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The Nursing Intensity Critical Care Questionnaire (NICCQ): Étude de validation chez des patients ayant subi une chirurgie cardiaque

par

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Résumé

Le recours à des outils permettant de justifier les milliards de dollars qui sont investis annuellement dans le système de la santé devient essentiel pour les gestionnaires en soins infirmiers. L'objectif de cette étude est d'établir la validité et la fiabilité du Nursing Intensity Critical Care Questionnaire (NICCQ) dans une unité de soins intensifs de chirurgie cardiaque d'un hôpital tertiaire de Montréal. La validité de contenu a été évaluée par un panel d'expert alors que la théorie de la généralisabilté a été utilisée pour estimer les coefficients d'étude G et D. Des études de décision ont permis aux chercheurs de déterminer si le fonctionnement actuel d'une infirmière qui attribue un score à un patient est adéquat. Aussi, des analyses factorielles précédées d'analyses en composantes principales ont visé à identifier la structure factorielle du NICCQ. Finalement, le NICCQ a été mis en corrélation avec un score de sévérité de la maladie connu sous le nom d'Acute Physiology and Chronic Health Evaluation II (APACHE II) pour estimer la corrélation entre la sévérité de la maladie et l'intensité des soins infirmiers requis par les patients.

Le NICCQ a été utilisé par des infirmières d'un hôpital tertiaire auprès d'un échantillon de patients ayant subi une chirurgie cardiaque et qui séjournait dans une unité de soins intensifs de chirurgie cardiaque. L'échantillonnage des infirmières (n = 12) et des patients (n = 280), de type échantillon de convenance, a reflété les procédures et les modes de fonctionnement usuels des soins infirmiers du service des soins intensifs de cet hôpital. L'intensité des soins a été mesurée pour chacun des items du questionnaire en utilisant une échelle ordinale à trois points (léger, modérée et sévère) pour les 11 premiers items et une échelle ordinale à cinq points pour l'item final d'évaluation globale (incluant les catégories intermédiaires : légère/modérée et modérée/sévère).

Le questionnaire s'est avéré valide et fiable. Les analyses ont démontré que 94.4% des coefficients de généralisabilté ont une valeur acceptable à excellente, la plupart (86.1%) étant plus élevés que 0.9. Une structure factorielle simple à quatre facteurs a été établie par des analyses exploratoires, cette structure explique relativement peu de variance (32%). Un coefficient de corrélation de 0.36 a indiqué que la sévérité de la maladie est corrélée en partie avec l'intensité des soins infirmiers requis par un patient.

L'étude a démontré que le NICCQ est un questionnaire valide, présentant un coefficient de généralisabilté suffisamment élevé pour servir à des fins administratives. Des recherches plus approfondies nécessitant de plus grands échantillons permettraient de confirmer la structure factorielle établie.

Mots Clés : Validation, fiabilité, intensité des soins, soins intensifs, soins infirmiers, chirurgie cardiaque, généralisabilité, analyse factorielle, questionnaire

Abstract

Nurse Managers need today more than ever instruments that can be used to justify the billions of dollars that are invested in the healthcare sector annually. The objective of the study was to establish the validity and reliability of the Nursing Intensity Critical Care Questionnaire (NICCQ) in a cardiac surgery intensive care unit (CSICU) of a tertiary hospital. An expert panel evaluated the questionnaire's content validity while generalizability theory was used to estimate the G and D coefficients. Decision studies enabled the investigators to determine if the current ward functioning of having one nurse rate one patient is adequate. Also, exploratory factorial analyses (EFA) preceded by principal component analyses (PCA) looked at establishing the factorial structure for the NICCQ. Finally, the NICCQ was correlated with a severity of illness score known as the Acute Physiology And Chronic Health Evaluation II (APACHE II) to estimate the correlation between patient illness and nursing intensity of care.

The NICCQ was used by nurses using a sample of patients who had undergone cardiac surgery and were hospitalized on a CSICU of a tertiary teaching hospital. A convenience sample of nurses and patients on the CSICU was used to reflect the procedures and usual functioning of the unit. Each item on the questionnaire measured nursing intensity of care using a three point ordinal scale (Light, Moderate, and Severe) for the first 11 items, and a five point ordinal scale for the global assessment item (including the intermediate categories light/moderate and moderate/severe).

The questionnaire proved to be both valid and able to be generalized to all nurses working in the CSICU. Overall results showed that 94.4% of the item generalizability coefficients indicated acceptable to excellent reliability, with most (86.1%) being larger than .90. The EFA established a simple 4 factor structure that explained little of the variance (32%). A correlation coefficient of 0.36 indicated that patient' severity of illness is somewhat correlated with nursing intensity of care.

The study showed that the NICCQ is a valid questionnaire with a generalizability coefficient that is large enough to be used by nurses' managers for administrative purposes. Further research using larger samples would be needed to further test the factor structure of the NICCQ.

Key Words: Validation, Reliability, intensity of care, intensive care unit, nursing, cardiac surgery, generalizability, factorial analysis, questionnaire

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Acronyms

APS :	Acute Physiology Score
APACHE :	Acute Physiological and Chronic Health Evaluation
CHUL :	Centre hospitalier Université Laval
CHUM :	Centre hospitalier de l'Université de Montréal
CSICU :	Cardiac surgery intensive care unit
D-STUDY :	Decision making study
G-STUDY :	Generalizability study
EFA :	Exploratory factor analyses
HSSG :	Hospital Systems Study Group
IUCPQ :	Institut Universitaire de Cardiologie et de Pneumologie de Québec
ICU :	Intensive care unit
MHI :	Montreal Heart Institute
NAS :	Nursing Activities Score
NEMS :	Nursing Equivalents of Manpower Score
NICCQ :	Nursing Intensity Critical Care Questionnaire
OECD :	Organisations for Economic Cooperation and Development
OPC :	Oulu Patient Classification
PAF	Principal axis factoring
PCA :	Principal component analyses
PCS :	Patient classification systems
SEM :	Standard error of measurement
TISS :	Therapeutic Intervention Scoring System

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Introduction

The world's total expenditure for healthcare was 6.5 trillion US dollars in 2011 which translates to a total global expenditure for healthcare per person per year of $948 US (WHO, 2012). The average amount spent per person per year on health in countries belonging to the Organisation for Economic Co-operation and Development (OECD) was $4380 US with the United States being the country with the highest total spending per person per year on health at $8362 US. In Canada, 205 billion dollars were spent on healthcare in 2011 which amounts to a total of $5 811 per person per year. In Quebec alone, 41.9 billion dollars were spent on healthcare which amounts to $5 261 per person per year (CIHI, 2011).

Nursing is responsible for a large portion of the billions of dollars that are invested in the healthcare system in Quebec (CIHI, 2005). This is particularly true when it comes to intensive care units (ICU) where according to Miranda, (Miranda, Nap, de Rijk, Schaufeli, & Iapichino, 2003) the nursing staff budget constitutes approximately 50% of all costs in ICUs. Due to its large financial impact, it is important to be able to assess and evaluate if the nursing resources are used in an optimal manner while maintaining quality of care. In the ICU, nurse to patient ratios range from 1:1 to 1:3 depending on the patients' nursing intensity of care needed throughout the work shift.

In June of 2010, the Government of Quebec passed bill 100; an Act to implement certain provisions of the Budget Speech of 30 March 2010, reduce the debt and return to a balanced budget in 2013-2014. In consequence to the passing of this bill, the healthcare sector was asked to cut down its healthcare cost and justify its spending. Unfortunately, nurse managers still do not have validated instruments to measure the nursing intensity of care on a day-to-day basis that is specific to a cardiac surgery ICU (CSICU) to help with cost justification. At this time, it was more than ever necessary to develop a nursing intensity of care instrument that could be used for cost justification.

A nursing intensity of care questionnaire has been used in a CSICU at the Montreal Heart Institute (MHI) since 2003. Its main use is the measurement of the nursing intensity of care of patients on a day-to-day basis to help in the justification of nursing resource allocation throughout the year. Unfortunately, this questionnaire has never been the subject of empirical study to evaluate both its content and psychometric properties.

General Objective

The objective of this study is to revise and validate the current questionnaire in a CSICU setting allowing for a better cost justification of nursing resource allocation in varying nursing intensity of care contexts. More and more pressure is put on nurse managers to not only control cost but also cut costs.

This is particularly challenging in the context of an aging population hospitalized with multiple co morbidities, with a higher life expectancy, which increases the pool of people who will require healthcare needs including cardiac care. Current annual budgets are often based on the number of surgeries or the number of patient days in the ICU but do not take into account the age of the patients along with the amount and type of care that is needed by these patients. Research has shown that the risks for octogenarians to undergo cardiac surgery are less than previously reported (Alexander et al., 2000) leading to surgeons having patients over 80 with multiple co morbidities undergo surgery.

For this reason, it is important to have a valid and reliable questionnaire that will enable nurse managers to evaluate the nursing intensity of care required by each of the patients on the ICU in order to justify nursing costs. This questionnaire, along with other factors, will help justify the nursing hours used on a daily basis according to the observed intensity of care and help in budget preparation. Therefore, it is crucial to develop a nursing intensity of care questionnaire that can be used for cost justification to avoid an inappropriate reduction of nursing hours and subsequently impact patient care and overall health of the population of Quebec.

Chapter 1: Literature Review

Introduction

In 2002, nursing was responsible for a large portion of the 29.0 billion dollars that were invested in the healthcare system in Quebec (CIHI, 2005). Of this amount, 10.3 billion (35.5%) was attributed to the salaries of the 62 000 registered nurses for that same year (Jean, 2005). According to Miranda (2003), the nursing staff budget constitutes approximately 50% of all hospital costs in the ICUs. Due to its large financial impact, it is important to be able to assess and evaluate whether the nursing resources are being used in an optimal manner while maintaining quality of care. Unfortunately, nurse managers do not have a validated questionnaire to measure the nursing intensity of care on a day-to-day basis in a CSICU to help with cost justification.

Nursing research in ICUs has spent much of the last 30 years trying to develop and use patient classification systems (PCS) to accumulate and synthesize evidence of the influence of nurse staffing on patient outcomes and costs (Giovannetti, 1979; Manojlovich et al., 2011). One of the early definitions of PCSs was proposed by Giovannetti in 1979 as a categorization of patients based on an estimate of their caring needs during a specific period of time (Giovannetti, 1979). In the following decades, response to developments in computer technology, changes in nursing, health services and government policy has lead to a large increase in PCS. Before the turn of the twenty-first century, in the USA and Canada alone, several hundred types of different systems of classification were used (Arthur & James, 1994; Fagerstrom & Engberg, 1998).

Earlier PCS were divided into two large methods of patient classification: prototype and factor evaluation systems. The prototype model of classification compares the patient's needs with a so-called prototypic patient's need of care (Finsen model). However, most PCS used today are based on the factor model of evaluation which uses specific factors or indicators to describe the patient's need of care or the time-consuming elements in the care (Fagerstrom & Engberg, 1998).

In its earliest developments, factor based PCS were based on time studies and activity analysis that were heavily influenced, especially in the USA, by an industrial view of caring. Caring was broken down into parts which each consumed an amount of time. These task oriented instruments were expensive to implement and focused on an approach that prioritized physical nursing over non-physical nursing care (Arthur & James, 1994; Fagerstrom & Engberg, 1998; Rauhala & Fagerstrom, 2004). These preliminary models' design were far from the definition of caring as defined by Eriksson (1992) that states that the ultimate aim of caring is to alleviate the suffering of the patient, and therefore the health of the patient is the focus of care. PCS shifted over time from the workload task-oriented medical

instruments towards patient dependency instruments which portrayed a more realistic picture of factors involved in nursing (Arthur & James, 1994; Ball, 2005; Hayes, 1991).

Over the years, nurse managers have developed a great number of factor-modeled PCS from three different approaches: intuitive, top-down management and bottom-up management approaches. The intuitive approach is easy to use and relies on the experience of the charge nurse to establish the number of resources needed on the ward based on her knowledge and experience. Instruments using this approach quickly became widely used and are still today the most widely developed and used types of instruments in the world even though they are sometimes criticized for being too subjective and lacking consistency. They are often used in ICUs because of the high variation in the number of patients and their nursing intensity level.

The top-down management approach uses theories and formulas to establish nursing ratios at a regional level making it a better approach for units where variation in the number of patients and the nursing intensity is low and staff requirement are steady over time (Arthur & James, 1994). For Arthur and James 2004, the top-down management approach is not very well suited for ICUs as in the example obtained from Adomat who mentions that "unplanned emergency admissions and/or the unexpected deterioration of a patient's condition can result in a situation where staffing levels do not comply with the 'standard' ratio because the census driven system is too rigid to accommodate such changes (Adomat & Hewison, 2004)."

The bottom-up approach can itself be divided into two categories: the task-oriented intervention and the category-oriented dependency approach. The time studies presented earlier are a good example of the task-oriented intervention approach with the qualities and the limitations associated with them while the category-oriented intervention is based on the belief that the dependency of the patient on the nurse is a good measure of the demand on the nurse's time. A study showed that there wasn't much difference between the number of nurses determined using either bottom-up approach but that the category-oriented dependency approach was easier, and cheaper to use while also being more consistent (Arthur & James, 1994).

In 2004, Adomat and Hewison reviewed the different types of approaches of PCS and after a broad review, they separated the systems in three different categories each containing instruments from the three approaches previously mentioned. They labelled each category as:

1) Patient dependency classification systems

2) Patient dependency classification and severity of illness systems and

3) Nursing intensity measuring systems.

Patient classification systems

The Acute Physiological And Chronic Health Evaluation (APACHE):

Patient dependency classification and severity of illness systems are mostly used to predict patient outcome or costing patient care but there has also been an attempt to use these types of classification systems to calculate nursing dependency and overall nurse intensity of care. This attempt is based on the premise of a relationship between severity of illness and nurse intensity of care where certain authors have found a significant, although small correlation between the scoring of severity of illness systems and nursing intensity of care measuring systems (Carr-Hill & Jenkins-Clarke, 1995; Kisorio, 2009). The most widely used and validated severity of illness system instrument is the Acute Physiological and Chronic Health Evaluation (APACHE) II system developed by Knaus *et al.* (1985). The APACHE II is a simplified version of the original APACHE developed by Knaus *et al.* (1981), whose basis for development was that severity of acute disease could be measured by quantifying the degree of abnormality of multiple physiological variables (Knaus, Draper, Wagner, & Zimmerman, 1985).

The original APACHE system provides weightings for 34 potential physiological measures, which are added up to provide an acute physiology score (APS). Each measure is rated on a scale of 0 to 4 as presented in table 1. A score of zero represents a normal physiological value and a score above zero is assigned to each physiological measure whether the value is above or below normal. The values used to measure the APS are the worst scenario value during the first 24 hours after the patient has been admitted to the ICU. The patient is then designated a letter between A and D, where A means excellent health while D means chronic organ system insufficiency. Because the original APACHE was complex and had not undergone formal multi-institutional validation, the number of physiological measures was reduced to 12 and scores for age and chronic health problems were added in the revision of the original APACHE. The APACHE II was validated using over 17 000 patients (Adomat & Hewison, 2004; Knaus et al., 1985). Data from an interobserver reliability testing experiment

Table 1: Example of APACHE scoring using measures for the pH range

Weighted Score	pH Range
+4	<7.15
+3	7.15-7.24
+2	7.25-7.32
0	7.33-7.49
+1	7.50-7.59
+3	7.60-7.69
+4	7.7 or >

revealed a 96% agreement for all physiological data, with an 86% correct classification for death rate when patients obtained a decision criterion greater than 0.5 (Knaus et al., 1985).

The primary purpose of the APACHE II scoring system is to obtain a probability of hospital mortality and not nursing intensity of care. Although there has been a significant but rather weak relationship between severity of illness and nursing intensity, there are many occasions where a patient will score very high on the physiological measures and be considered severely ill, but nevertheless still requires very minimal nursing care. (Adomat & Hewison, 2004; Kisorio, 2009). Also, the APACHE II scoring system rates each patient using the worst case scenario value during the first 24 hours after the patient has been admitted to the ICU. Patients in ICU vary a lot over the course of 24 hours, thus, using the worst case scenario is not necessarily the best option to get a realistic picture of nursing intensity of care. For example, using the APACHE II in the immediate postoperative period after a cardiac surgery would produce a high score just because this system uses the worst case scenario value; however the patient will require minimal ICU nursing care after just 4 to 6 hours after surgery.

Therapeutic Intervention Scoring System (TISS):

Rather than looking at severity of illness as a measure of nursing care, nursing intensity measuring systems assess the amount and complexity of nursing care needed by a patient (Adomat & Hewison, 2004). One of the ways of establishing the amount and complexity of nursing care is by looking at the amount of therapeutic diagnostic and nursing activities needed by patients. This helps to establish the health status of a patient which is the basis for the Therapeutic Intervention Scoring System (TISS) and TISS-28 (Lefering, 1999). The following four instruments are examples of nursing intensity systems. They are the Therapeutic intervention scoring system (TISS) along with its decedents, the reduced TISS score TISS-28, the Nursing activities score (NAS) and the Nine equivalents of nursing manpower use score (NEMS).. The NEMS and NAS scores have shown to provide similar results when scoring intensity of care in a unit, but higher staffing requirements was obtained when using the NAS compared to using NEMS for staff requirement calculations. The higher staff requirement measurement using NAS could in part be due to the fact that the NAS involves assessing activities that go beyond evaluating the patient's severity (Carmona-Monge, Rollán, Herranz, Gómez, & Marín-Morales, 2013).

