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CONTENTS

The Art of Clinical Supervision: strategies to assist with the delivery of student feedback

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KEY WORDS

Clinical supervision, student nurse, clinical teaching, clinical feedback

PREAMBLE

Objective
The Art of Clinical Supervision (ACS) seminar was developed to provide health professionals with the essential knowledge, skill and attitude to support student clinical learning. This paper provides an outline of the strategies provided to participants to support the delivery of feedback to students on clinical placement.

Setting
Western Australian health services.

Primary argument
The provision of timely and descriptive feedback to students on clinical placement is essential for learning and achievement of competence. Health professionals working with students in the delivery of patient care, termed clinical supervisors, require effective strategies to support this communication technique.

Conclusion
ACS participant feedback supports the use of both strategies to formulate the delivery of feedback. This ensures that the student and supervising health professional have discussed the required learning needs, strategies for learning and evaluation.

INTRODUCTION

The Art of Clinical Supervision (ACS), a one-day seminar for nurses and health professionals, provides a safe learning environment for the sharing and reflecting of clinical supervision practice. The seminar was designed as an intervention strategy for a Dr of Philosophy (2010), and with Health Workforce Australia funding was extended for a further three years (2011 – 2014) covering the state of Western Australia (WA). The seminar continues to date as a form of professional development, provided through the University of Notre Dame, Australia to health professionals in WA. This article focuses on one key aspect provided within the ACS, the delivery of feedback to health professional students.

BACKGROUND

In the context of entry to practice health professional education, clinical supervision is the relationship between a student, and the registered health professional responsible for their clinical practice. Health Workforce Australia defines a clinical supervisor as:

> *an appropriately qualified and recognised professional who guides learners' education and training during clinical placements. The clinical supervisor's role may encompass educational, support and organisational functions. The clinical supervisor is responsible for ensuring safe, appropriate and high quality patient-client care (2014, pp.22).*

Other terms used to describe this relationship include preceptor, mentor, coach, buddy and facilitator (Dimitriadou et al 2015).

The clinical supervisor provides student opportunities for practice, incorporating a number of clinical teaching strategies, inclusive of feedback. Feedback provides closure to the student learning experience, which enables an understanding of competence, and supports targeted learning.

Feedback has various definitions, however for the purpose of this seminar, feedback is defined as:

> *a two-way respectful and mutually beneficial process between supervisors and learners. It occurs through communication (written or verbal) between the supervisor and the learner, before, during and after a supervisory or other learning event, and objectively provides the learner with a clear understanding of the level of their competency at a particular time. It also ... enable(s) the learner to express views about the learning experience which enable a supervisor to reflect on and improve their supervisory skills and performance (Health Workforce Australia 2013, pp. 23).*

Feedback supports students to close the gap between current and required performance (Allen and Molloy 2015; Burgess and Mellis 2015; Schartel 2012) to attain competence (Allen and Molloy 2015). Delany and Molloy (2018) describe feedback as vital for teaching and correcting learners, revealing learners' blind spots, reinforcing learning, motivating learners, identifying gaps, improving patient care, and collaboration (p.307). However, despite its importance, feedback is inherently an emotive conversation for both the supervisor and student, which can be seen to threaten relationships, and therefore difficult to effectively engage in (Delany and Molloy 2018).

The literature articulates insufficient and superficial feedback is common on student placements. Consequently, students are left confused and unsure about their level of practice, achieved learning, and skills requiring consolidation. In contrast students provided with informative and descriptive detail are able to reflect on their performance and enact change or reinforce behaviour to consolidate competence (Allen and Molloy 2015; Schartel 2012).

Various barriers are cited to providing feedback, in particular health professionals being time poor in busy clinical environments in which patient care is a priority; and supervisors lack of confidence in their ability to provide feedback (Ford et al 2016; Plakht et al 2013), in particular when there is concern about student performance (Plakht et al 2013). Regardless, clinical supervisors can ill afford to doubt the undeniable link between clinical supervision and student learning (Ford et al 2015), and the role of feedback in this process (Burgess and Mellis 2015). Clinical supervisor education for health professionals is lacking in entry to practice training, therefore its delivery in the workplace is essential to support ability and confidence in clinical teaching, assessment and feedback (Russell et al 2016).

