases	4.97	1.09-22.61	.038*
CPCR	0.51	0.13-2.01	.332
APACHE II score	0.94	0.88-1.01	.083
Circuit	2.13	0.87-5.14	.094
Laboratory parameters			
pH	17.70	0.00-117392.70	.522
PaO2	1.01	1.00-1.02	.118
PaCO2	1.04	0.99-1.10	.150
$HCO3^-$	1.10	1.01-1.21	.036*
Albumin	2.60	0.94-7.23	.066
Hb	1.70	1.13-2.55	.010*
BUN	0.99	0.97-1.00	.098
Respiratory parameters			
TMV%	0.99	0.98-0.99	.009*
VT	1.01	1.00-1.01	.001*
RR	1.01	0.96-1.07	.596
RSBI	0.99	0.99-1.00	.152
PImax	0.97	0.92-1.02	.179

Crs	1.01	0.98-1.03	.691
Raw	1.05	0.95-1.16	.355

Factor	OR	Adjusted OR	95% CI	p
TMV%	0.99	0.98	0.97- 0.99	.006*
VT	1.01	1.01	1.01- 1.02	<.001*
$HCO3^-$	1.10	1.14	1.03- 1.29	.022*

DETAILS

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PurposeEarly enteral nutrition (EN) can improve clinical outcomes in critically ill patients. This study aimed to evaluate the effects of this clinical nursing practice guideline (CNPG) of EN care on the duration of mechanical ventilator in critically ill patients to investigate whether it was able to improve clinical outcomes.MethodsThis study compares a pretest-posttest design for the two groups, which was done before and after to determine the effects of a CNPG of EN care on the duration of a mechanical ventilator in critically ill patients. This study was performed on 44 critically ill patients admitted to the intensive care unit (ICU). The patients were divided into two groups according to EN. For the intervention group, CNPG started within the first 48 hours of admission to the ICU, and for the control group, they received standard nursing care.ResultsAfter the implementation, it showed significant associations between the duration of mechanical ventilator in ICU. The intervention group who received the CNPG had significantly shorter starting time of EN and a reduced duration of mechanical ventilator than those in the control group ($p < .001$).ConclusionA CNPG for EN care reduced the duration of mechanical ventilator. This could possibly improve the delivery of target calories when compared with current standard practice and improve the outcome of critically ill patients.

Kim, J., Lee, H., Cho, E., Lee, K. H., Park, C. G., & Cho, B. (2020). Multilevel effects of community capacity on active aging in community-dwelling older adults in south korea. Asian Nursing Research, 14(1), 36-43. doi:https://doi.org/10.1016/j.anr.2020.01.001

PurposeThis study aimed at identifying the level of active aging in older adults and the influence of the individual and community levels of community capacity on active aging.MethodsA cross-sectional survey was conducted on a stratified sample of 380 older adults living in 35 neighborhoods of five regions in Seoul, the capital of South Korea. The structured questionnaire included the Korean version of instruments that measure active aging and community capacity at the individual level. Secondary data including metropolitan statistical information, a public data portal, and a city plan were used to acquire community-capacity factors at the community level. Data were analyzed with multilevel models.ResultsThe overall active aging mean score was 3.00 ± 0.55 out of 5; the highest mean score was in the security domain (3.46 ± 0.65) and the lowest one was in the participation domain (2.71 ± 0.66). Individual factors associated with active aging included age, education, income, and community capacity at the individual level. At the community level, two community-capacity factors (senior leisure welfare facilities and cooperative unions) were significantly associated with active aging. In active aging, 6.4% and 4.1% of total variance could be explained by 35 neighborhoods, after considering individual and community level variables, respectively.ConclusionThis study showed that community capacity is important for active aging among older adults. Appropriate strategies that consider both individual and community factors, such as contextual indicators of community capacity, are necessary to improve active aging.

Kim, S., Ju-Yeon Uhm, Duck-Hee Chae, & Park, Y. (2020). Low body mass index for early screening of adolescent idiopathic scoliosis: A comparison based on standardized body mass index classifications. Asian Nursing Research, 14(1), 24-29. doi:https://doi.org/10.1016/j.anr.2019.12.003

PurposeScoliosis is a common musculoskeletal problem in adolescents. This study aimed to identify the prevalence of adolescent idiopathic scoliosis (AIS) and its associated factors among Korean adolescents. The prevalence of thin individuals among students with AIS was compared based on body mass index (BMI) classifications.MethodsThis study was a secondary data analysis and used the 2016 Korean National Health Examination for School Students data. Data from 16,412 students were analyzed using descriptive statistics, Chi-square tests, and logistic regression analysis.ResultsThe prevalence of AIS was higher in women (3.8%) than in men (1.6%), and a higher school year was a risk factor for AIS in both sexes. In woman adolescents, scoliosis was associated with thinness; however, the risk of AIS was inversely associated with overweight/obesity in both sexes. The prevalence of thin woman students

with scoliosis differed based on the criteria used: 3.3% by the World Health Organization criteria and 14.3% by the International Obesity Task Force criteria.ConclusionThe prevalence of thin students with scoliosis could increase by up to four times depending on the BMI criteria. For early screening of thin people at risk of AIS among female students, the criterion of International Obesity Task Force should be used as it is more permissive of thinness. This is also because of the underestimation of AIS prevalence when using the BMI Z score of the World Health Organization cutoff.

Chen, L., Zheng, J., Kong, D., & Yang, L. (2020). Effect of enhanced recovery after surgery protocol on patients who underwent off-pump coronary artery bypass graft. Asian Nursing Research, 14(1), 44-49. doi:https://doi.org/10.1016/j.anr.2020.01.004

PurposeEnhanced recovery after surgery (ERAS) is an evidence-based perioperative measure to improve outcomes. Although the benefits of ERAS are well proven for other surgeries, little is known about its effect on off-pump coronary artery bypass graft (OPCABG) surgery. Thus, this study aimed to explore the effect of an ERAS protocol in patients who underwent OPCABG surgery.MethodsThis quasi-experimental study included 94 participants (traditional care group = 47 vs ERAS group = 47). An ERAS protocol was established by a multidisciplinary team. Knowledge of coronary artery disease, fasting time, water deprivation time, extubation time of the tracheal tube and pericardial and mediastinal drainage tube, off-bed activity participation rate, length of hospital stay, hours of intensive care unit (ICU) stay, expenses in ICU, incidence rates of ICU delirium and postoperative nausea and vomiting, and the 6-Minute Walk Test on postoperative day 7 were recorded and calculated between the groups.ResultsDemographics, lifestyle, and disease severity showed no significant difference between the two groups ($p > .05$). The ERAS group patients had improved understanding of coronary artery disease ($t = -3.89$, $p < .01$), shorter fasting time ($t = 7.98$, $p < .01$), shorter water deprivation time ($t = 9.29$, $p < .01$), increased off-bed activity participation ($t = 17.67$, $p < .01$), and the improved 6-Minute Walk Test on postoperative day 7 ($t = -3.23$, $p < .01$).ConclusionsThe ERAS protocol is safe and effective for patients undergoing OPCABG surgery.