The original Therapeutic intervention scoring system (TISS) was developed in 1974 at the Massachusetts General Hospital (USA) and was first reported by Cullen in that same year (Cullen, Civetta, Briggs, & Ferrara, 1974). Originally, TISS was designed to measure severity of illness, nursing intensity of care, nursing staff requirements and patient costs. However, due to criticism for many of its

uses, it became an instrument that served almost exclusively for the quantification of resource utilization and nursing intensity of care over time (Lefering, 1999; Lefering, Zart, & Neugebauer, 2000; Padilha et al., 2007; Pirret, 2002). In 1983, Keene and Cullen revised the instrument from its original form to a 76 item instrument (TISS-76) to assess activities performed in the ICU (Keene & Cullen, 1983). There was much criticism for the TISS-76 due to the fact that it was time cumbersome to use, it was unreliable due to varying interpretations of the 76 therapeutic interventions and due to the fact that interventions listed were not always reflecting all patient care activities in the ICU (Carayon & Gurses, 2005; Padilha et al., 2007; Pirret, 2002). Miranda et al (1996) revised the TISS-76, reducing the number of items to twenty-eight, each with a new scoring system ranging from one to eight, and using factor analysis with data of 10 000 patients (Lefering, 1999). The simplified TISS-28 was considered nearly identical to TISS-76 with a correlation of $r^2 = 0.86$ between the two instruments which means that TISS-28 can explain 86% of the variation in TISS-76 while being less cumbersome and time consuming to use (Miranda, de Rijk, & Schaufeli, 1996). The TISS-28 has become the most widely used nursing intensity measuring system after being tested on thousands of patients in many ICUs across the world (Miranda et al., 1996; Moreno & Morais, 1997).

Although the TISS-28 is the most common system for measuring the intensity of interventions during ICU stay, it still has its limitations. The TISS-28 is criticized for not including items that address many of the indirect nursing tasks including mentorship, teaching, and organizational tasks. Also, like the APACHE II scoring system, the TISS-28 uses the worst case scenario value once per 24 hour period that does not reflect the nursing intensity of care for the entire day. Finally, some research results have shown that TISS-28 has a tendency to underestimate the TISS-76 (Ball, 2001; Jakob & Rothen, 1997; Pirret, 2002; Pyykko, Laurila, Ala-Kokko, & Hentinen, 2001).

Patient dependency classification systems are an evolution of the factor evaluation system model of patient classification. These instruments primarily assess patients, categorize and allocate them to groups with similar nursing needs (Adomat & Hewison, 2004). These types of instruments combine nursing intensity measures and physiological indicators to evaluate the nursing intensity of care of a particular patient.

The Oulu Patient Classification System (OPC):

The Oulu patient classification (OPC) was developed and tested between 1991 and 1993 at the Oulu University Hospital in Finland on the basis of the Canadian method of patient classification known as the Hospital Systems Study Group's (HSSG) System (Fagerstrom & Engberg, 1998; Fagerstrom & Rainio,

1999). Qualitative aspects such as spiritual and psychosocial needs were added to the HSSG system that was criticized for only measuring the patient's physical need of care (Fagerstrom, Eriksson, & Engberg, 1999; Fagerstrom & Rainio, 1999).

The OPC combines nursing intensity measures and physiological indicators into six areas of needs as seen in Table 2. Each area of needs is rated on a four point ordinal scale between A and D where A=1, B=2, C=3 and D=4 on the care actually provided. A cumulative score of nursing intensity of care ranging from 6 to 24 is obtained by adding up the scores from each of the categories. The four categories of nursing intensity of care found in table 3 range from minimal need of care to maximal need of care (Fagerstrom & Engberg, 1998; Fagerstrom & Rainio, 1999)

Although the OPC included qualitative aspects of nursing care to supplement physical needs, the integration of these qualitative aspects into quantitative terms was difficult. For this reason, spiritual needs were not included in the sixth area of needs (Fagerstrom et al., 1999). Although the OPC is currently used in surgery, internal medicine, neurology and on pediatrics wards, it has not been specifically tested for validity in ICUs. The OPC has been developed, validated and used in Finland, thus limiting its generalizability to other medical systems around the world.

Table 2: Six areas of needs of the Oulu Patient Classification (OPC)

1	Planning and coordination of nursing care
2	Breathing, blood circulation and symptoms of disease
3	Nutrition and medication
4	Personal hygiene and secretion
5	Activity / movement, sleep and rest
6	Teaching and guidance in care and follow-up care, emotional support

Table 3: Four categories of nursing intensity of care

1	Minimal need of care, 6-8 points
2	Average need of care, 9-12 points
3	More than average need of care, 13-15 points
4	Maximal need of care, 16-24 points

Patient Classification Systems: Where are we headed?

Due to the lack in variation in ICU staffing across hospitals, researchers have not been able to evaluate the association between nurse staffing in post operative ICUs and hospital mortality (Lesaffre et al., 2009). However, research does show that nursing intensity of care is one of the most important determinants of patient safety, quality of care, and staff job satisfaction in ICUs (Carmona-Monge et al., 2013; Panunto & Brito, 2012).

In the context of the nursing shortage, cost containment efforts and an aging population hospitalized in ICUs with multiple co morbidities, there is today more than ever an imperative to have a valid and reliable instrument to justify nursing costs in ICUs (Carayon & Gurses, 2005; Kiekkas et al., 2008). The complexity of nursing care makes it very unlikely that a perfect system of measurement will

be developed (Ball, 2001). It becomes challenging to cover all areas of nursing care while maintaining a classification system that is easy to use and can be incorporated in the daily routine of the department. Because patients' condition vary considerably throughout a 24 hour period in ICU, a prerequisite of the classification system will certainly be its ability to use more than one measure per day (Carr-Hill & Jenkins-Clarke, 1995; Jakob & Rothen, 1997).

Lastly, there are many differences in medical systems around the world making it difficult to use and compare PCS from one part of the world to another. The type of care and interventions in different types of ICUs (medical or surgical) also present a problem because patient needs are very different in each type of ICU. For this reason, it is difficult to use the same classification system without validating the PCS in each setting.

According to Fagerström (1998), defining optimal patient ratios for administrative purposes has been the primary reason for the development of PCS. Still today, there is a debate over whether these instruments that help establish patient ratios are developed for the purpose of quality of care or simply for management purposes. Much of the literature is ambivalent on the subject although authors tend toward proposing that PCS are mostly developed for administrative purposes to allow for productivity, cost-effectiveness and allocation of resources (Fagerström, 1998; Rauhala, 2004).

At the turn of the decade, expert nurses at the Montreal Heart Institute (MHI) showed interest in PCS. Looking at the existing literature and expert advice, a first version of a PCS was developed. The PCS was a questionnaire that consisted of a simple checklist of 11 items. The first version was used from 2003 to 2007, where in that same year minor modifications were done regrouping the 11 items into 9 clinical indicators, each containing one or two items each. Measures were taken three (3) times per twenty-four (24) hour period at the same time each day (7:00 am, 3:00 pm and 11:00 pm) in the CSICU. Its main use was the measurement of the nursing intensity of care of patients on a day-to-day basis to help in the justification of nursing resource allocation throughout the year. On a monthly basis, the nursing intensity questionnaire represented valuable data to help justify costs and variation in total nursing hours over time. Unfortunately, this version of the PCS has never been the subject of empirical study to evaluate both its content and psychometric properties.

This PCS uses a three point ordinal scale based on the nursing intensity level (light, moderate or severe). A patient's nursing intensity of care global assessment is rated on a five point ordinal scale, by adding two levels, light/moderate and moderate/severe to the three previously mentioned nursing intensity levels. Despite its great potential, the PCS is unfortunately lacking an objective way of obtaining

a nursing intensity of care global assessment for a patient. The global assessment score identified by the rater is based on a subjective judgement when looking at the scores obtained for each of the individual items. Further development could provide a quantitative way to obtain a nursing intensity of care global assessment once the content of the questionnaire has been validated and that the questionnaire shows a high reliability among each of the 11 individual items.

Specific objectives

The goal of the study was to revise and validate the NICCQ currently used at the MHI CSICU. The revision and validation were done in 4 steps.

Primary objectives:

A. Revise the NICCQ and evaluate its content validity
B. Conduct a generalizability study to evaluate the reliability and the variance components of the error sources of the instrument.

Secondary objectives:

C. Evaluate the factorial structure of the NICCQ as well as the reliability of each of the factors
D. Evaluate the criterion validity of the NICCQ using the APACHE II as a concomitant criterion

Chapter 2: Methods

Content Validity

The present study was conducted to validate a nursing intensity of care questionnaire used for administrative purposes, the NICCQ. The original questionnaire contained 13 items (12 items and a global assessment item) found in appendix A (in table 7) which covered medical, psychological and patient care indicators. The first twelve items are rated using a 3 point ordinal scale (light, moderate, or severe) while the global assessment item is rated using a 5 point ordinal scale with the addition of two intermediate categories: light/moderate and moderate/severe.

The purpose of content validation is to assess whether the items adequately represent a performance domain or construct of specific interest. A typical procedure for content validation is to have a panel of independent experts, judge whether the items adequately sample the domain of interest (Crocker & Algina, 2008). McDowell (2006) states that content validity reveals for its part the sensitivity of the measuring instrument and comprises a subjective estimate of the measurement rather than statistical analysis (McDowell, 2006). In this study, content validation was obtained by having an expert panel assess the clarity and pertinence of each of the items as well as the clarity and pertinence of the scale used for each item.

The original questionnaire currently used since 2003 at the MHI, a teaching hospital in Montreal (Quebec), needed to be updated before it could be tested for its content validity. Prior to presenting the questionnaire to the expert panel, a preliminary revision of the questionnaire based on the literature and expert knowledge was done by the researcher and the expert nurse participating in the research group. In the past five years, the questionnaire was modified from its original version by two hospitals, the Centre Hospitalier de l'Université de Montréal (CHUM) and the Centre Hospitalier de l'Université Laval (CHUL). These two revisions were also considered in the preliminary revision. The preliminary revision of the questionnaire was completed by integrating changes proposed by the eight nurses from the MHI who would later take part in the expert panel. A semi-directed meeting with the eight expert nurses was held to obtain feedback on the changes proposed for improvements. The changes were made and the updated version was presented to the expert panel for content validity.

During the spring of 2012, a group of physicians and nurses were approached to act as experts in the study. The expert panel was made up of two intensivist physicians and nine expert nurses who had at least eight years of experience in a CSICU and acted as assistant head nurse or head nurse. Eight of the nine expert nurses were currently working in the CSICU, had at least eight years of experience in a

CSICU and had acted as either an assistant head nurse or head nurse. The ninth nurse part of the panel was an expert nurse at the Institut Universitaire de Cardiologie et de Pneumologie de Québec (IUCPQ) who also had at least 8 years surgical intensive care experience. This expert allowed for an external perspective in the validation process from an expert nurse in a different, yet similar setting. Two intensivist physicians with at least 10 years of critical care experience (one from the MHI and one from the Centre Hospitalier Universitaire Sainte-Justine) also participated in the panel as medical experts. Once again, the inclusion of a medical expert from a different hospital allowed for an external point of view in the validation of the questionnaire.

The expert nurses and physicians who provided written consent received the updated questionnaire with the guidelines. For each item in the questionnaire, the experts were asked to independently evaluate the pertinence and the clarity of each of the 13 items using a 3 point ordinal scale (not clear, somewhat clear, or clear) and the same type of scale for pertinence. Finally, they were asked to add any items they felt were missing from the questionnaire in a comment section located at the end of the questionnaire. The questionnaire completed by the experts is found in appendix F. The questionnaires were collected; frequencies and simple descriptive statistics were used to assess agreement, following which the necessary adjustments were made to the questionnaire based on comments made by experts and the literature. Once the content validity phase was completed, a one hour training was given to each of the expert nurses that took part in evaluation of the psychometric properties of the questionnaire. The validated copy of the NICCQ is found in appendix A, table 8.

Generalizability

Once the questionnaire's content validity has been validated, the following step is to measure the questionnaire's generalizability. Generalizability is concerned with the extent to which a sample of measurements generalizes to a universe of measurements with the help of a Generalizability (G) study. Optimization techniques can be used to conduct a Decision (D) study for decision making purposes (Crocker & Algina, 2008). A two facet generalizability method (described below) was used to test the questionnaire's generalizability and obtain a generalizability coefficient for each of the twelve items on the questionnaire as per generalizability theory (Cronbach, 1972).

The validated questionnaire was used for data collection. At the present time, nurses do not rate each of the items individually on the questionnaire but rather only assign a global score based on their clinical judgement. In the present study, during the data collection, the nurses were asked to rate each of the items individually (based on the 3-point global scale) on the questionnaire before scoring

the 5-point global assessment item. This procedure explicitly required the nurses to score all the items specifically covering all the patient care indicators before providing their final global assessment, hence insuring that their final score (expressing global assessment) was based on their previous specific scores. The generalizability study was based on two random facets: the patient population (or differentiation facet), denoted *p* and the instrumentation facet (raters), denoted *i.* Both facets were crossed, *p x i.* This design was used for each item separately. Specifically, the results obtained allow the generalization of the results to all the specialised nurses that have received the training and work in the CSICU. The study was a two facet design where both the differentiation and instrumentation facets were considered random since both the raters and the patients came from a potential large pool allowing the interpretation that they came from a universe containing an infinite number of raters and patients that meet the inclusion criteria.

Study population

The study population was made up of CSICU nurses from the MHI. The nurses acted as raters (instrumentation facet) to assess the patients' intensive care requirement (differentiation facet). The MHI CSICU employs over 100 specialised critical care nurses ("MHI - 2010-2011 Annual Report," 2010-2011). All of the nurses working on the unit received both theoretical and practical critical care training, including a final examination as part of the MHI critical care training program. The specialised nurses had also received advanced training in immediate post-operative cardiac surgery care, hemofiltration and advanced ventricular assistance.

The following inclusion criteria were met by the nurses who took part in the study:

- Work as a CSICU nurse at the MHI.
- Complete a 1 hour training session on the proper use of the NICCQ.
- Provide written informed consent.

A list of all nurses that met the inclusion criteria was made for each of the three work shifts; night, day, and evening. For each of the work shifts, four nurses had to work at the same time on each occasion when data would be collected. For this reason, the work day schedules of the nurses were analysed to find the best possible combination. Each nurse was then approached to participate in the study. If a nurse were to refuse, the following nurse whose schedule best fit with the others in the group would have been approached. Fortunately, all nurses that were approached agreed to participate in the study.

The nurses taking part in the study had from two (2) to twenty-seven (27) years of experience in the MHI ICU. Each were considered specialised CSICU nurses and had undergone the advanced training program in immediate post-operative cardiac surgery care, hemofiltration and advanced ventricular assistance. Some of the nurses held full-time positions while others held part-time positions on a steady work shift, night, day or evening.

The patient study population consisted of all male and female patients, 18 years and over, scheduled to undergo cardiac surgery at the MHI during the months of December of 2012 to December of 2013. The MHI is an ultra specialised cardiac healthcare center that performed over 1600 surgeries in 2011. It includes seven short term care cardiac units, pre-post surgery, CSICU, medicine, medical ICU, ambulatory care, coronary care and an emergency ("MHI - 2010-2011 Annual Report," 2010-2011). Data were collected in a 22 bed CSICU where 17 beds are occupied on average.

The following inclusion criteria were met by patients who took part in the study:

1. At least 18 years of age
2. Undergone cardiac surgery at the MHI

A convenient sampling method of N=288 eligible patients was used to select the sample of patients. Patients taking part in the study were identified based on the patient assignment from the assistant head nurse. Each nurse on the ward usually cares for one to three patients during a work shift but only one patient per nurse could take part in the study per work shift. If a nurse was assigned more than one patient that could take part in study, one patient was randomly selected. Each patient could take part in the study only once. Recruitment was planned to enrol 288 patients in total stratified by each of the 3 work shifts. Data was independently collected on the three different shifts (7:00 am, 3:00 pm and 11:00pm).

At the beginning of each shift, the 4 nurses acting as raters were assigned 1 to 3 patients according to usual unit procedures. The patients taking part in the study were patients from the same three nurses on each occasion while the fourth nurse was not assigned to any of the patients taking part in the study. At the end of each shift, all four nurses assessed independently and at about the same time the three patients by filling out the questionnaire without communicating with each other. The same four nurses formed a group that took part in the same shift throughout the study. For each group, it was always the same nurse that did not care for any of the three patients (see table 4).

This procedure took into account the actual assessment practice where the caring nurse, assigned to a specific patient was responsible for filling out the NICCQ. Because it was not possible to assign more than one caring nurse to a single patient, and because our generalizability study required that a single patient be assessed by more than one nurse, we designed our study to best represent the way the NICCQ will be used on a regular basis while obtaining quality data. If one of the nurses in a group was absent on a particular shift, data collection was postponed to another day to ensure that there were no missing values. Replacement nurses were identified in advance for each group in case one of the nurses decided to leave the project or was absent for a long period of time.

Table 4 – Nurse Research groups participating in the study

Night Shift - 7:00 am	Day Shift - 3:00 pm	Evening Shift - 11:00 pm
• 4 nurses (Night shift)* • 3 patients/day (32 days) • 96 patients	• 4 nurses (Day shift)* • 3 patients/day (32 days) • 96 patients	• 4 nurses (Evening shift)* • 3 patients/day (32 days) • 96 patients

*same 4 nurses for each shift

The four raters of a given shift scored all the items for each of their assigned patients. Once the data was collected, statistical analysis was performed using the Statistical Package for Social Sciences software (SPSS 17.0 for Windows, SPSS Inc., Chicago, IL, USA) to prepare the data and the European DDC User's Group software (EduG 6.0 for Windows, EDUCAN inc., Longueuil, QC, Canada) for the generalizability analyses. EduG software provided estimates of generalizability coefficients, variance components estimates, standard error of estimates for the following design (see table 5), as well as estimates for alternative designs for decision making (D-studies), among which is the all important usual clinical restriction of using only one rater as in "real life" situations. It also enabled to obtain an absolute generalizability coefficient and standard error of measurement (SEM) for each item with the help of a single instrumentation facet, crossed design generalizability study. In the case of a questionnaire that is used for administrative purposes and not for medical decision making, a generalizability coefficient of 0.7 (Nunnally, 1978) or better was required. A coefficient of 0.8 was considered as good and 0.9 as very good (Bain, 1996; Walsh & Betz, 1995).

It was considered that a sample of N = 96 patients per time frame (work shift) for a total number of 288 patients was a large enough sample for a crossed design generalizability study with a single instrumentation facet to ensure adequate power (Shoukri, Asyali, & Donner, 2004). An optimization study helped determine the number of raters needed to obtain a good reliability

coefficient. It also enabled obtaining the generalizability coefficient for the least costly scenario of one nurse per patient.