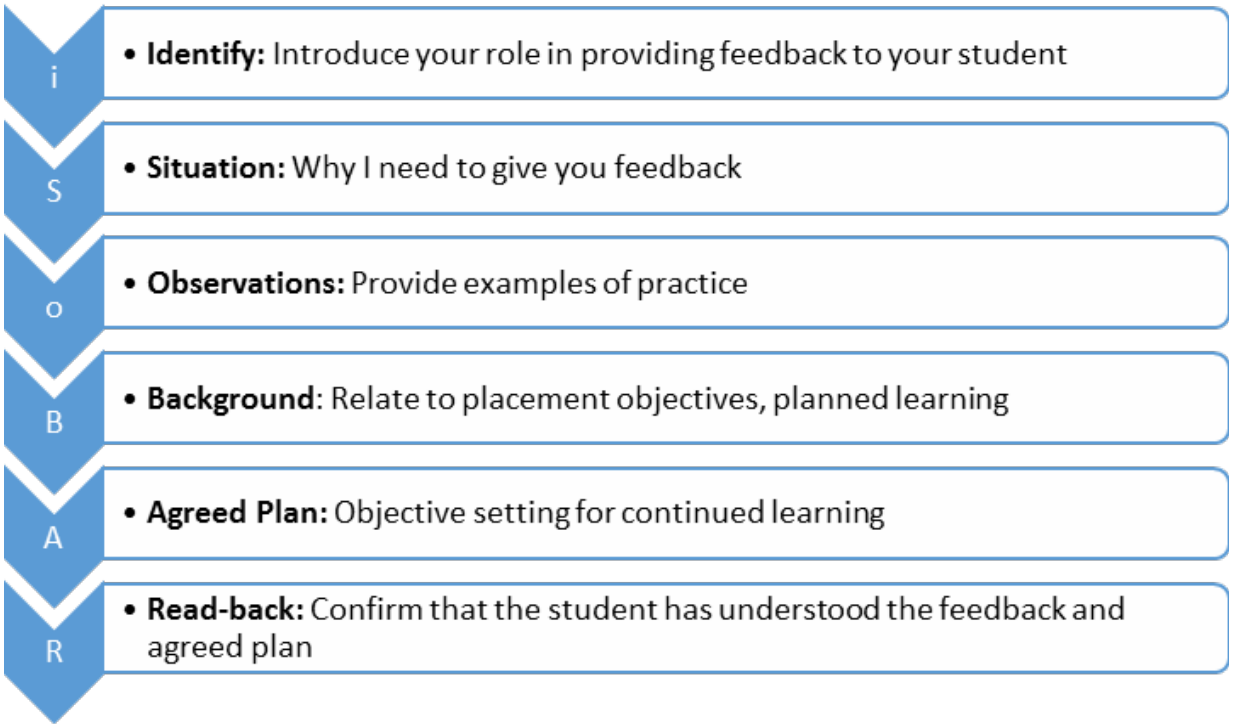
ACS: Effective strategies for the delivery of student feedback

The ACS seminar provides tips for success for health professionals, inclusive of feedback. The seminar acknowledges that supervisors may have no formal qualifications in education, nor desire to, due to their speciality practice being patient care. To avoid educational jargon, and to ensure that health professionals can easily recall strategies for success, the ACS deliberately avoids adding additional acronyms for professionals to learn and remember. As such for the delivery of feedback the iSoBAR method was chosen along with Blooms Taxonomy of learning, both well-recognised sets of terms used within health services and entry to practice programs. Additionally, Bloom's taxonomy, is embedded within the seminar as a framework to plan, deliver and evaluate learning, which closes with feedback.

iSoBAR

iSoBAR is the Western Australian Health clinical handover tool (Government of Western Australia 2013) that is incorporated across health service documentation. There are a variety of versions of isobar in use that are advocated by the National Safety and Quality Framework, (2017). The below figure 1 articulates the application of the iSoBAR acronym in the context of student feedback.

Figure 1: iSoBAR for student feedback (adapted from iSoBAR, Government of Western Australia 2013, pp.7)



Examples of Feedback

Application of the iSoBAR tool for the delivery of feedback is provided in the following four examples to ACS participants. Each example highlights common forms of feedback by clinical supervisors.

Feedback types

Example 1. Immediate – 'positive/achieved' feedback

Example 2. Immediate – 'consolidating/working towards' feedback

Example 3. Summary (end of shift/week/placement) – 'positive/achieved' feedback

Example 4. Summary (end of shift/week/placement) – 'consolidating/working towards' feedback

Within this paper two examples have been provided, Example 1 (figure 2) and Example 4 (figure 3).

BLOOM'S TAXONOMY OF LEARNING

There are three domains of learning according to Bloom et al (1956), later revised (Anderson et al 2001):

1. Knowledge (cognitive, mental skills)
2. Skills (psychomotor, manual or physical skills)
3. Attitude (affective, growth in feelings)

The clinical environment is a place for students to practice and gain both confidence and competence in all three of these domains. The clinical environment supports this process through experiential learning that is learning through practice (Delany and Molloy 2018)

During the ACS, participants are introduced to structured clinical learning around these three domains to facilitate student development of knowledge, skill and attitude. This framework can then be used to provide feedback. The following example in table 1 and table 2 articulates this into practice with the three domains applied to the example of blood pressure. In table 1 Bloom's domains are applied to the clinical teaching and assessment of blood pressure, whilst table 2 describes considerations for the provision of feedback about the student's competence related to blood pressure.

Table 1: Clinical Teaching using Bloom's domains of learning – blood pressure, example

Domain	Teaching/learning considerations
Knowledge questioning	What is the student's knowledge level about blood pressure, for example use questioning to determine their understanding of: what is a blood pressure the measurement of, when/why it should be measured, what other information it can be used with to determine clinical assessment and care decisions? Ask questions of increasing difficultly to determine level of knowledge through to evaluation, refer to Blooms 6 levels of cognitive domain.
Skill observing	What level of skill does the student possess in performing the procedure – can they apply the skill in different situations e.g. (paediatric versus adult patient, obese patient, manual versus machine operated). You will need to observe the student, and ask clarifying questions about different scenarios that are not able to be observed.
Attitude observing	Does the student display an appreciation for the appropriate application of the knowledge and skills obtained? In this instance does the student display acceptance about the importance of a blood pressure and its relationship to patient health status. You will need to observe that the student incorporates the knowledge and skill into everyday practice with an appreciation for its use and benefit, you may support this with questions about application in different scenarios.