Table 5 : Nursing intensity of care ratings																
Night Raters (7:00 am)						Day Raters (3:00 pm)						Evening Raters (11:00 pm)				
		1	2	3	4			5	6	7	8			9	10	11	12
Patient	1					Patient	97					Patient	193				
	2						98						194				
	3						99						195				
	4						100						196				
	...						...						...				
	96						192						288				

Principal component and factor analyses

The purpose of a factor analysis is to determine the number of common factors required to account for the pattern of correlations between all pairs of tests in a set of tests (Crocker & Algina, 2008). In this study, the factor analysis helped to determine whether there were one or more clusters of items in the questionnaire that presented a clear factor structure. Exploratory principal components and factor analyses were performed on all the specific items (excluding the special global assessment final item).

First, principal component (PC) analyses followed by exploratory factor analyses (EFA) were performed to assess the factor structure of the 11 specific items. If a clear factor structure were to be identified, that is a simple structure in the loading matrix, a Cronbach's alpha reliability coefficient for each factor would be computed. An alpha reliability coefficient would also be computed for the total score based on the 11 items. All principal component and factor analyses were performed using SPSS 17.0 FACTOR procedure. Typically, a first sequence of PC analyses using an orthogonal rotation (VARIMAX) allows determining an optimal number of orthogonal components that explain total variance. A second sequence of EFA analyses using PAF and ML methods of estimation allowed identifying an optimal number of factors that explain common variance. The final structure was

reanalysed with an oblique rotation (OBLIMIN) in order to retain the simplest pattern matrix (regression coefficients) possible.

Criterion Validity

Criterion validity is used to test the relationship between the test scores and criterion measurements (Crocker & Algina, 2008). In this study, the criterion validity was assessed by having the raters' evaluate the patients using both the NICCQ and the Acute Physiology and Chronic Health Evaluation II (APACHE II) questionnaire. The latter is a validated severity of illness score based on physiological measures. The literature showed a positive, although weak correlation between severity of illness and nursing intensity in a critical care setting (Fagerstrom, Rainio, Rauhala, & Nojonen, 2000). A similar finding would support the hypothesis that severity of illness though correlated to nursing intensity of care, is not a valid measure of nursing intensity of care by itself. This would show that severity of illness is only one factor to consider when establishing nursing intensity, which includes many other factors other than the illness itself.

Due to time constraints, it was only possible to administer the APCHE II questionnaire to one out of three patients on each occasion, hence the criterion validity was planned for 96 patients in all. One of the four nurses who filled out the NICCQ was selected at random at the beginning of the study to administer the APACHE II patient classification for her patient throughout the study. The strength of the relationship between the NICCQ and APACHE II was determined by the Pearson product moment correlation. A low correlation would indicate high divergent validity of the NICCQ with respect to the APACHE II and support the notion that the severity of patients' illness is not enough in itself to measure nursing intensity of care (Padilha et al., 2007). A correlation coefficient $r < 0.3$ would indicate a highly divergent validity, whereas $r < 0.5$ would indicate a somewhat divergent validity (Fagerstrom et al., 2000).

Chapter 3: Results and Discussion

Article

NURSING AND HEALTHCARE MANAGEMENT AND POLICY

The Nursing Intensity Critical Care Questionnaire (NICCQ): Validation Study in Cardiac Surgery Patients

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CHAMPIGNY S., PARENT N., COSSETTE S., LEDUC N. & DASSA C., (2014), **The Nursing Intensity Critical Care Questionnaire (NICCQ): Validation study in cardiac surgery patients**

Objective: To establish the validity and reliability of the Nursing Intensity Critical Care Questionnaire (NICCQ) in a cardiac surgery intensive care unit (CSICU) of a tertiary hospital.
Methods: Content validity was determined by an expert panel. Generalizability theory was used to estimate generalizability coefficients and decision studies were performed to determine whether having only one nurse as a rater per patient is adequate. Exploratory factorial analyses examined possible factorial structure among the questionnaire items. Finally, the NICCQ was correlated with a severity of illness score known as the Acute Physiology And Chronic Health Evaluation II (APACHE II) in order to study the criterion validity between patient illness and nursing intensity of care.
Setting: The validated NICCQ was completed by nurses for 286 patients who had undergone cardiac surgery and were hospitalized in a CSICU of a tertiary teaching hospital.
Participants: Convenience sample of nurses and patients at the CSICU.
Main Outcome Measures: Each item on the questionnaire measured nursing intensity of care using a three point ordinal scale (Light, Moderate, and Severe) for the first 11 items and an extended five point ordinal scale (including Light/Moderate and Moderate/Severe) for the global assessment item.
Results: The questionnaire proved to be both valid and reliable. Overall results of the generalizability study showed that 94.4% of the generalizability coefficients of the items for all of the work shifts indicated acceptable to excellent reliability, with most (86.1%) of the coefficients values being larger than .90. A four factor simple structure was obtained explaining a relatively low proportion of total variance (32%). The criterion validity indicated a somewhat divergent validity (correlation of 0.36) between patient illness and nursing intensity of care.
Conclusion: The NICCQ is a valid and reliable questionnaire that can be used by nursing management for administrative purposes. Further research is needed to confirm the factor.

INTRODUCTION

The world's total expenditure for health care was 6.5 trillion US dollars in 2011; this translates to a total global expenditure for health per person per year of $948 US (WHO, 2012). The average amount spent per person per year on health in countries belonging to the Organisation for Economic Co-operation and Development (OECD) was $4380 US with the United States being the country with the highest total spending per person per year on health at $8362 US. In Canada, 205 billion dollars were spent on health care in 2011 amounting to a total of $5 811 per person per year. In Quebec alone, 41.9 billion dollars were spent on health care amounting to $5 261 per person per year (CIHI, 2011).

Nursing is responsible for a large proportion of the total healthcare system costs in Quebec (CIHI, 2005). This is particularly true when it comes to intensive care units (ICUs) where according to Miranda, (Miranda et al., 2003) the nursing staff budget constitutes approximately 50% of all costs in the ICU. These costs reflect the need for high nurse to patient ratios in the ICU. The nurse to patient ratios generally range from 1:1 to 1:3 depending on the intensity of care required for each patient. Given the significant financial impact, it is important to be able to assess and evaluate if the nursing resources are used in an optimal manner while maintaining quality of care.

Nursing research in ICUs has evolved over the last 30 years with the development and use of patient classification systems (PCS). These systems have been developed to accumulate and synthesize evidence regarding the impact of nurse staffing on patient outcomes and costs (Giovannetti, 1979; Manojlovich et al., 2011). Giovanetti (1979) was the first to formally define and use a PCS which he described as "a categorization of patients based on an estimate of their caring needs during a specific period of time" (Giovannetti, 1979). Before the turn of the twenty-first century, in the USA and Canada alone, several hundred types of different PCS were used.

These instruments were traditionally divided into two main types of classification systems: prototype and factor evaluation systems. The prototype model of classification compares the patient's needs with a so-called prototypic patient's need of care (Finsen model) (Fagerstrom & Engberg, 1998). Today, most PCS are based on the factor model of evaluation which incorporates specific factors or indicators describing the patient's need of care or the time-consuming elements of care (Fagerstrom & Engberg, 1998).

Factor based PCS were originally developed based on time studies and activity analysis that were heavily influenced, especially in the USA, by an industrial view of caring. Caring was broken down into distinct parts; each part consumed a given amount of time. These task oriented instruments were expensive to implement and focused on an approach that prioritized physical nursing over non-physical nursing care (Arthur & James, 1994; Fagerstrom & Engberg, 1998; Rauhala & Fagerstrom, 2004). An industrial view of caring included in these preliminary models' design was quite different from the meaning of caring described by Eriksson (1992) who stated that "the ultimate aim of caring is to alleviate the suffering of the patient, and therefore the health of the patient is the focus of care."(Eriksson, 1992). PCS shifted over time from workload and task-oriented medical instruments to patient dependency instruments, the later reflecting a more realistic picture of factors involved in nursing.

In 2010, the Government of Quebec passed bill 100 thereby putting into motion a number of strategies to reduce the debt and return to a balanced budget in 3 years. Reduction in spending was expected across all sectors including healthcare; dollars spent on healthcare were to be reduced and all remaining spending was to be justified. Unfortunately, cost justification was challenging if not impossible for nurse managers. Validated tools to measure the nursing intensity of care on a day-to-day basis specific to a cardiac surgery ICU (CSICU) were not and are still not available. Four years later, it remains crucial to develop a nursing intensity of

care instrument that can be used for cost justification in order to avoid reduction of nursing hours and subsequent impact on patient care and overall health of the population of Quebec.

A patient dependency PCS, the Nursing Intensity Critical Care Questionnaire (NICCQ), has been used in a CSICU at the Montreal Heart Institute (MHI) since 2003. Although it has been used to measure nursing intensity of care to justify costs, this PCS has never been the subject of empirical study to evaluate both its content and psychometric properties. Furthermore, although it is currently used on a day-to-day basis, no evidence exists to demonstrate that such use is adequate. The objective of this study is to revise and validate the current PCS in a CSICU setting allowing for a better follow-up of resource allocation**.**

Given these challenges, the present study was undertaken to revise and validate the current PCS, and to test its generalizability in a CSICU setting. Finally, a decision study was used to evaluate the questionnaire's reliability in the case of only one nurse rater per patient, as the current practice for this healthcare setting.

METHODS

The NURSING INTENSITY CRITICAL CARE QUESTIONNAIRE (NICCQ)

The NICCQ to be validated contains 13 items (12 specific items and a global assessment item) which cover medical, psychological and patient care indicators. The first twelve items are rated using a 3 point ordinal scale (Light, moderate, or severe) and the 13^{th} item (global assessment item) is rated using a 5 point ordinal scale (light, light/moderate, moderate, moderate/severe and severe). The study was conducted at the MHI from 2012 to 2013 and included four main components: content validation, generalizability, principal component and factor analysis, and criterion validity. The NICCQ was shortened to 12 items after content validity (see results). The shortened version was used for the remainder of the study.

Determination of Content Validity

The purpose of content validation is to assess whether the items adequately represent a performance domain or construct of specific interest. In this study, content validation was determined by an expert panel that independently assessed the clarity and pertinence of each of the 13 items as well as the scale used for each item.

The expert panel was composed of nine senior assistant head nurses and two intensivist physicians, with at least eight years of extensive experience in a CSICU. It was recognised that the panel would be strengthened by including experts, external to the institution (MHI) but within the same CSICU setting. As such, one of the nine nurses and one of the two physicians recruited to the panel practised at another hospital.

For each specific item in the questionnaire, the experts were asked to independently evaluate the pertinence and the clarity using a 3 point ordinal scale (not clear, somewhat clear, or clear). A section was available for comments on each of the items. Finally, experts were asked to add any items they felt were missing from the questionnaire. Frequency distribution and descriptive statistics were used to assess agreement, and the necessary adjustments were made to the questionnaire based on expert responses and the literature.

Generalizability

A two facet generalizability method was used in this study to test the questionnaire's reliability and to obtain a generalizability coefficient for each of the twelve items on the questionnaire as per generalizability theory (Cronbach, 1972).

All other analyses in this study were conducted using the validated questionnaire which was shortened from the original 13 items to 12. Generalizability of the questionnaire was determined based on two random facets; the differentiation facet (patients), denoted *p* and

the instrumentation facet (raters), denoted *i.* Both facets were crossed, *p x i.* This design was used for each of the questionnaire's 12 items separately (11 items as well as for the global assessment item). Both the differentiation and instrumentation facets were considered random since both the raters and the patients came from a sufficiently large pool (Shoukri et al., 2004).

Raters were eligible for the study if they were employed part-time or full-time as a CSICU nurse at the MHI, completed the advanced training program in immediate post-operative cardiac surgery care, hemofiltration and advanced ventricular assistance, and willing to complete a 1 hour training session. Data collection methods required four raters for each of the three work shifts (night, day, and evening). Therefore, the list of eligible nurses was stratified by shift and nurses were approached using a convenience sampling method.

Patients were eligible for the study if they were aged 18 and over, able to speak French or English, and scheduled to undergo cardiac surgery at the MHI during the one year recruitment period. Recruitment was planned to enrol 12 raters and 288 patients. All raters who volunteered to participate signed an informed consent form approved by the MHI institutional research ethics board. Informed consent from patients was not needed since there was no active participation on their part.

Patients were selected for inclusion in the study through convenience sampling beginning with the morning shift of the recruitment period and ending after 13 months. Patients taking part in the study were selected based on patient assignment by the assistant head nurse. If a nurse was assigned more than one patient, one patient was selected randomly. Each patient could take part in the study only once.

The questionnaire was completed for a maximum of three patients per shift. Three of the four raters were assigned patients to care for and the fourth rater although aware of the subject's identity, was not assigned to a specific patient. Instead, in accordance with the usual CSICU procedure, the 4th nurse participated in the caring of another patient not taking part in the study. The 4 raters were present as a team for each of the data collection shifts. At the end of the shift, each of the four nurses completed the questionnaire independently for each of the three patients. The 4th rater, not assigned to a specific patient, completed one questionnaire for each of the 3 patients.

Substitute nurses were identified in advance for each rater team in the event one of the nurses left the project or was absent for a long period of time.

Analysis was performed using the Statistical Package for Social Sciences software (SPSS 17.0 for Windows, SPSS Inc., Chicago, IL, USA) to prepare the data and European DDC User's Group software (EduG 6.0 for Windows, EDUCAN inc., Longueuil, QC, Canada). Estimates and standard errors were derived for generalizability coefficients, variance components, alternative designs for decision making (D) studies, while accounting for the use of only one rater as would be the case in "real life". An absolute generalizability coefficient was computed for each item using the single instrumentation facet, crossed design generalizability study. A generalizability coefficient of 0.7 or better was required to be considered acceptable for administrative purposes. (Nunnally, 1978). A coefficient of 0.8 was considered as good and 0.9 as very good (Bain, 1996; Walsh & Betz, 1995).

Sample size was determined to be 288 (96 patients per shift) to ensure adequate power.

Principal component and factor analyses

In order to determine the factor structure of the NICCQ, principal component analyses (PCA) and exploratory factor analyses (EFA) were performed using the11 specific items. The global assessment item was not used in these analyses. Cronbach's alpha reliability coefficients were computed for each factor based on the mean score (ad hoc factor scores). A first sequence of PC analyses using an orthogonal rotation (VARIMAX) was performed

in order to determine an optimal number of orthogonal components to explain the total variance. A second sequence of EFA analyses using a principal axis factoring method (PAF) allowed the identification of an orthogonal simple structure factor solution to explain the common variance. The final structure was reanalysed using an oblique rotation (OBLIMIN) in order to retain the simplest pattern matrix (regression coefficients); only this result will be reported. All principal component and factor analyses were performed using SPSS 17.0 FACTOR procedure.

Criterion Validity

In order to determine criterion validity, a second questionnaire, the Acute Physiology and Chronic Health Evaluation II (APACHE II) was completed by each of the 4 raters for 96 of the 288 planned study subjects. One of the three nurses whose patients participated in the study was randomly selected to act as the rater using the APACHE II questionnaire for the entire study. The APACHE II questionnaire was completed for 1 of the 3 tested subjects per shift because of time constraints. The APACHE II questionnaire is a validated 15-item questionnaire used to quantify illness severity based on physiological measures.

In order to determine if there was an association between nursing intensity of care as measured by the NICCQ and disease severity (APACHE II), the Pearson product moment correlation was calculated. A correlation coefficient $r < 0.3$ would indicate highly divergent validity whereas $r < 0.5$ would indicate a somewhat divergent validity (Fagerstrom et al., 2000). A somewhat divergent validity would indicate that severity of illness explains a large part of nursing intensity while a highly divergent validity would indicate that severity of illness in itself is not a valid measure of nursing intensity.

RESULTS

Determination of Content Validity

Each of the nine nurses and the two physicians on the expert panel (100.0%) returned their questionnaires after assessing both the clarity and pertinence for each of the 13 items on the questionnaire for a total of 286 ratings. For both clarity and pertinence, the mean score for each questionnaire item was greater or equal than 2 (somewhat clear or somewhat pertinent). The greatest variance was for item 9 (Nursing Surveillance) with 7 of the 11 experts rating the item as 'somewhat clear', 3 as 'clear' and 1 as 'not clear'. As the concept of nursing surveillance was covered in several other items, this item was removed from the questionnaire and the final validated questionnaire contained 12 items (Table 1). On each of the eight cases occasions where the mean ±1 standard deviation overlapped the score of two, the corresponding items were modified based on the experts' comments. No new items were added to the questionnaire.