Figure 2: Example 1. Immediate – 'positive/achieved' feedback

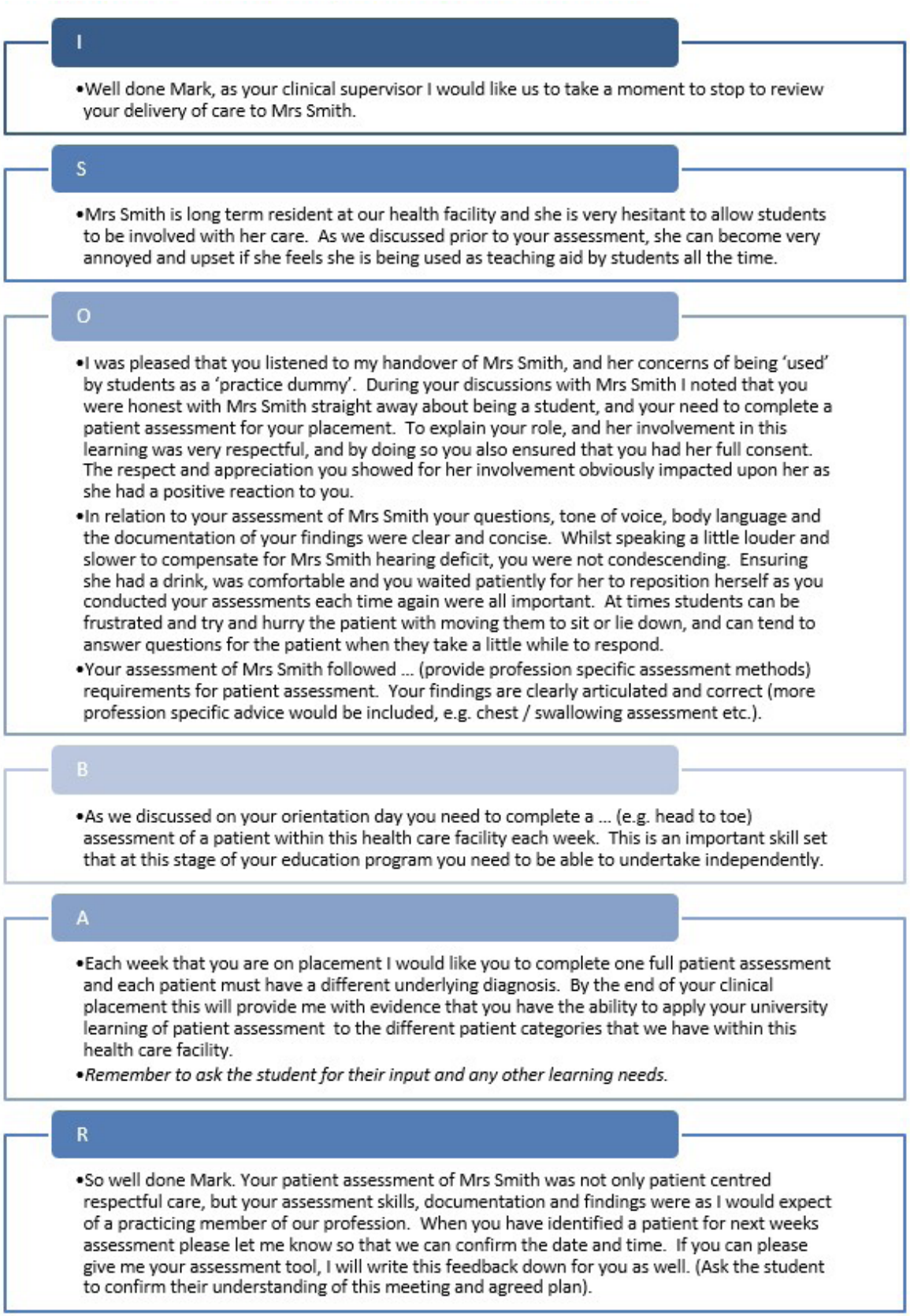


Figure 3: Example 4. Summary (end of shift/week/placement) – 'consolidating/working towards' feedback