Generalizability

Overall, 340 patients were included in the study. Of these, 60 patients did not meet the inclusion criteria and were removed from the analysis. Of the 60 excluded, the majority (53) had been included more than once in the study and the other 7 had not undergone cardiac surgery. Of the 280 eligible patients, there were

Table 1 : Items of the Nursing Intensity Critical Care Questionnaire (NICCQ)

Item	Name	Item	Name	Item	Name
1	Respiration	5	Instrumentation	9	Isolation
2	Cardiac Rhythm	6	Pain	10	Family
3	Hemodynamics	7	Anxiety	11	Examination
4	Bleeding	8	Dressings	12	Global Assessment

Table 2 : Generalizability (G) and Decision (D) Coefficients for 4 Raters, 1 Occasion, 12 Items (n=280)

	G-Study		D-Study							
			1 Rater		2 Raters		3 Raters		5 Raters	
	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute
Night shift (midnight – 8:00 am)										
Item										
1	0.963	0.963	0.867	0.867	0.929	0.929	0.952	0.952	0.970	0.970
2	0.977	0.976	0.913	0.911	0.954	0.954	0.969	0.969	0.981	0.981
3	0.966	0.965	0.875	0.874	0.933	0.933	0.955	0.954	0.972	0.972
4	0.977	0.977	0.915	0.915	0.956	0.956	0.970	0.970	0.982	0.982
5	0.992	0.992	0.970	0.970	0.985	0.985	0.990	0.990	0.994	0.994
6	0.990	0.990	0.963	0.962	0.981	0.980	0.987	0.987	0.992	0.992
7	0.958	0.954	0.850	0.839	0.919	0.913	0.945	0.940	0.966	0.963
8	0.989	0.989	0.956	0.956	0.978	0.978	0.985	0.985	0.991	0.991
9	0.991	0.991	0.966	0.966	0.983	0.983	0.988	0.988	0.993	0.993
10	0.889	0.889	0.667	0.667	0.800	0.800	0.857	0.857	0.909	0.909
11	0.963	0.963	0.867	0.867	0.929	0.929	0.952	0.952	0.970	0.970
12	0.895	0.868	0.680	0.621	0.809	0.766	0.864	0.831	0.914	0.891
Day shift (8:00 am – 4:00 pm)										
Item										
1	0.972	0.972	0.898	0.898	0.946	0.946	0.964	0.964	0.978	0.978
2	0.969	0.968	0.887	0.884	0.940	0.938	0.959	0.958	0.975	0.974
3	0.974	0.973	0.904	0.902	0.950	0.948	0.966	0.965	0.979	0.979
4	0.970	0.969	0.890	0.888	0.942	0.941	0.960	0.960	0.976	0.975
5	0.955	0.953	0.841	0.836	0.913	0.911	0.941	0.939	0.963	0.962
6	0.966	0.966	0.877	0.877	0.934	0.934	0.955	0.955	0.973	0.973
7	0.947	0.947	0.816	0.816	0.899	0.899	0.930	0.930	0.957	0.957
8	0.913	0.911	0.725	0.720	0.841	0.837	0.888	0.885	0.830	0.928
9	0.991	0.991	0.967	0.967	0.983	0.983	0.989	0.989	0.993	0.993
10	0.949	0.949	0.823	0.823	0.903	0.903	0.933	0.933	0.959	0.959
11	0.907	0.907	0.709	0.709	0.830	0.830	0.880	0.880	0.924	0.924
12	0.938	0.932	0.791	0.774	0.883	0.872	0.919	0.911	0.950	0.945
Evening Shift (4:00 pm – midnight)										
Item										
1	0.951	0.947	0.828	0.817	0.906	0.899	0.935	0.930	0.960	0.957
2	0.970	0.969	0.889	0.888	0.941	0.940	0.960	0.959	0.976	0.975
3	0.959	0.957	0.854	0.848	0.921	0.918	0.946	0.944	0.967	0.965
4	0.989	0.989	0.959	0.959	0.979	0.979	0.986	0.986	0.992	0.992
5	0.974	0.973	0.904	0.901	0.950	0.948	0.966	0.965	0.979	0.978
6	0.958	0.957	0.851	0.847	0.920	0.917	0.945	0.943	0.966	0.965
7	0.943	0.940	0.805	0.796	0.892	0.887	0.925	0.921	0.954	0.951
8	0.365	0.364	0.126	0.125	0.223	0.223	0.302	0.300	0.418	0.417
9	0.995	0.995	0.982	0.982	0.991	0.991	0.994	0.994	0.996	0.996
10	0.968	0.968	0.885	0.885	0.939	0.939	0.958	0.958	0.975	0.975
11	0.526	0.526	0.217	0.217	0.357	0.357	0.454	0.454	0.581	0.581
12	0.910	0.896	0.716	0.683	0.834	0.811	0.883	0.866	0.926	0.915

101 females (36.1%) and 179 males (63.9%) and the average age was 66.8 years. It was possible to obtain a full sample for two of the three work shifts (N=97 for the night shift and N=96 for the day shift).

Only N=87 patients could be included in the evening due to the premature departure of one of the 4 nurses. It was determined that a lower than ideal sample size in one shift would likely have less of an impact on the study results than the variability that might be introduced if a new rater joined the study in order to avoid missing data. All the questionnaires were reviewed onsite to ensure that they were correctly completed.

The Generalizability (G) and Decision making (D) coefficients (relative and absolute) for each NICCQ items are summarised in Table 2. Overall, 94% of the G coefficients for all items across all shifts indicated 'acceptable' to 'excellent' reliability as measured by Nunnally (Nunnally, 1978). The G coefficients determined using 4 raters were greater or equal to 0.90 for most of the items (86.1 %) evaluated in each of the three shifts. Little difference was noted between absolute and relative coefficients across all items and all shifts. Given that the absolute coefficients are always lower than the relative ones, only the former will be presented. Questionnaire Item 8 (Dressings) and item 11 (Exams) had low G coefficients for the evening shift (Table 2) likely explained by the small differentiation variance (0.002). The high inter-rater agreement per item and the lack of variation reduced the informative aspect of the G coefficient for these two items for the evening shift. A rating of 1 (light) was attributed by all 4 nurses 95% of the time for item 8 and 98% of the time for item 11.

Table 3 : Factor Analyses (PAF, OBLIMIN), 11 Items, 280 Subjects

Name of Factor	Items	Regression Coefficients (loadings)* Factors				Cronbach's Alpha
		F_1	F_2	F_3	F_4	
F_1 Respiration / Circulation	05-Instrumentation 01-Respiration 03-Hemodynamics	0.697 0.575 0.564				0.640
F_2 Social support / Cardiac stability	02-Heart Rate 10-Family 09-Isolation		0.485 0.455 (0.246)			0.311 including item 9 0.289 excluding item 9
F_3 Anxiety / Pain	07-Anxiety 06-Pain			0.545 0.405		0.356
F_4 Direct care	11-Examination 08-Dressings 04-Bleeding				0.613 0.532 0.442	0.554
11-item questionnaire		Percentage of variance explained: Principal component (56.28%) Principal axis factoring (32.05%)				
* Loadings inferior to 0.35 were not included except for item 9.						

Decision (D) coefficients decreased slightly with the decrease in number of raters (from 4 to 1) across all 12 items and all shifts. Most items had a D coefficient greater than 0.70 with one rater which is well within the acceptable range for an administrative questionnaire. Exceptions were noted for items 10 (Family) and 12 (Global) for the night shift (D Coefficients were 0.667 and 0.621 respectively), and items 8 (Dressings), 11 (Exams) and 12 (Global) for the evening shift (D-coefficient were 0.125, 0.217 and 0.683 respectively). No values below 0.7 were found for the day shift. The G coefficient for item 12 exceeded 0.7 ranging from 0.766 to 0.872 depending on the work shift, for two raters.

Principal component and factor analyses

The final principal axis factoring (PAF) results with oblique rotation (OBLIMIN) are presented in table 3. A simple structure was obtained regrouping the 11 items in 4 factors with item 9 presenting a low loading on factor 2. The factors were named as follows: Factor 1 - Respiration/Circulation (Items 03, 05, 01), Factor 2 - Social Support/Cardiac Stability (Items 10, 02, (09)), Factor 3 - Anxiety/Pain (Items 07, 06) and Factor 4 - Direct Care (Items 11, 08, 04). The orthogonal principal component analysis explained 56.28% of total variance whereas the oblique principal axis factoring analysis explained 32.05% of total variance. Cronbach's alpha coefficient for the 11 items was 0.551. It barely changed (0.556) when item 9 is removed. Cronbach's alpha values for each factor were respectively, 0.640, 0.311 (0.289 excluding item 9), 0.356 and 0.554. These values were low (Crocker & Algina, 2008) and precluded the definition of factor based subscores. Correlations among the factors were low ranging from 0.082 to 0.324.

Results are presented for the whole sample. Separate analyses for each shift were not feasible due to small sample sizes. However, the factor structure obtained with the entire sample of 280 patients clarifies the internal construct of the NICCQ.

Criterion Validity

The APACHE II questionnaire was completed for 80 subjects over all three shifts (night shift n=28, day shift n=29, evening shift n=23). Criterion validity was measured by a correlation between the NICCQ global assessment item and the APACHE II score. Its value (r=0.296) shows a somewhat divergent validity (95% C.I. for r extends from 0.08 to 0.485). The mean score for the 11 NICCQ items was highly correlated with the NICCQ global assessment item (r=0.934; 95% C.I for r extends from 0.898 to 0.958; N=76, 4 outliers were excluded).

Discussion

This study was undertaken to validate the NICCQ, an important administrative tool used to quantify nursing intensity of care in a CSICU setting. This study follows work done by Guimarães (Guimarães, Rabelo, Moraes, & Azzolin, 2010), who embarked on the search for a PCS that can be used in a CSICU setting. All NICCQ items except one, Nursing Surveillance, were found to be highly clear and pertinent thereby demonstrating high content validity. The item on nursing surveillance was not consistently rated as clear from one rater to another. This suggests that nursing surveillance was subjective and difficult to interpret. To date, no studies have been able to demonstrate effective nursing surveillance patterns or an effect of nursing surveillance on patients' outcomes (Voepel-Lewis, Pechlavanidis, Burke, & Talsma, 2013). As a result, removing the 'Nursing Surveillance' item and shortening the original NICCQ from 13 items to 12 items is unlikely to impact the administrative value of the tool. In addition to validating the tool, this study also demonstrated that the NICCQ was highly generalizable for most items. It is advantageous to have a reliable tool in a large tertiary care setting as it means that the questionnaire can be used by any nurse working in the ICU. Ninety four percent of all items across all shifts demonstrated 'acceptable' to 'excellent' reliability. Not surprisingly, generalizability coefficients were lower for two

items evaluated at the end of the evening shift (Item 8 (Dressings) and Item 11 (Exams). As dressing changes and physical exams are rarely scheduled during the night, it would be expected that these items would rate 1 (light) since they are almost never scheduled for the night shift.

This study demonstrates that the NICCQ is a practical administrative questionnaire for day-to-day use in CSICU. Overall, we found that having 1 nurse to complete the NICCQ for one patient was just as effective as 4 nurses. Results of the D-study revealed that most generalizability coefficients were greater than 0.70, well within the acceptable range for an administrative questionnaire (Nunnally, 1978). As was expected, a generalizability coefficient <0.70 was found for item 10 (Family) for the night shift. As family visits are rarely authorised during the night, it would be expected that any measures made on this item during the nightshift would be less reliable (i.e., <0.70) since any assessment related to 'Family' could only be made through second hand information obtained by the nurse from the preceding shift (Kirk, 1986).

In practice, the nurse provides the assistant head nurse a patient assessment at the end of each shift based on the items in the questionnaire. Together, the two nurses assign the global assessment item to the patient. Not surprisingly, regardless of shifts, having two raters is ideal as the value of the G coefficient increases from what was observed with one rater.

The best structure observed included 4 important factors associated with patient care under which different items were logically grouped together (Respiration/Circulation, Social Support/Cardiac Stability, Anxiety/Pain, and Direct Care).

The first factor (Respiration/Circulation) included items pertaining to medical aspects of patient care such as, Hemodynamic, Instrumentation and Respiration. This is in agreement with Gonzalez (1991), demonstrating the link between hemodynamic instrument and the patient's respiration (Gonzalez, Basnight, & Appleton, 1991). The second factor included items related to with Social Stability and Cardiac Care. This is in agreement with what others have found and highlights the fact that family support plays a central role in psychological wellbeing of the patient which in turn has an effect on the patient's heart rate (Udupa et al., 2007). The grouping of items in the third factor (Anxiety/Pain) was consistent with clinical experience and what others have observed (Ploghaus et al., 2001). Ploghaus et al. have clearly demonstrated that patients who are anxious about pain can in fact exacerbate the sensation of pain. The grouping of items within the fourth factor (Direct Care) was also consistent with the literature (Fagerstrom & Rainio, 1999; Fagerstrom et al., 2000). When items representing control of bleeding, changing dressing and patient exams are grouped together, it indicates the importance of both dressings and exams when a patient is bleeding. These findings are consistent with the literature (Billingsley & Maloney, 1997; Gill et al., 2009). Finally, the fact that Patient Isolation loaded poorly on factor 2 and not at all on the other factors suggests that this item is relatively independent of the other items. No further factor analyses studies were possible with the available sample.

The overall 4 factor structure obtained with exploratory factor analysis is relatively weak and requires further studies with an independent sample that would allow testing of the factor structure using structural equation modeling. Such a sample was not available in the current study.

The present study confirmed what others have observed, that the severity of patients' illness is in itself a valid measure of nursing intensity of care (Padilha et al., 2007). This is important because past instruments have been criticized for not representing total nursing care and by only including medical elements. There was little correlation between the APACHE II score and the global assessment item for NICCQ. This is reassuring because it shows that the questionnaire is able to measure nursing intensity of care and not severity of illness. This shows that the use of a severity of illness

questionnaire would not be valid when trying to justifying nursing costs which are based on the intensity of care that they need to provide.

Furthermore, we observed a very strong correlation between the mean score of the eleven NICCQ items and the global assessment item. This result confers criterion validity to the global assessment item. This does not mean that we can replace the 11 item questionnaire by the single global assessment item because the latter is completed *after* assessing each of the 11 individual items pertaining to (Respiration/Circulation, Social Support/Cardiac Stability, Anxiety/Pain, and Direct Care). Hence, CSICU nurses must complete each of the 11 items separately before completing the global assessment item to ensure that the global assessment is properly informed.

Strengths and limitations

This study has many strengths. The fact that the study was conducted in a tertiary teaching hospital allowed access to highly trained experts in their respected fields. The sample sizes were large with a high completion rate of questionnaires with a high attainment rate since very little data was excluded. It was possible to easily recruit patients and nurses. There was a high ascertainment rate of patients and no nurses dropped out during the study.

An important limitation of this study pertains to its generalizability to other health care settings since the study was conducted in a very specialized unit in a Quebec context. Hence, this questionnaire which has been validated in a CSICU would need to be re-evaluated for other (general) ICUs. Also, a separate independent sample was not available to allow testing of the 4 factor structure that was obtained with the exploratory factor analysis.

Conclusion

This study provides hospital administrators with a much-needed validated questionnaire that can be used for cost justification in the current healthcare setting. The generalizability study has demonstrated that the questionnaire is reliable and can be used as an administrative tool for nursing managers. The optimization study has shown that the questionnaire is reliable enough to be used by one nurse for the patient for which she is caring for. In order to maximise reliability, our results indicate that there is benefit to consultation between the nurse caring for the patient and the assistant head nurse prior to completion of the global assessment item.

Further studies with an independent sample would allow testing of the factor structure using structural equation modeling. Such a sample was not available in the current study. Finally, a small correlation was observed between the NICCQ and APACHE II suggesting divergent validity between patient illness and nursing intensity of care. Further research could be done to substantiate this finding.

References

Arthur, T., & James, N. (1994). Determining nurse staffing levels: a critical review of the literature. *Journal of Advanced Nursing, 19*(3), 558-565. doi: 10.1111/j.1365-2648.1994.tb01121.x

Bain, D., Pini, G. (1996). Pour évaluer vos évaluations: la générasibilité, mode d'emploi (pp. 125). Genève: CRPP.

Billingsley, E. M., & Maloney, M. E. (1997). Intraoperative and Postoperative Bleeding Problems in Patients Taking Warfarin, Aspirin, and Nonsteroidal Antiinflammatory Agents. *Dermatologic Surgery, 23*(5), 381-383. doi: 10.1111/j.1524-4725.1997.tb00065.x

CIHI, C. I. f. H. I. (2005). *Hospital Trends in Canada : Results of a Project to Create a Historical Series of Statistical and Financial Data for Canadian Hospitals Over Twenty-Seven Years*.

CIHI, C. I. f. H. I. (2011). National Health Expenditure Trends, 1975 to 2011.

Crocker, L., & Algina, J. (Eds.). (2008). *Introduction to Classical & Modern Test*

Theory. Mason, Ohio, USA: Cengage Learning.

Cronbach, L. J., gleser, G. C., and Rajaratnam, N. (1972). *The dependability of behavioral measurements*. New York: John Wiley.

Eriksson, K. (1992). The alleviation of suffering--the idea of caring. *Scandinavian journal of caring sciences, 6*(2), 119-123.

Fagerstrom, L., & Engberg, I. B. (1998). Measuring the unmeasurable: a caring science perspective on patient classification. [Review]. *J Nurs Manag, 6*(3), 165-172.

Fagerstrom, L., & Rainio, A. (1999). Professional assessment of optimal nursing care intensity: a new method for assessment of staffing levels for nursing care. *Journal of Clinical Nursing, 8*, 369-379.

Fagerstrom, L., Rainio, A., Rauhala, A., & Nojonen, K. (2000). Validation of a new method for patient classification, the Oulu Patient Classification. *Journal of Advanced Nursing, 31*(2), 481-490.

Gill, R., Herbertson, M., Vuylsteke, A., Olsen, P. S., von Heymann, C., Mythen, M., . . . Schmidt, T. A. (2009). Safety and Efficacy of Recombinant Activated Factor VII: A Randomized Placebo-Controlled Trial in the Setting of Bleeding After Cardiac Surgery. *Circulation, 120*(1), 21-27. doi: 10.1161/circulationaha.108.834275

Giovannetti, P. (1979). Understanding patient classification systems. *J Nurs Adm, 9*(2), 4-9.

Gonzalez, M. S., Basnight, M. A., & Appleton, C. P. (1991). Experimental pericardial effusion: Relation of abnormal respiratory variation in mitral flow velocity to hemodynamics and diastolic right heart collapse. *Journal of the American College of Cardiology, 17*(1), 239-248. doi: http://dx.doi.org/10.1016/0735-1097(91)90733-P

Guimarães, R. d. C. M., Rabelo, E. R., Moraes, M. A., & Azzolin, K. (2010). Severity of postoperative cardiac surgery patients: na evolution analysis according to TISS-28. *Revista Latino-Americana de Enfermagem, 18*, 61-66.

Kirk, J., and Miller, Marc L. (1986). *Reliability and Validity In Qualitative Research* (Vol. 1). California: SAGE Publications Ltd.

Manojlovich, M., Sidani, S., Covell, C. L., & Antonakos, C. L. (2011). Nurse Dose: Linking Staffing Variables to Adverse Patient Outcomes. *Nursing Research, 60*(4), 214-220. doi: 10.1097/NNR.0b013e31822228dc

Miranda, D. R., Nap, R., de Rijk, A., Schaufeli, W., & Iapichino, G. (2003). Nursing activities score. [Research Support, Non-U S Gov't]. *Crit Care Med, 31*(2), 374-382.

Nunnally, J. (1978). *Psychometric theory* (2nd ed. ed.). New York.

Padilha, K. G., Sousa, R. M. C., Kimura, M., Miyadahira, A. M. K., da Cruz, D. A. L. M., Vattimo, M. d. F., . . . Mayor, E. R. C. (2007). Nursing workload in intensive care units: A study using the Therapeutic Intervention Scoring System-28 (TISS-28). *Intensive and Critical Care Nursing, 23*(3), 162-169. doi: 10.1016/j.iccn.2006.07.004

Ploghaus, A., Narain, C., Beckmann, C. F., Clare, S., Bantick, S., Wise, R., . . . Tracey, I. (2001). Exacerbation of Pain by Anxiety Is Associated with Activity in a Hippocampal Network. *The Journal of Neuroscience, 21*(24), 9896-9903.

Rauhala, A., & Fagerstrom, L. (2004). Determining optimal nursing intensity: the RAFAELA method. [Research Support, Non-U S Gov't

Validation Studies]. *J Adv Nurs, 45*(4), 351-359.

Shoukri, M. M., Asyali, M. H., & Donner, A. (2004). Sample size requirements for the design of reliability study: review and new results. *Statistical Methods in Medical Research, 13*(4), 251-271. doi: 10.1191/0962280204sm365ra

Udupa, K., Sathyaprabha, T. N., Thirthalli, J., Kishore, K. R., Lavekar, G. S., Raju, T. R., & Gangadhar, B. N. (2007). Alteration of cardiac autonomic functions in patients with major depression: A study using

heart rate variability measures. *Journal of Affective Disorders, 100*(1–3), 137-141.

Voepel-Lewis, T., Pechlavanidis, E., Burke, C., & Talsma, A. N. (2013). Nursing surveillance moderates the relationship between staffing levels and pediatric postoperative serious adverse events: A nested case-control study. *International Journal of Nursing Studies, 50*(7), 905-913. doi: 10.1016/j.ijnurstu.2012.11.014

Walsh, W. B., & Betz, N. E. (1995). *Tests and assessment (3rd ed.)*. Englewood Cliffs, NJ, US: Prentice-Hall, Inc.

WHO, W. H. O. (2012). WHO Global Health Expenditure Atlas.

Conclusion

This study provides hospital administrators with a much-needed validated questionnaire that can be used for cost justification in the current healthcare setting. The generalizability study has proven that the questionnaire in its revised form is reliable enough to be used as an administrative tool for nursing managers. The optimization study has shown that the questionnaire is reliable enough to be used by one nurse for the patient for which she is caring for. In order to maximise reliability, our results indicate that there is benefit to consultation between the nurse caring for the patient and nursing management (i.e., assistant head nurse) prior to completion of the global score.

Further research using larger samples would be needed to further test the factor structure of the NICCQ. Finally, a small correlation was observed between the NICCQ and APACHE II indicating divergent validity between a patient's illness and nursing intensity of care and thus confirming the distinction between severity of illness and nursing intensity of care.

References

Adomat, R., & Hewison, A. (2004). Assessing patient category/dependence systems for determining the nurse/patient ratio in ICU and HDU: a review of approaches. *Journal of Nursing Management, 12*(5), 299-308.

Alexander, K. P., Anstrom, K. J., Muhlbaier, L. H., Grosswald, R. D., Smith, P. K., Jones, R. H., & Peterson, E. D. (2000). Outcomes of cardiac surgery in patients age ≥80 years: results from the National Cardiovascular Network. *Journal of the American College of Cardiology, 35*(3), 731-738. doi: 10.1016/s0735-1097(99)00606-3

Arthur, T., & James, N. (1994). Determining nurse staffing levels: a critical review of the literature. *Journal of Advanced Nursing, 19*(3), 558-565. doi: 10.1111/j.1365-2648.1994.tb01121.x

Bain, D., Pini, G. (1996). Pour évaluer vos évaluations: la générasibilité, mode d'emploi (pp. 125). Genève: CRPP.

Ball, C. (2001). Patient:nurse ratios in critical care -- time for some radical thinking. *Intensive and Critical Care Nursing, 17*, 125-127.

Ball, C. (2005). Measuring nursing workload -- an outdated concept. *Care of the Critically Ill, 21*(2), 46-50.

Billingsley, E. M., & Maloney, M. E. (1997). Intraoperative and Postoperative Bleeding Problems in Patients Taking Warfarin, Aspirin, and Nonsteroidal Antiinflammatory Agents. *Dermatologic Surgery, 23*(5), 381-383. doi: 10.1111/j.1524-4725.1997.tb00065.x

Carayon, P., & Gurses, A. P. (2005). A human factors engineering conceptual framework of nursing workload and patient safety in intensive care units. [Research Support, U S Gov't, P H S

Review]. *Intensive Crit Care Nurs, 21*(5), 284-301.

Carmona-Monge, F. J., Rollán, Herranz, C. Q., Gómez, S. G., & Marín-Morales, D. (2013). Evaluation of the nursing workload through the nine equivalents for nursing manpower use scale and the nursing activities score: A prospective correlation study. *Intensive & Critical Care Nursing, 29*(4), 228-233. doi: 10.1016/j.iccn.2013.03.003

Carr-Hill, R. A., & Jenkins-Clarke, S. (1995). Measurement systems in principle and in practice: the example of nursing workload. [Research Support, Non-U S Gov't]. *J Adv Nurs, 22*(2), 221-225.

CIHI, C. I. f. H. I. (2005). *Hospital Trends in Canada : Results of a Project to Create a Historical Series of Statistical and Financial Data for Canadian Hospitals Over Twenty-Seven Years*.

CIHI, C. I. f. H. I. (2011). National Health Expenditure Trends, 1975 to 2011.

Crocker, L., & Algina, J. (Eds.). (2008). *Introduction to Classical & Modern Test Theory*. Mason, Ohio, USA: Cengage Learning.

Cronbach, L. J., gleser, G. C., and Rajaratnam, N. (1972). *The dependability of behavioral measurements*. New York: John Wiley.

Cullen, D. J., Civetta, J. M., Briggs, B. A., & Ferrara, L. C. (1974). Therapeutic intervention scoring system: a method for quantitative comparison of patient care. *Critical Care Medicine, 2*(2), 57-60.

Eriksson, K. (1992). The alleviation of suffering--the idea of caring. *Scandinavian journal of caring sciences, 6*(2), 119-123.

Fagerstrom, L., & Engberg, I. B. (1998). Measuring the unmeasurable: a caring science perspective on patient classification. [Review]. *J Nurs Manag, 6*(3), 165-172.

Fagerstrom, L., Eriksson, K., & Engberg, I. B. (1999). The patient's perceived caring needs: measuring the unmeasurable. *Int J Nurs Pract, 5*(4), 199-208.

Fagerstrom, L., & Rainio, A. (1999). Professional assessment of optimal nursing care intensity: a new method for assessment of staffing levels for nursing care. *Journal of Clinical Nursing, 8*, 369-379.

Fagerstrom, L., Rainio, A., Rauhala, A., & Nojonen, K. (2000). Validation of a new method for patient classification, the Oulu Patient Classification. *Journal of Advanced Nursing, 31*(2), 481-490.

Gill, R., Herbertson, M., Vuylsteke, A., Olsen, P. S., von Heymann, C., Mythen, M., . . . Schmidt, T. A. (2009). Safety and Efficacy of Recombinant Activated Factor VII: A Randomized Placebo-Controlled Trial in the Setting of Bleeding After Cardiac Surgery. *Circulation, 120*(1), 21-27. doi: 10.1161/circulationaha.108.834275

Giovannetti, P. (1979). Understanding patient classification systems. *J Nurs Adm, 9*(2), 4-9.

Gonzalez, M. S., Basnight, M. A., & Appleton, C. P. (1991). Experimental pericardial effusion: Relation of abnormal respiratory variation in mitral flow velocity to hemodynamics and diastolic right heart collapse. *Journal of the American College of Cardiology, 17*(1), 239-248. doi: http://dx.doi.org/10.1016/0735-1097(91)90733-P

Guimarães, R. d. C. M., Rabelo, E. R., Moraes, M. A., & Azzolin, K. (2010). Severity of postoperative cardiac surgery patients: na evolution analysis according to TISS-28. *Revista Latino-Americana de Enfermagem, 18*, 61-66.

Hayes, E. (1991). Matching demands and resources in an intensive care environment. *Intensive Care Nursing, 7*(4), 206-213.

Jakob, S., & Rothen, H. (1997). Intensive care 1980–1995: change in patient characteristics, nursing workload and outcome. *Intensive Care Medicine, 23*(11), 1165-1170. doi: 10.1007/s001340050474

Jean, S. (2005). *Projection de la Main D'oeuvre Infirimière de 2004-2005 à 2019-2020*.

Keene, A. R., & Cullen, D. J. (1983). Therapeutic Intervention Scoring System: update 1983. *Crit Care Med, 11*(1), 1-3.

Kiekkas, P., Sakellaropoulos, G. C., Brokalaki, H., Manolis, E., Samios, A., Skartsani, C., & Baltopoulos, G. I. (2008). Association between nursing workload and mortality of intensive care unit patients. *Journal of Nursing Scholarship, 40*(4), 385-390.

Kirk, J., and Miller, Marc L. (1986). *Reliability and Validity In Qualitative Research* (Vol. 1). California: SAGE Publications Ltd.

Kisorio, L. C. S., Shelley; Becker, Piet J. (2009). Validity and reliability of the simplified therapeutic intervention scoring system in intensive care units of a public sector hospital in Johannesburg. *Southern African Journal of Critical Care, 25*(2).

Knaus, W. A., Draper, E. A., Wagner, D. P., & Zimmerman, J. E. (1985). APACHE II: a severity of disease classification system. [Comparative Study

Research Support, Non-U S Gov't

Research Support, U S Gov't, P H S]. *Crit Care Med, 13*(10), 818-829.

Lefering, R. (1999). Biostatistical aspects of outcome evaluation using TISS-28. *Eur J Surg Suppl, 584*, 56-61.

Lefering, R., Zart, M., & Neugebauer, E. A. M. (2000). Retrospective evaluation of the simplified Therapeutic Intervention Scoring System (TISS-28) in a surgical intensive care unit. *Intensive Care Medicine, 26*(12), 1794-1802. doi: 10.1007/s001340000723

Lesaffre, E., Diya, L., Vleugels, A., Clarke, S. P., Aiken, L. H., & Sermeus, W. (2009). The relationship between inpatient cardiac surgery mortality and nurse numbers and educational level: analysis of administrative data. *International Journal of Nursing Studies, 46*(6), 796-803. doi: 10.1016/j.ijnurstu.2008.12.018

Manojlovich, M., Sidani, S., Covell, C. L., & Antonakos, C. L. (2011). Nurse Dose: Linking Staffing Variables to Adverse Patient Outcomes. *Nursing Research, 60*(4), 214-220. doi: 10.1097/NNR.0b013e31822228dc

McDowell, I. (2006). *Measuring Health. A Guide to Rating Scales and Questionnaires* (Vol. Third). New York, New York: Oxford University Press, Inc.

. MHI - 2010-2011 Annual Report. (2010-2011). Montreal: Montreal Heart Institute.

Miranda, D. R., de Rijk, A., & Schaufeli, W. (1996). Simplified Therapeutic Intervention Scoring System: the TISS-28 items--results from a multicenter study. [Multicenter Study

Research Support, Non-U S Gov't]. *Crit Care Med, 24*(1), 64-73.

Miranda, D. R., Nap, R., de Rijk, A., Schaufeli, W., & Iapichino, G. (2003). Nursing activities score. [Research Support, Non-U S Gov't]. *Crit Care Med, 31*(2), 374-382.

Moreno, R., & Morais, P. (1997). Validation of the simplified therapeutic intervention scoring system on an independent database. *Intensive Care Med, 23*(6), 640-644.

Nunnally, J. (1978). *Psychometric theory* (2nd ed. ed.). New York.

Padilha, K. G., Sousa, R. M. C., Kimura, M., Miyadahira, A. M. K., da Cruz, D. A. L. M., Vattimo, M. d. F., . . . Mayor, E. R. C. (2007). Nursing workload in intensive care units: A study using the Therapeutic Intervention Scoring System-28 (TISS-

28). *Intensive and Critical Care Nursing, 23*(3), 162-169. doi: 10.1016/j.iccn.2006.07.004
Panunto, M. R., & Brito. (2012). Nursing workload in an intensive care unit of a teaching hospital. *Acta Paulista de Enfermagem, 25*(1), 96-101.
Pirret, A. M. (2002). Utilizing TISS to differentiate between intensive care and high-dependency patients and to identify nursing skill requirements. *Intensive & Critical Care Nursing, 18*(1), 19-26.
Ploghaus, A., Narain, C., Beckmann, C. F., Clare, S., Bantick, S., Wise, R., . . . Tracey, I. (2001). Exacerbation of Pain by Anxiety Is Associated with Activity in a Hippocampal Network. *The Journal of Neuroscience, 21*(24), 9896-9903.
Pyykko, A. K., Laurila, J., Ala-Kokko, T. I., & Hentinen, M. (2001). Intensive Care Nursing Scoring System: part 2: nursing interventions and nursing outcomes. *Intensive & Critical Care Nursing, 17*(1), 16-28.
Rauhala, A., & Fagerstrom, L. (2004). Determining optimal nursing intensity: the RAFAELA method. [Research Support, Non-U S Gov't

Validation Studies]. *J Adv Nurs, 45*(4), 351-359.
Shoukri, M. M., Asyali, M. H., & Donner, A. (2004). Sample size requirements for the design of reliability study: review and new results. *Statistical Methods in Medical Research, 13*(4), 251-271. doi: 10.1191/0962280204sm365ra
Udupa, K., Sathyaprabha, T. N., Thirthalli, J., Kishore, K. R., Lavekar, G. S., Raju, T. R., & Gangadhar, B. N. (2007). Alteration of cardiac autonomic functions in patients with major depression: A study using heart rate variability measures. *Journal of Affective Disorders, 100*(1–3), 137-141.
Voepel-Lewis, T., Pechlavanidis, E., Burke, C., & Talsma, A. N. (2013). Nursing surveillance moderates the relationship between staffing levels and pediatric postoperative serious adverse events: A nested case-control study. *International Journal of Nursing Studies, 50*(7), 905-913. doi: 10.1016/j.ijnurstu.2012.11.014
Walsh, W. B., & Betz, N. E. (1995). *Tests and assessment (3rd ed.)*. Englewood Cliffs, NJ, US: Prentice-Hall, Inc.
WHO, W. H. O. (2012). WHO Global Health Expenditure Atlas.

Appendix

A: Extra Tables

Table 1 – Content Validity, 11 Raters, 12 Items, Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pertinence Item 1	12	1	3	2.50	.798
Clarté Item 1	12	1	3	2.33	.778
Pertinence Item 2	12	1	3	2.58	.669
Clarté Item 2	12	1	3	2.17	.835
Pertinence Item 3	12	1	3	2.75	.622
Clarté Item 3	12	1	3	2.67	.651
Pertinence Item 4	12	2	3	2.83	.389
Clarté Item 4	12	1	3	2.50	.674
Pertinence Item 5	12	1	3	2.67	.651
Clarté Item 5	12	1	3	2.67	.651
Pertinence Item 6	12	2	3	2.75	.452
Clarté Item 6	12	1	3	2.67	.651
Pertinence Item 7	12	2	3	2.67	.492
Clarté Item 7	12	1	3	2.75	.622
Pertinence Item 8	12	2	3	2.83	.389
Clarté Item 8	11	3	3	3.00	.000
Pertinence Item 9	12	2	3	2.75	.452
Clarté Item 9	12	1	3	2.25	.622
Pertinence Item 10	12	2	3	2.92	.289
Clarté Item 10	12	2	3	2.67	.492
Pertinence Item 11	12	3	3	3.00	.000
Clarté Item 11	11	2	3	2.82	.405
Pertinence Item 12	12	1	3	2.42	.669
Clarté Item 12	12	1	3	2.42	.793
Pertinence Item 13	12	2	3	2.92	.289
Clarté Item 13	12	1	3	2.67	.651

Tables 2 : G-Study and D-study Coefficients for 4 Raters, 1 Occasion, 12 Items, 280 Subjects

			D-Study							
	G-Study		1 Rater		2 Raters		3 Raters		5 Raters	
	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute
Nuit										
Item										
1	0.963	0.963	0.867	0.867	0.929	0.929	0.952	0.952	0.970	0.970
2	0.977	0.976	0.913	0.911	0.954	0.954	0.969	0.969	0.981	0.981
3	0.966	0.965	0.875	0.874	0.933	0.933	0.955	0.954	0.972	0.972
4	0.977	0.977	0.915	0.915	0.956	0.956	0.970	0.970	0.982	0.982
5	0.992	0.992	0.970	0.970	0.985	0.985	0.990	0.990	0.994	0.994
6	0.990	0.990	0.963	0.962	0.981	0.980	0.987	0.987	0.992	0.992
7	0.958	0.954	0.850	0.839	0.919	0.913	0.945	0.940	0.966	0.963
8	0.989	0.989	0.956	0.956	0.978	0.978	0.985	0.985	0.991	0.991
9	0.991	0.991	0.966	0.966	0.983	0.983	0.988	0.988	0.993	0.993
10	0.889	0.889	0.667	0.667	0.800	0.800	0.857	0.857	0.909	0.909
11	0.963	0.963	0.867	0.867	0.929	0.929	0.952	0.952	0.970	0.970
12	0.895	0.868	0.680	0.621	0.809	0.766	0.864	0.831	0.914	0.891
Jour										
Item										
1	0.972	0.972	0.898	0.898	0.946	0.946	0.964	0.964	0.978	0.978
2	0.969	0.968	0.887	0.884	0.940	0.938	0.959	0.958	0.975	0.974
3	0.974	0.973	0.904	0.902	0.950	0.948	0.966	0.965	0.979	0.979
4	0.970	0.969	0.890	0.888	0.942	0.941	0.960	0.960	0.976	0.975
5	0.955	0.953	0.841	0.836	0.913	0.911	0.941	0.939	0.963	0.962
6	0.966	0.966	0.877	0.877	0.934	0.934	0.955	0.955	0.973	0.973
7	0.947	0.947	0.816	0.816	0.899	0.899	0.930	0.930	0.957	0.957
8	0.913	0.911	0.725	0.720	0.841	0.837	0.888	0.885	0.830	0.928
9	0.991	0.991	0.967	0.967	0.983	0.983	0.989	0.989	0.993	0.993
10	0.949	0.949	0.823	0.823	0.903	0.903	0.933	0.933	0.959	0.959
11	0.907	0.907	0.709	0.709	0.830	0.830	0.880	0.880	0.924	0.924
12	0.938	0.932	0.791	0.774	0.883	0.872	0.919	0.911	0.950	0.945
Soir										
Item										
1	0.951	0.947	0.828	0.817	0.906	0.899	0.935	0.930	0.960	0.957
2	0.970	0.969	0.889	0.888	0.941	0.940	0.960	0.959	0.976	0.975
3	0.959	0.957	0.854	0.848	0.921	0.918	0.946	0.944	0.967	0.965
4	0.989	0.989	0.959	0.959	0.979	0.979	0.986	0.986	0.992	0.992
5	0.974	0.973	0.904	0.901	0.950	0.948	0.966	0.965	0.979	0.978
6	0.958	0.957	0.851	0.847	0.920	0.917	0.945	0.943	0.966	0.965
7	0.943	0.940	0.805	0.796	0.892	0.887	0.925	0.921	0.954	0.951
8	0.365	0.364	0.126	0.125	0.223	0.223	0.302	0.300	0.418	0.417
9	0.995	0.995	0.982	0.982	0.991	0.991	0.994	0.994	0.996	0.996
10	0.968	0.968	0.885	0.885	0.939	0.939	0.958	0.958	0.975	0.975
11	0.526	0.526	0.217	0.217	0.357	0.357	0.454	0.454	0.581	0.581
12	0.910	0.896	0.716	0.683	0.834	0.811	0.883	0.866	0.926	0.915

Tables 3 : G-Study Coefficients for 4 Raters, 1 Occasion, 12 Items, 280 Subjects

	Variance component (%)			G-Study		Relative Variance Error				
	P	I	PI	Relative	Absolute	P	I	PI	Mean	SD from mean
Nuit										
Item										
1	86.7	0.0	13.3	0.963	0.963	...	...	0.002	1.052	0.025
2	91.1	0.1	8.7	0.977	0.976	...	...	0.006	1.348	0.053
3	87.4	0.2	12.5	0.966	0.965	...	...	0.013	1.515	0.063
4	91.5	0.0	8.5	0.977	0.977	...	...	0.002	1.075	0.033
5	97.0	0.0	3.0	0.992	0.992	...	...	0.003	2.054	0.066
6	96.2	0.1	3.7	0.990	0.990	...	...	0.004	1.500	0.065
7	83.9	1.3	14.8	0.958	0.954	...	...	0.010	1.211	0.058
8	95.6	0.0	4.4	0.989	0.989	...	...	0.001	1.034	0.024
9	96.6	0.0	3.4	0.991	0.991	...	...	0.001	1.075	0.027
10	66.7	0.0	33.3	0.889	0.889	...	...	0.001	1.008	0.008
11	86.7	0.0	13.3	0.963	0.963	...	...	0.002	1.052	0.025
12	62.1	8.6	29.3	0.895	0.868	...	...	0.055	2.557	0.147
Jour										
Item										
1	89.8	0.0	10.2	0.972	0.972	...	...	0.010	1.378	0.061
2	88.4	0.3	11.3	0.969	0.968	...	...	0.011	1.505	0.062
3	90.2	0.2	9.6	0.974	0.973	...	...	0.011	1.484	0.067
4	88.8	0.2	11.0	0.970	0.969	...	...	0.004	1.135	0.037
5	83.6	0.5	15.8	0.955	0.953	...	...	0.026	1.536	0.083
6	87.7	0.0	12.3	0.966	0.966	...	...	0.011	1.276	0.058
7	81.6	0.0	18.4	0.947	0.947	...	...	0.018	1.388	0.059
8	72.0	0.7	27.3	0.913	0.911	...	...	0.009	1.146	0.037
9	96.7	0.0	3.3	0.991	0.991	...	...	0.001	1.078	0.033
10	82.3	0.1	17.7	0.949	0.949	...	...	0.012	1.214	0.049
11	70.9	0.0	29.1	0.907	0.907	...	...	0.005	1.042	0.024
12	77.4	2.2	20.4	0.938	0.932	...	...	0.065	2.372	0.134
Soir										
Item										
1	81.7	1.4	16.9	0.951	0.947	...	...	0.016	1.422	0.072
2	88.8	0.2	11.0	0.970	0.969	...	...	0.007	1.339	0.053
3	84.8	0.6	14.5	0.959	0.957	...	...	0.016	1.557	0.072
4	95.9	0.0	4.1	0.989	0.989	...	...	0.002	1.118	0.043
5	90.1	0.4	9.5	0.974	0.973	...	...	0.011	1.793	0.073
6	84.7	0.5	14.8	0.958	0.957	...	...	0.009	1.256	0.053
7	79.6	1.2	19.2	0.943	0.940	...	...	0.014	1.333	0.062
8	12.5	0.5	87.0	0.365	0.364	...	...	0.003	1.014	0.009
9	98.2	0.0	1.8	0.995	0.995	...	...	0.001	1.118	0.042
10	88.5	0.0	11.5	0.968	0.968	...	...	0.002	1.055	0.028
11	21.7	0.0	78.3	0.526	0.526	...	...	0.002	1.009	0.006
12	68.3	4.6	27.1	0.910	0.896	...	...	0.057	2.428	0.130

Tables 4 : Factor Analysis, 12 Raters, 11 Items, 280 Subjects

Nuit

Facteur	3 Facteurs 1	2	3	4 Facteurs 1	2	3	4	5 Facteurs 1	2	3	4	5
08	.789											
10	.729		.323									
11	.596											
04	.563	.347	-.426									
09	.518											
05		.694										
03		.662										
01		.540										
07		.345	.645									
02			-.379									
06			.377									

Jour

Facteur	3 Facteurs 1	2	3		4 Facteurs 1	2	3	4	5 Facteurs 1	2	3	4	5
05	.860			05	.888								
03	.567			03	.519								
01	.511			04	.486								
04	.452			08	.440								
08	.405			01	.397								
10	.400			11									
07		.657		10		.891							
06		.333		02		.383	-.516						
02	.407		-.470	09			-.466						
09			-.367	06				.558					
11				07				.368					

Soir

Facteur	3 Facteurs 1	2	3	4 Facteurs 1	2	3	4		5 Facteurs 1	2	3	4	5
01	.801							01	.737				
05	.631							05	.668				
04	.608							04	.654				
09		.760						09		.976			
10		.378	.316					10		.314	.648		
08		.330						11			.516		
07		.328						03			.329		
11			.671					08				.456	
03			.427					02				.426	
06								07					.561
02								06					.437

N280

Facteur	3 Facteurs 1	2	3		4 Facteurs 1	2	3	4		5 Facteurs 1	2	3	4	5
05	.696			05	.697				05	.691				
01	.585			01	.575				01	.582				
03	.552			03	.564				03	.562				
07		.622		02		.485			07		.755			
06		.341		10		.455			10		.302			
08			-.609	09					06					
11			-.463	07			.545		11			-.608		
04	.325		-.424	06			.405		08			-.562		
10			-.323	11				-.613	04			-.446		
02				08				-.532	02				.555	
09				04	.300			-.442	09					.669

Table 5 : Factor Analyses, 11 Items, 280 Subjects

Factor	Respiration/ Circulation	Social support/ Cardiac stability	Anxiety/ Pain	Direct care	Omitted
Items	Hemodynamic Instrumentation Respiration	Family Heart Rate	Anxiety Pain	Examination Dressings Bleeding	Isolation

Table 6 : Concurrent Validity, NICCQ/APACHE II

	APACHE II				
	Night N=28	Day N=29	Evening N=23	Total N=80	Total (excluding outliers) N=76
Item 1	0.605**	0.246	0.689**	0.441**	0.463**
Item 2	0.684**	0.200	-0.265	0.307**	0.281**
Item 3	0.563**	0.314	0.261	0.381**	0.354**
Item 4	0.674**	0.281	0.627**	0.468**	0.449**
Item 5	0.161	0.192	0.385	0.194	0.215
Item 6	-0.197	0.360	-0.077	-0.261	-0.302
Item 7	0.182	-0.092	-0.311	-0.032	-0.106
Item 8	0.508**	0.342	0.241	0.386**	0.319**
Item 9	0.449	-0.196	0.341	0.136	0.031
Item 10	0.546**	0.025	0.038	0.213	0.093
Item 11	0.733**	0.119	-0.076	0.342	0.253*
Global	0.260	0.181	0.601	0.29601**	0.35949**
Mean 11 items	0.695**	0.212	0.582**	0.44002**	0.41723**
	GLOBAL SCORE				
	Night N=28	Day N=29	Evening N=23	Total N=80	Total (excluding outliers) N=76
Mean 11 items	0.385*	0.927**	0.885**	0.67617**	0.93406**

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

Table 7 : Original Items of the Nursing Intensity Critical Care Questionnaire (NICCQ)

Item	Name	Item	Name	Item	
1	Respiration	6	Pain	11	Family
2	Cardiac Rhythm	7	Anxiety	12	Examination
3	Hemodynamics	8	Dressings	13	Global assessment
4	Bleeding	9	Nursing Surveillance		
5	Instrumentation	10	Isolation		

Table 8 : Revised Items of the Nursing Intensity Critical Care Questionnaire (NICCQ)

Item	Name	Item	Name	Item	
1	Respiration	6	Pain	11	Family
2	Cardiac Rhythm	7	Anxiety	12	Examination
3	Hemodynamics	8	Dressings	13	Global assessment
4	Bleeding	9	Nursing Surveillance		
5	Instrumentation	10	Isolation		

Table 9 : Criterion Validity: Nursing Intensity Critical Care Questionnaire (NICCQ) and Acute Physiology And Chronic Health Evaluation (APACHE II)

		APACHE II				
		Night	Day	Evening	Total	Total (excluding outliers)
		N=28	N=29	N=23	N=80	N=76
NICCQ	Item 1	0.605**	0.246	0.689**	0.441**	0.463**
	Item 2	0.684**	0.200	-0.265	0.307**	0.281**
	Item 3	0.563**	0.314	0.261	0.381**	0.354**
	Item 4	0.674**	0.281	0.627**	0.468**	0.449**
	Item 5	0.161	0.192	0.385	0.194	0.215
	Item 6	-0.197	0.360	-0.077	-0.261	-0.302
	Item 7	0.182	-0.092	-0.311	-0.032	-0.106
	Item 8	0.508**	0.342	0.241	0.386**	0.319**
	Item 9	0.449	-0.196	0.341	0.136	0.031
	Item 10	0.546**	0.025	0.038	0.213	0.093
	Item 11	0.733**	0.119	-0.076	0.342	0.253*
	Global	0.260	0.181	0.601	0.296**	0.360**
	Mean 11 items	0.695**	0.212	0.582**	0.440**	0.417**

* p<0.05, two-tailed
** p<0.01, two-tailed

		GLOBAL SCORE				
		Night	Day	Evening	Total	Total (excluding outliers)
		N=28	N=29	N=23	N=80	N=76
NICCQ	Mean 11 items	0.385*	0.927**	0.885**	0.676**	0.934**

* p<0.05, two-tailed
** p<0.01, two-tailed

Table 10 : Factor Analyses (PAF, OBLIMIN), 11 Items, 280 Subjects

Name of Factor	Items	Regression Coefficients (loadings)* Factors				Cronbach's Alpha
		F_1	F_2	F_3	F_4	
F_1 Respiration / Circulation	05-Instrumentation 01-Respiration 03-Hemodynamics	0.697 0.575 0.564				0.640
F_2 Social support / Cardiac stability	02-Heart Rate 10-Family 09-Isolation		0.485 0.455 (0.246)			0.311 including Item 9 0.289 excluding item 9
F_3 Anxiety / Pain	07-Anxiety 06-Pain			0.545 0.405		0.356
F_4 Direct care	11-Examination 08-Dressings 04-Bleeding				0.613 0.532 0.442	0.554
11 item questionnaire		Percentage of variance explained: Principal component (56.28%) Principal axis factoring (32.05%)				
* Loadings inferior to 0.35 were not included except for item 9.						

B: Approbation of the scientific committee

INSTITUT DE CARDIOLOGIE DE MONTRÉAL

ÉVALUATION D'UN PROJET
COMITÉ SCIENTIFIQUE DE LA RECHERCHE

Réunion du CIR : 1er août 2012

No du projet : 12-1379

Investigateur principal : Dre Sylvie Cossette

Titre du projet : **The critical care nursing workload questionnaire : validation study in cardiac surgery patients.**

Décision du comité :

=> Classe 1 - Approuvé sans modification.*

Classe 2 - Approuvé mais une réponse aux commentaires ou aux questions est nécessaire.*

Classe 3 - Projet acceptable, mais une réponse aux commentaires ou aux questions est nécessaire avant une approbation définitive.*

Classe 4 - Problèmes majeurs identifiés, une révision majeure est nécessaire avant reconsidération.*

Classe 5 - Autre - voir ci-dessous.*

Commentaires du comité :

- Aucun commentaire.

Contrat : ☐ en attente de recevoir un contrat ☐ contrat en processus de révision
☐ contrat prêt pour signature ☒ non applicable

Dr Jean-Claude Tardif
Président
Comité scientifique de la recherche

Adressez vos réponses au Comité interne de la recherche, Secrétariat du Comité d'éthique.
*Le projet sera acheminé au Comité d'éthique pour évaluation de la déontologie.

Centre de recherche
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Institut universitaire affilié à l'Université de Montréal

C: Conditional approbation of the Ethics Committee

INSTITUT DE CARDIOLOGIE DE MONTRÉAL

AFFILIÉ À Université de Montréal

Le 24 août 2012

Docteure Sylvie Cossette
À l'attention de : Monsieur Shawn Champigny
Centre de recherche
Institut de Cardiologie de Montréal

Projet #12-1379 **The critical care nursing workload questionnaire: validation study in cardiac surgery patients.**

Chère Docteure Cossette,

Nous vous adressons la décision du Comité d'éthique lors de l'analyse de vos documents soumis à la réunion du 16 août 2012 concernant votre projet.

2012-07-18	Documents soumis : Formulaire de soumission d'un projet de recherche, version no. 1 datée du 18 juillet 2012. Formulaire de soumission du protocole d'éthique médicale, version no. 1 datée du 18 juillet 2012. Lettre d'appui de Mme Marie-Hélène Carbonneau, directrice des soins infirmiers de l'ICM, en date du 4 juillet 2012. Demande d'autorisation de consulter les dossiers médicaux au DSP, en date du 17 juillet 2012. Autorisation du DSP de consulter les dossiers médicaux, en date du 17 juillet 2012. Annexe 1 : "Critical care nurse workload questionnaire", version reçue le 18 juillet 2012. Grille d'analyse à compléter par l'expert, version reçue le 18 juillet 2012. Formulaires de consentement, ICM, français et anglais, versions initiales reçues le 17 juillet 2012. Formulaires de consentement, ICM, français, experts & infirmières, versions initiales reçues le 18 juillet 2012.
2012-08-01	Approbation scientifique.

Résumé: Nouveau projet institutionnel biparti. Il est premièrement visé de réviser et de valider le Critical Care Nursing Workload Questionnaire (CCNWQ) présentement utilisé aux soins intensifs chirurgicaux à l'Institut de Cardiologie de Montréal en quatre étapes : réviser le CCNWQ et évaluer la validité du contenu; réaliser une étude de généralisabilité pour évaluer la fiabilité des composantes de la variance des sources d'erreurs de l'instrument; évaluer la structure factorielle du CCNWQ, ainsi que la fiabilité de chacun des facteurs; évaluer la validité de critère du CCNWQ en utilisant l'APACHE II en tant que critère concomitant.

Il est prévu que l'étude se déroule en deux parties. La partie initiale consiste à évaluer la validité de la version courante de l'instrument avec l'aide de 6 infirmières expertes et de 2 médecins experts. La deuxième partie consistera à évaluer les propriétés psychométriques du questionnaire en utilisant une étude croisée en design de généralisation avec la participation de 12 infirmières et de 288 patients.

Financement : Projet de Maîtrise.

Décision du comité interne : 2012-08-01 : Classe 1 – Approuvé sans modification.

Décision du Comité : Accepté conditionnellement aux réponses aux questions et commentaires du CÉR.

Commentaires :

1) Projet qui ne présente à peu près pas de risques.

2) Le Comité comprend que la direction des soins infirmiers a accepté que ce projet soit conduit à l'ICM et conséquemment présume que les ressources humaines sont disponibles. Pouvez-vous s.v.p. valider cet énoncé.

3) Qui paiera les infirmières pour leur participation à la session de formation d'une heure? Les autres infirmières seront-elles pénalisées (devront-elle assumer la couverture de celles qui s'absenteront pour assister à la formation?).

4) Le Comité se questionne sur la faisabilité de ce projet, surtout à propos de la collecte des données au niveau des infirmières. S.v.p., justifier qu'il est possible que 4 infirmières travaillent les mêmes journées et sur le même quart de travail pendant 32 jours sur une période de 4 mois.

5) Attester que ce projet de recherche n'affectera pas les soins cliniques en aucune circonstance.

6) Pourquoi ne pas faire une étude de faisabilité avant de commencer le projet?

7) À quel endroit les données seront-elles conservées par Shawn Champigny? Cette conservation n'est-elle pas la responsabilité de la chercheure principale?

8) Le Comité questionne pourquoi les patients devraient signer un formulaire de consentement puisque le patient n'a aucune participation active. À éliminer ou en justifier la nécessité d'utilisation.

9) Le Comité ne suggère pas de changement au formulaire de consentement pour les infirmières et à celui pour les experts.

Veuillez agréer, Chère Docteure Cossette, l'expression de mes sentiments les meilleurs.

Michel Carrier, MD
Chirurgien cardiovasculaire et thoracique
Président du Comité d'éthique de la recherche et
du développement des nouvelles technologies

MC/fd

D: Feasibility Study

Rapport portant sur l'étude de faisabilité

Lors de la rencontre du 16 août 2012 du comité d'éthique de la recherche, ce dernier avait questionné la faisabilité de la collecte de données au niveau des infirmières du projet de recherche #12-1379 : **"The Nursing Intensity Critical Care Questionnaire (NICCQ): Validation Study In Cardiac Surgery Patients"**.

Le protocole soumis proposait un échantillon de 96 patients par quart de travail pour un total de 288 patients. Pour chacun des quarts de travail, 4 infirmières devaient travailler au même moment à 32 occasions sur une période de 4 mois. À chacune des occasions, 3 patients étaient évalués (32 occasions x 3 patients par occasion = 96 patients). Dans la lettre de réponse que nous vous avons fait parvenir datée du 30 août 2012, nous avions proposé que;

« Cette étude de faisabilité sera effectuée auprès de n = 6 patients sur chacun des quarts de travail pour un total de n = 18 patients sur une période d'une semaine. »

Un exemple de canevas d'horaire de 4 infirmières travaillant de jour avait aussi été envoyé en annexe.

Suite à la réception des réponses aux questions, le comité d'éthique de la recherche et du développement des nouvelles technologies a approuvé le projet de recherche #12-1379 lors de la rencontre du 13 septembre 2012. Cependant, celui-ci a demandé qu'on lui fasse parvenir un rapport portant sur l'étude de faisabilité.

Vous trouverez ci-dessous le rapport de l'étude de faisabilité tel que demandé par le comité :

Modalités de l'étude de faisabilité :

L'étude de faisabilité a été réalisée du 22 au 28 octobre 2012. Pendant cette période, 3 équipes de 4 infirmières chacune, ont été formées : une équipe de jour, une équipe de soir et une équipe de nuit. Chaque équipe a évalué les patients deux fois (deux quarts). À chaque quart, l'équipe a évalué trois patients. Au total, 18 patients ont été évalués selon ces modalités qui sont identiques à celles prévues au protocole de recherche.

Au début du mois d'octobre 2012, 12 infirmières qui répondaient aux critères d'inclusion ont été recrutées pour l'étude de faisabilité. Afin d'assurer un minimum de collecte de données par semaine, toutes les infirmières qui ont été recrutées avaient la même fin de semaine de travail. Toutes les infirmières approchées ont accepté de participer au projet selon les modalités établies.

Pendant la semaine du 8 octobre, les infirmières de chacune des équipes ont été rencontrées durant une session d'information d'une durée d'une heure. Durant la rencontre, le "Nursing Intensity Critical Care Questionnaire" a été présenté aux infirmières. Le déroulement du processus de collecte de données a aussi été expliqué, à la suite de quoi, les infirmières ont signé un formulaire de consentement.

Collaboration et Support des responsables :

L'équipe de recherche a reçu le support des assistantes infirmières chefs des soins intensifs chirurgicaux pour assurer le bon fonctionnement du projet. Dès le premier jour, un plan de relève pour chacune des infirmières a été établi avant l'arrivée du chercheur pour assurer la qualité des soins. Il y a eu une participation active des 12 infirmières participant à l'étude de faisabilité. Elles ont posé plusieurs questions et suggéré quelques éléments d'amélioration du processus notamment de faire un rappel concernant l'horaire de collecte de données. L'avis des assistantes infirmières chefs et de l'infirmière chef a été demandé pour assurer le meilleur dénouement possible. Elles ont confirmé que le déroulement se passait bien et la chef de service du département a écrit une lettre qui témoigne du bon déroulement du projet de recherche (voir lettre en annexe).

Réalisations connexes à l'étude de faisabilité :

L'étude de faisabilité s'est terminée le 28 octobre 2012. Des données additionnelles ont été colligées entre le 29 octobre et le 11 novembre 2012. Au total, 33 patients ont été évalués selon les mêmes modalités, ce qui permet de confirmer le rythme de collecte des données. La durée de collecte prévue au protocole est donc confirmée (114 jours).

Au cours de l'étude de faisabilité, les modalités d'identification des patients ont été précisées afin de ne pas faire évaluer un patient par plus d'un groupe d'infirmière et ce conformément au protocole de recherche. À cette fin, le processus suivant à été adopté : une liste de patients présents au département est remise à l'assistante infirmière avec le nom des patients qui ont déjà participé à l'étude surligné en jaune. À l'aide de cette liste, elle s'assurait que ces patients n'étaient pas assignés à nouveau aux infirmières qui participaient au projet.

Problèmes rencontrés et solutions :

Le maintient des équipes étant prévue dans le devis statistique (étude de fiabilité) du protocole de recherche, les contretemps ont été documentés. Ainsi, pendant l'étude de faisabilité, la collecte des données a dû être reportée à 4 occasions. À deux occasions, une des infirmières d'une des équipes était absente; une fois pour une raison médicale et une fois pour une raison familiale. De plus, la collecte des données d'une équipe a été annulée parce qu'à ce moment, il a été jugé qu'il n'était pas possible de libérer les infirmières tout en assurant la sécurité des patients, étant donné que plusieurs patients étaient dans un état critique. Finalement, à une occasion, une infirmière s'est fait offrir une « absence autorisé » pour la nuit et elle a accepté, ne se souvenant plus que cette journée était prévue pour le projet. Ce type de contretemps et de report était prévu lors de la planification de la recherche. L'étude de faisabilité a permis d'identifier des moyens de les réduire, notamment par une meilleure communication auprès des infirmières participantes.

Cette étude de faisabilité a démontré qu'il était possible d'atteindre la taille d'échantillon de 288 patients prévue au protocole de recherche. Pour améliorer le processus, l'horaire des jours de collectes de données a été remis aux infirmières à l'avance pour qu'elles prévoient ces journées. Un horaire a aussi été remis à l'assistante infirmière chef pour qu'elle soit en mesure d'assurer une relève pour remplacer les infirmières qui font partie du projet lors des jours de collecte de données.

L'étude de faisabilité étant terminée, les équipes sont maintenant prêtes à débuter la collecte de données prévue au protocole de recherche. Les horaires de travail pour la période se terminant le 9 février 2013 sont maintenant disponibles et les journées de collecte déjà planifiées.

Veuillez agréer, Docteur Carrier, l'expression de mes sentiments les meilleurs.

Shawn Champigny
Étudiant à la maitrise (administration des services de santé)

Dre Sylvie Cossette
Chercheure Principale

Sous la responsabilité de :

Clément Dassa, Ph. D.
Nicole Leduc, Ph. D.
Nicole Parent, Ph. D.

E: Final approbation of the ethics committee

INSTITUT DE CARDIOLOGIE DE MONTRÉAL

AFFILIÉ À Université de Montréal

Le 22 février 2013

Docteure Sylvie Cossette
À l'attention de : Monsieur Shawn Champigny
Centre de recherche
Institut de Cardiologie de Montréal

Projet #12-1379 **The critical care nursing workload questionnaire: validation study in cardiac surgery patients.**

Chère Docteure Cossette,

Nous vous adressons la décision du Comité d'éthique lors de l'analyse de vos documents soumis à la réunion du 14 février 2013 concernant votre projet.

2013-01-23 Réponses aux questions et commentaires du CÉRDNT du 13 septembre 2012. Lettre explicative de Mme Johanne Bernatchez, coordonnatrice des soins intensifs chirurgicaux, appuyant la thèse de faisabilité de l'étude, datée du 10 décembre 2012.

Décision du Comité : Le Comité remercie l'équipe de recherche d'avoir obtempéré à sa demande et de fournir un rapport de faisabilité de l'étude honnête et bien étoffé.

Veuillez agréer, Chère Docteure Cossette, l'expression de mes sentiments les meilleurs.

Michel Carrier, MD
Chirurgien cardiovasculaire et thoracique
Président du Comité d'éthique de la recherche et
du développement des nouvelles technologies

MC/fd

5000, rue Bélanger, Montréal (Québec) H1T 1C8 • Tél. : 514 376-3330

F: Questionnaire completed by expert panel

GRILLE D'ANALYSE À COMPLÉTER PAR L'EXPERT

Critical Care Nursing Workload Questionnaire

Dans le cadre du projet de recherche intitulé :

"The Critical Care Nursing Workload Questionnaire: Validation Study In Cardiac Surgery Patients"

Préparé par:

Shawn Champigny
Candidat à la maitrise (administration des services de santé)

Sous la responsabilité de :

Clément Dassa, Ph. D.
Nicole Leduc, Ph. D.
Nicole Parent, Ph. D.

Université de Montréal
Centre de recherche de
L'Institut de Cardiologie de Montréal

Identification du répondant

1. Indiquez votre nom (facultatif) : _____
2. Indiquez votre discipline (cochez la ou les cases appropriées)

   ☐ Infirmière

   ☐ Médecin

   ☐ Statistiques et mesure

   ☐ Autre (précisez) : _____

3. Indiquez le nombre d'année d'expérience que vous avez en soins intensifs chirurgicaux.

_____

GUIDE POUR L'EXPERT

Dans le cadre de mon mémoire de maîtrise, nous poursuivons la révision et la validation du Critical Care Nursing Workload Questionnaire (CCNWQ). Ce questionnaire a pour but de mesurer l'intensité de soins infirmiers requis par un patient en soins intensifs chirurgicaux ayant subi une chirurgie cardiaque à l'Institut de Cardiologie de Montréal.

Nous vous demandons, à titre d'expert, de vous prononcer, selon votre jugement professionnel, sur la **pertinence** et la **clarté** des items du CCNWQ.

La **pertinence** se définie comme le potentiel des différents items identifiées dans l'instrument (incluant les indicateurs cliniques de soins, les items, le système de cotation des chacun des items et le système de cotation du score global) à fournir de l'information sur l'intensité des soins infirmiers requis d'un patient ayant subi une chirurgie cardiaque.

La **clarté** est définie comme l'intelligibilité ou la compréhensibilité de la définition des indicateurs soins, des items et du système de cotation des items ainsi que du score global en lien avec les objectifs de l'outil.

BRÈVE INTRODUCTION AU CCNWQ

Voici un rappel de certains grands concepts clés retrouvés dans le CCNWQ vous est ici présenté. Ce rappel, nous l'espérons, vous permettra dans un premier temps d'avoir un coup d'œil rapide sur le questionnaire dans sa globalité et dans un deuxième temps, vous aidera à effectuer les exercices demandés.

En 2003, des infirmières spécialisées en soins intensifs chirurgicaux (SIC) de l'Institut de Cardiologie de Montréal (ICM) ont développées un questionnaire pour mesurer l'intensité des soins infirmiers requis par un patient en SIC suite à une chirurgie cardiaque. Ce questionnaire a été développé en se basant sur la littérature et l'expertise clinique d'infirmières en SIC. Il est utilisé à l'ICM depuis plusieurs années mais n'a pas fait l'objet d'une étude de validation. Le questionnaire compte neuf indicateurs cliniques de soins comportant un à quatre items chacun mesurés utilisant une échelle ordinale en trois points ainsi qu'un score global utilisant une échelle ordinale en cinq points. L'intensité des soins requis pour chacun des patients est mesurée à la fin de tous les quarts de travail de huit heures.

L'objectif de la validation de contenu est d'apporter les changements nécessaires afin d'avoir un instrument de mesure qui est fiable et valide. Aux besoins, des changements, des additions ou des soustractions d'items ainsi que des changements au niveau de la structure seront apportés à au questionnaire. Pour rendre ceci possible, nous devons nous assurer d'aller chercher l'expertise nécessaire pour aider dans la validation de l'instrument. C'est pour cette raison que nous vous demandons de remplir le guide au meilleur de vos connaissances.

DIRECTIVES AUX EXPERTS POUR REMPLIR LE QUESTIONNAIRE

Pour vous prononcer sur la pertinence et la clarté du questionnaire, vous trouverez ci-joint une description de chaque tâche du CCNWQ révisé. Pour chacun des items, vous trouverez les systèmes de cotations ainsi que les items tel que trouvé dans le questionnaire actuel.

Dans votre appréciation du questionnaire, nous vous demandons de coter pour chaque tâche, sur une échelle de 1 à 3, la **pertinence** du système de cotation et des items (1 = non pertinent, 2 = plus ou moins pertinent et 3 = clair). Ensuite, vous pouvez inscrire vos commentaires directement sur la version électronique si vous le désirez dans l'espace réservé à cet effet à la suite des sections portant respectivement sur la description de chaque tâche et du système de cotation.

En vous remerciant de votre précieuse collaboration,

Shawn Champigny, BSc,
Candidant à la maîtrise (administration des services de santé)

École de Santé Publique, Faculté de Médecine
Université de Montréal
1420 Mont-Royal
Montréal, Qc
H2J 4E9

Laboratoire de Recherche Sylvie Cossette, Inf, PhD
Centre de recherche de l'Institut de Cardiologie de Montréal
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H1T 1C8
(514)-376-3330 poste 2794

EXERCICES RÉLIÉS À LA PERTINENCE ET LA CLARTÉ

les indicateurs cliniques de soins, les items, le système de cotation des chacun des items et le système de cotation du score global

Système de cotation du score globale

Système de cotation des items

Chacun des items

Pages 6 – 13 à remplir par l'expert

Évaluation de la pertinence et clarté de chacun des items

1.1 Échelle de mesure :

Échelle de mesure utilisée pour mesurer l'intensité des soins du score global : ☐légère ☐ légère/modérée ☐ modérée ☐ modérée/sévère ☐ sévère					
Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)
Commentaires			Commentaires		

1.2 Échelle de mesure :

Échelle de mesure utilisée pour mesurer l'intensité des soins pour chacun des items : ☐ légère ☐ modérée ☐ sévère					
Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)
Commentaires			Commentaires		

2. Respiration (Répondre à seulement un des trois indicateurs dépendants de la condition du patient)

Intensité légère	**Intensité modérée**	**Intensité sévère**
❑ Extubé : Respiration autonome facile avec ou sans oxygénothérapie ❑ Intubé : N/A ❑ Extubation : protocole d'extubation JIT bien toléré, patient est ou sera extubé rapidement (< de 4 heures)	❑ Extubé : Respiration autonome avec dépendance au ventimasque ou collier trachéale > 24 hrs ❑ Intubé : Paramètres de ventilation dans les limites de la normale ❑ Extubation : protocole d'extubation JIT en cours / évolution progressive et normale	❑ Extubé : Respiration laborieuse (Réflexe de toux faible ou absent) ou collier trachhéale < 24 hrs ❑ Intubé : Paramètres ventilatoire maximaux / ajustement fréquent des paramètres (Jet, BiPAP, CPAP facial, NO, Flovan ou trachéo sous respirateur) ❑ Extubation : retardée, difficile ; nécessité de ré intuber

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)

Commentaires	Commentaires

3. Rythme cardiaque

Intensité légère	**Intensité modérée**	**Intensité sévère**
❑ Absence d'arythmie ou présence d'arythmies avec réponse hémodynamique stable	❑ Arythmie avec administration médication anti-arythmique et réponse hémodynamique stable	❑ Arythmie avec réponse hémodynamique instable ; administration et titrage de médication (ex. vasopresseurs)

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)

Commentaires	Commentaires

4. Hémodynamie

Intensité légère	**Intensité modérée**	**Intensité sévère**
❑ Stabilité hémodynamique : absence d'inotropes ou vasapressors	❑ Stabilité hémodynamique : présence d'inotropes et/ou vasopressors et/ou BIA ou inotropes et/ou vasopressors en sevrages	❑ Instabilité hémodynamique : dépendances / titrages des inotropes et/ou vasopressors

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)

Commentaires	Commentaires

5. Saignements

Intensité légère	**Intensité modérée**	**Intensité sévère**
❑ Absence ou saignement minimal (<50 ml / h x 2 heures)	❑ Saignement modéré (<100 ml / h x 2 heures), transfusion ponctuel	❑ Saignement abondant (>100ml / h x 2 heures), cells saver, multiple transfusion sanguine, réchauffe sang, administration de facteur de coagulation

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)
Commentaires			Commentaires		

6. Instrumentation

Intensité légère	**Intensité modérée**	**Intensité sévère**
❑ Instrumentation absente ou légère (ligne artérielle, drain médiastinal et/ou pleural, cathétère central	❑ Processus de désinstrumentation JIT : drain médiastinaux et pleuraux, swan ganz, LA, cathéter central, BIA	❑ Installation / ajustement de technologie spécialisée (hémofiltration, SWAN, BIA, ECMO, cœur mécanique ou assistance ventriculaire

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)
Commentaires			Commentaires		

7. Douleur

Intensité légère	**Intensité modérée**	**Intensité sévère**
❑ Douleur à l'EVA (0 à 3), totalement soulagée par analgésie post op ou par coanalgésie ponctuelle	❑ Douleur à l'EVA (4 à 6), ajustement optimale et régulière de la douleur par analgésie et coanalgésie	❑ Douleur à l'EVA (7 à 10), gestion de la douleur complexe, difficile à contrôler ou patient non soulagé

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)
Commentaires			Commentaires		

8. Anxiété / Délirium

Intensité légère	**Intensité modérée**	**Intensité sévère**
❑ Anxiété légère ; calme et orienté ; éveillé et coopératif	❑ Anxiété modérée ou variable contrôlée par médication; calme, légère confusion ou désorientation	❑ Anxiété sévère difficilement contrôlable; agité; délirium; contention chimique et/ou physique requise

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)
Commentaires			Commentaires		

9. Surveillance infirmière

Intensité légère	Intensité modérée	Intensité sévère
❑ Surveillance infirmière ponctuelle et régulière	❑ Surveillance infirmière accrue (monitoring, signes cliniques, sv, valeurs de Swan, signes neurologiques, évaluation des facteurs de risques de dépression respiratoire, cardioversion	❑ Surveillance infirmière constante (risques et complications potentiels élevées)

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)
Commentaires			Commentaires		

10.1 Soins généraux

Intensité légère	Intensité modérée	Intensité sévère
❑ Pansements standards	❑ Pansement stérile (plaie de lit, colostomie)	❑ Pansement VAC ou pansement stérile complexe ou soins de plaies complexes (plaie de lit, colostomie)

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)
Commentaires			Commentaires		

10.2 Soins généraux

Intensité légère	Intensité modérée	Intensité sévère
❑ Absence d'isolement	❑ Isolement (ERV, MRSA, BMR ou C-diff avec ≤ 2 selles par quart de travail	❑ Isolement C-diff avec ≥ 3 selles par quart de travail

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)
Commentaires			Commentaires		

10.3 Soins généraux

Intensité légère	Intensité modérée	Intensité sévère
❑ Capacité d'adaptation de la famille : intervention minimale	❑ Intervention fréquente requises auprès de la famille ou soins palliatifs (soutien à la famille)	❑ Ajout du plan d'intervention familiale

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)
Commentaires			Commentaires		

10.4 Soins généraux

Intensité légère	Intensité modérée	Intensité sévère
❑ Rx et ECG fait au lit	❑ Examen plus complexe (Ex : ETT, EEG) fait au lit	❑ Examen complexe (Ex : ETO, Bronchoscopie) fait au lit ou examen à l'extérieur du département

Pertinence			Clarté		
Non (1)	Plus ou moins (2)	Oui (3)	Non (1)	Plus ou moins (2)	Oui (3)

Commentaires	Commentaires

11.0 Commentaires

Svp ajouter tous commentaires dont vous jugez pertinent

G : Instruments

Date : _____ # Dossier : _____
Heure : _____ Infirmière : _____
Avez-vous été responsable de ce patient pendant le dernier quart de travail : _____

INSTITUT DE CARDIOLOGIE DE MONTRÉAL
DIRECTION DES SOINS INFRIMIERS - SECTEUR CHIRURGIE
NURSING INTENSITY CRITICAL CARE QUESTIONNAIRE (NICCQ)

Questionnaire à compléter par l'infirmière à la fin du quart de travail. Pour chacun des items, veuillez cocher une seule case selon le niveau d'intensité des soins requis par le patient.

		Intensité légère	Intensité modérée	Intensité sévère
1.		**RESPIRATION** (Choisir un seul item selon que le patient est extubé ou intubé)		
	Extubé	❑ **Respiration autonome facile** avec ou sans oxygénothérapie	❑ **Respiration autonome avec dépendance au ventimasque** ou collier trachéal > 24 hrs	❑ **Respiration laborieuse** difficultés respiratoires importantes nécessitant une intervention immédiate (détresse respiratoire, narcose), (pression positive continue; CPAP facial), patient avec possibilité de réintubation
		OU		
	Intubé	❑ **Protocole d'extubation bien toléré** patient sera extubé rapidement (< de 4 heures)	❑ **Paramètres de ventilation dans les limites de la normale**	❑ **Paramètres de ventilation élevés ou maximaux** ajustements fréquents des paramètres, BiPAP®, Oxyde Nitrique (NO), Flolan®)
2.		**RYTHME CARDIAQUE**		
		❑ **Absence d'arythmie**	❑ **Arythmie avec réponse hémodynamique stable** (Voir signes vitaux, fréquence cardiaque, tension artérielle, débit cardiaque, index cardiaque, tension veineuse centrale (TVC)) administration de médication anti-arythmique	❑ **Arythmie avec réponse hémodynamique instable** administration et titrage de médication anti-arythmique
3.		**HÉMODYNAMIE**		
		❑ **Stabilité hémodynamique** absence d'inotropes et de vasopresseurs	❑ **Stabilité hémodynamique** présence d'inotropes et/ou vasopresseurs avec ou sans sevrage	❑ **Instabilité hémodynamique** dépendances / titrages des inotropes et/ou vasopresseurs
4.		**SAIGNEMENTS**		
		❑ **Absence ou saignement minimal** (<50 ml / h x 2 heures)	❑ **Saignement modéré** (entre 50 et 100 ml / h x 2 heures) ou saignement d'une autre origine, transfusion ponctuelle de produits sanguins	❑ **Saignement abondant** (>100ml / h x 2 heures), transfusions de multiples produits sanguins, administration de facteurs de coagulation
5.		**INSTRUMENTATION**		
		❑ **Instrumentation absente ou légère** (ligne artérielle et/ou fémorale, drain médiastinal et/ou pleural, ou cathéter central)	❑ **Désinstrumentation en cours** (drains médiastinaux et pleuraux, cathéter artériel pulmonaire de type Swan-Ganz®, ligne artérielle, cathéter central, ballon intra aortique (BIA))	❑ **Installation, ajout et/ou maintien de technologies spécialisées** (hémofiltration, cathéter artériel pulmonaire de type Swan-Ganz®, BIA, oxygénation par membrane extracorporelle (ECMO), assistance ventriculaire)

	Intensité légère	Intensité modérée	Intensité sévère
	DOULEUR		
6.	❑ **Douleur à l'échelle visuelle analogue (EVA) entre 0 et 3** bien contrôlée par analgésie ou coanalgésie	❑ **Douleur à l'EVA entre 4 et 6** ajustements réguliers de l'analgésie ou coanalgésie	❑ **Douleur à l'EVA entre 7 et 10** gestion complexe de la douleur
	ANXIÉTÉ / DÉLIRIUM		
7.	❑ **Anxiété légère** calme et orienté éveillé et coopératif	❑ **Anxiété modérée** légère confusion ou désorientation contrôlée par médication	❑ **Anxiété sévère** agitation ou délirium plus ou moins contrôlé par contention chimique et/ou physique
	PANSEMENTS		
8.	❑ **Pansements standards**	❑ **Pansements avec technique stérile** (cathéters veineux centraux)	❑ **Changement de pansement stérile complexe (VAC®)** ou soins de plaies complexes
	ISOLEMENT		
9.	❑ **Absence d'isolement**	❑ **Isolement** (Entérocoques Résistants à la Vancomycine (ERV), Staphylococcus Aureus Résistants à la Méthicilline (SARM), Bactéries Multi Résistantes (BMR) ou C-difficile avec ≤ 2 selles par quart de travail)	❑ **Isolement C-difficile** avec ≥ 3 selles par quart de travail
	FAMILLE		
10.	❑ **Interventions minimales** auprès de la famille ou famille non présente	❑ **Interventions fréquentes** auprès de la famille	❑ **Interventions soutenues** auprès de la famille (soins palliatifs, difficulté de communiquer ou d'obtenir la collaboration de la famille et/ou crise au sein de la famille)
	EXAMENS		
11.	❑ **Examens standards faits au lit** (Rayon X (Rx), Électrocardiogramme (ECG), Échographie Transthoracique (ETT) Électroencéphalogramme (EEG))	❑ **Examens complexes faits au lit** (Bronchoscopie, Échographie transoesophagienne (ETO))	❑ **Examens à l'extérieur de l'unité** (Imagerie par Résonance Magnétique (IRM), Scan, cathéter central inséré par voie périphérique (PICC Line))
	APPRÉCIATION GLOBALE DE L'INTENSITÉ DES SOINS		
12.	**Veuillez cocher une seule case :** ☐ **légère** ☐ **légère-modérée** ☐ **modérée** ☐ **modérée-sévère** ☐ **sévère**		

Signature de l'infirmière : _____

APACHE II

Température (°C)	Pression Artérielle Moyenne (mmHg)	Fréquence Cardiaque
Fréquence Respiratoire	Si FIO2 ≥ 0.5 : Grad (A-a)O2*	Si FIO2 < 0.5 : PaO2 (mmHg)
Si ph indisponible: $HCO3^-$ (mmol/L)	pH Artériel	Natrémie (mmol/L)
Kaliémie (mmol/L)	Créatinémie avec IRA (micromol/L)	Créatinémie sans IRA
Hématocrite (L/L)	Leucocytes (/mm^3)	Glasgow
Age		Défaillance viscérale chronique

Et chirurgie : programmée / d'urgence

* PaCO2, PaO2, FIO2

PaCO2

PaO2

FIO2

IRA : Insuffisance rénale aigue

http://www.unc.edu/~rowlett/units/scales/clinical_data.html

H: Consent form

INSTITUT DE CARDIOLOGIE DE MONTRÉAL

Université de Montréal

APPROUVÉ / APPROVED
Comité d'éthique ICM
MHI – Research Ethics Board
Date : 13 septembre 2012 FD

FORMULAIRE DE CONSENTEMENT

PROJET DE RECHERCHE : ICM #12-1379

The Critical Care Nursing Workload Questionnaire : Validation Study in Cardiac Surgery Patients

Investigateur principal et collaborateurs
Sylvie Cossette, Inf, PhD., Shawn Champigny, étudiant maîtrise, Clément Dassa, PhD., Nicole Leduc, PhD., Nicole Parent, PhD., Marie-Hélène Carbonneau, Inf, MSc.

INFORMATIONS - Infirmières

DESCRIPTION GÉNÉRALE

Vous êtes invité à participer à un projet de recherche qui porte sur la validation d'un questionnaire parce que vous êtes une infirmière[1] ou CEPI travaillant aux soins intensifs chirurgicaux (SIC) de l'Institut de Cardiologie de Montréal (ICM). L'étude est sous la responsabilité de Mme Sylvie Cossette, infirmière, PhD, chercheure en soins infirmiers au Centre de recherche de l'ICM et professeure titulaire à la Faculté des sciences infirmières de l'Université de Montréal. Le projet est réalisé dans le cadre des études de maîtrise de Monsieur Shawn Champigny, dirigé par M Clément Dassa, professeur titulaire au département de Médecine sociale et préventive.

Ce formulaire de consentement décrit les procédures que vous devrez suivre si vous acceptez de participer à cette étude.

Avant de signer ce formulaire de consentement, veuillez prendre tout le temps nécessaire pour lire (ou vous faire lire) et comprendre l'information présentée ci-dessous. N'hésitez pas à poser des questions à l'équipe de recherche. Prenez le temps nécessaire pour prendre votre décision.

But de l'étude
La nature :

Cette étude porte sur la révision et la validation d'un instrument nommé le « Critical Care Nursing Workload Questionnaire, » qui mesure l'intensité des soins infirmiers en soins intensifs chirurgicaux.

Les objectifs :

a. Réviser le CCNWQ et évaluer la validité de contenu.
b. Réaliser une étude de généralisabilité pour évaluer la fiabilité et les composantes de la variance des sources d'erreurs de l'instrument.
c. Évaluer la structure factorielle du CCNWQ ainsi que la fiabilité de chacun des facteurs.
d. Évaluer la validité de critère du CCNWQ en utilisant l'APACHE II en tant que critère concomitant.

[1] *Le genre féminin, employé pour alléger le texte, désigne autant les hommes que les femmes*

5000, rue Bélanger, Montréal (Québec) H1T 1C8 | Tél. : 514-376-3330 | Téléc. : 514-376-1355

Justification de la recherche :

Les coûts du système de santé ne cessent d'augmenter chaque année et des contraintes budgétaires s'imposent. Les coûts reliés aux soins infirmiers représentent une grande partie des dépenses globales d'un établissement de santé et ceux reliés aux soins intensifs sont responsables d'une grande partie de ces dépenses également. Dans un tel contexte, il s'avère important d'être en mesure d'évaluer l'intensité des soins infirmiers requis pour chacun des patients afin d'assurer que les ressources soient utilisées de façon optimale tout en assurant la qualité des soins pour les patients.

Au total douze (12) infirmières de L'institut de Cardiologie de Montréal participeront à l'étude.

DÉROULEMENT DE L'ÉTUDE

Votre participation requiert que vous assistiez à une formation d'une durée d'une heure sur l'utilisation du CCNWQ et de l'APACHE II. Cette formation sera obligatoire afin de vous permettre de participer à la phase de la collecte de données.

La collecte de données comptera 32 jours et sera échelonnée sur une période de 4 mois. Au cours de cette période, vous ferez partie d'un groupe de 4 infirmières qui travailleront les mêmes journées et sur le même quart de travail. Trois d'entre vous devront évaluer le patient sous votre responsabilité en utilisant le CCNWQ une heure avant la fin du quart de travail; vous devrez également évaluer les deux autres patients de vos collègues. Une des 4 infirmières n'aura pas de patient sous sa responsabilité. L'infirmière remplira les CCNWQ pour les 3 patients de ses collègues. Tous les jours, les mêmes 3 infirmières auront chacune un patient de recherche sous sa responsabilité et la même infirmière n'en aura pas. Chaque jour un patient fera également l'objet d'une évaluation à l'aide d'un deuxième questionnaire de 12 items, soit l'APACHE II.

Si vous acceptez de participer au projet, votre implication sera requise pour toute la durée du projet, soit la formation d'une heure et les 32 jours de collecte de données. Toutefois, si une des infirmières du groupe s'absente pour une journée, la collecte de donnée sera reportée à un autre jour. Vous pouvez vous retirer à n'importe quel moment, sans aucune conséquence pour vous.

RISQUES ET INCONVÉNIENTS

Vous ne courez aucun risque à participer à cette étude. Aucun inconvénient n'est connu autre que de prendre le temps de participer à la formation d'une heure précédent la collecte de données.

AVANTAGES

Vous ne retirez aucun bénéfice direct en participant à cette étude. Toutefois votre participation à ce projet de recherche contribuera à l'avancement des connaissances dans le domaine des soins infirmiers en cardiologie.

CONFIDENTIALITÉ

Tous les renseignements obtenus seront strictement confidentiels (à moins d'une autorisation de votre part à les communiquer à d'autres personnes ou d'une exception de la loi nous autorisant à les communiquer).

L'équipe de recherche utilisera vos données et en fera l'analyse, avec les données des autres participants pour réaliser ce projet de recherche. Pour protéger votre identité, vos données personnelles ne seront identifiées que par un code qui vous sera assigné en remplacement de votre nom. Les données révélant votre identité seront conservées à l'ICM sous la responsabilité de M Shawn Champigny. Tous les dossiers de recherche seront conservés sous clé et dans des fichiers sécurisés pendant 7 ans.

Afin de s'assurer du bon déroulement du projet, il est possible qu'un délégué du comité d'éthique consulte les données de recherche.

Les résultats de cette étude seront publiés et diffusés, mais aucune information permettant de vous identifier ne sera dévoilée.

PARTICIPATION VOLONTAIRE ET POSSIBILITÉ DE RETRAIT

En signant ce formulaire de consentement, vous ne renoncez à aucun de vos droits prévus par la loi. De plus, vous ne libérez pas les investigateurs de leur responsabilité légale et professionnelle advenant une situation qui vous causerait préjudice.

Votre participation à ce projet est libre et volontaire. Vous pouvez vous retirer du projet en tout temps. Quelle que soit votre décision, cela n'affectera pas le cours de votre travail dans votre unité de soins. En cas de retrait, les données non utilisées seront détruites.

IDENTIFICATION DES PERSONNES-RESSOURCES

Si vous avez des questions concernant le projet de recherche ou si vous éprouvez un problème que vous croyez relié à votre participation au projet de recherche, vous pouvez communiquer avec le chercheur responsable du projet de recherche aux numéros suivants :

Vous pouvez communiquer en tout temps avec :

Institut de Cardiologie de Montréal

Dre Sylvie Cossette, Inf, PhD, Chercheure :	Tél. : (514) 376-3330, poste 4012
Monsieur Shawn Champigny, Étudiant Maîtrise	Tél. : (514) 376-3330, poste 2794

Pour toute question concernant vos droits en tant que sujet participant à ce projet de recherche ou si vous avez des plaintes ou des commentaires à formuler vous pouvez communiquer avec le commissaire local aux plaintes et à la qualité des services de l'Institut de Cardiologie de Montréal au numéro suivant : (514) 376-3330 poste 3398.

Initiales de l'infirmière: _____

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J'ai eu l'occasion de poser toutes les questions voulues au sujet de ce projet et on y a répondu à ma satisfaction.

Je comprends que je demeure libre de me retirer de ce projet en tout temps sans que cela n'affecte le cours de mon travail dans l'unité de soins.

J'ai lu ou l'on m'a lu ce formulaire de consentement et j'en comprends le contenu.

Je, soussigné(e), accepte de participer au présent projet de recherche.

Signature de l'infirmière	*Nom du l'infirmière en lettres moulées*	*Date (a/m/j)*	*Heure*
Signature de l'un des chercheurs	*Nom du chercheur en lettres moulées*	*Date (a/m/j)*	*Heure*

Je certifie que j'ai expliqué les buts du projet à _____et il(elle) a signé le consentement en ma présence.

Signature du chercheur ou de son délégué	*Nom du chercheur ou de son délégué en lettres moulées*	*Date (a/m/j)*	*Heure*

Le Comité d'éthique de la recherche et du développement des nouvelles technologies de l'Institut de Cardiologie de Montréal autorise le début du recrutement en date du 13 septembre 2012. La version courante no. 1 du consentement en français datée du 13 septembre 2012 est approuvée.

N.B. : L'original de ce formulaire sera remis au participant et une copie sera gardée par l'investigateur.

I: Authorisation memoire by article in english

Université de Montréal

École de santé publique

Le 15 avril 2014

Monsieur Shawn Champigny
275, 20e Avenue Nord
Sherbrooke, Qc
J1E 3W6

Objet : Mémoire par articles et dans une autre langue que le français
Programme 2-770-1-1

Madame,

Par la présente, nous vous accordons l'autorisation de rédiger votre mémoire « *Nursing Intensity Critical Care Questionnaire : Validation Study in Cardiac Surgery Patients*» sous forme d'articles et en **anglais**.

Vous devrez remettre au moment du dépôt une liste dactylographiée des noms des coauteurs des articles et joindre à votre mémoire la déclaration écrite des coauteurs signifiant leur accord et la permission écrite de tous les coauteurs d'articles publiés ou acceptés pour la publication de même que celle de l'éditeur du livre ou de la revue concernée en vue du microfilmage et de la diffusion du mémoire.

Veuillez agréer l'expression de nos sentiments distingués.

Claude Sicotte, Ph.D.
Directeur des programmes

/nr

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Montréal QC Canada H3C 3J7

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