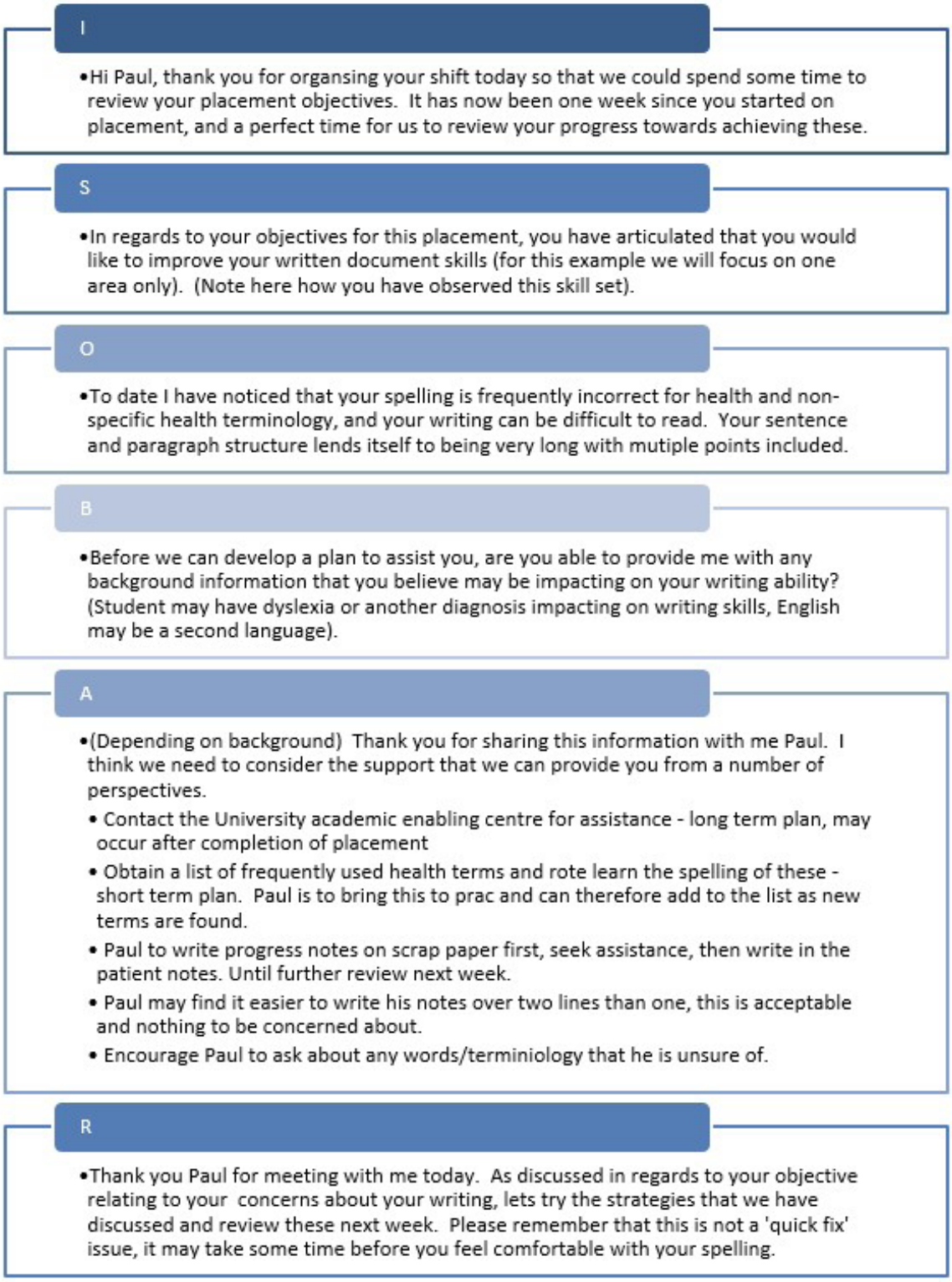


Table 2: Feedback example using Bloom et al's (1956) domains of learning – blood pressure, example

Domain	Feedback
Knowledge	Relate information to the student about their knowledge – do they need to read further, you may refer to texts, journal articles, and policy and procedure manuals.
Skill	Provide specific detail about the skill, completed steps, missed steps, and any incomplete steps. This should also include their style of communication with the patient during the procedure, was it appropriate, did they inform the patient appropriately of the care to be delivered.
Attitude	Provide clarification about their application of knowledge and skills. Does the student naturally undertake the procedure without prompting? Have they incorporated blood pressure as a necessary form of patient assessment?

This delivery method can also be used for skills that do not involve a manual or physical skill set, for example communication: Knowledge would relate to the best practice of communication, whilst the skill relates to the application of these communication styles.

FEEDBACK

Participants of the ACS have articulated that these two processes of delivering feedback are appropriate and helpful for fulfilling the role of the clinical supervisor. Ongoing evaluation of the seminar has provided support for these strategies. Examples of feedback include:

> *"Teaches us how to provide feedback in a constructive way" (2018)*

> *"Useful tools we can use as a framework for feedback" (2018)*

> *"Valuable insight into giving feedback" (2018)*

In addition, ongoing evaluation of the ACS continues to demonstrate the seminar's value:

> *"Thank you for organising a very useful workshop. It was excellent and has helped me to refocus on the most important things we need to undertake for the benefit of the students who come to our hospitals for their practical placements" (2018).*

DISCUSSION

Engaging with health professionals to improve their knowledge, skill and attitude as a clinical supervisor is essential for the continued graduation of safe and competent health professionals (Burgess & Mellis 2015). The literature overwhelmingly supports the concept that feedback promotes student engagement with learning, achievement of clinical competencies and engagement with self-evaluation, whilst insufficient or inappropriate feedback can hinder student progress (Burgess & Mellis 2015; Plakht et al 2013; Schartel 2012).

The delivery of professional development education to support clinical supervisors that is relevant, meaningful and effortlessly implemented is essential in a time when employees are overwhelmed by continuing changes to the health care system. Additionally, the literature articulates that teaching how to deliver feedback should be centred on student 'knowledge, behaviours or actions' (Schartel 2012, pp. 86). Utilising Bloom's domains of learning provides such a model to direct both learning and feedback, providing a streamlined approach for health professionals. This supports timely feedback that is also patient care centred, to improve student practice (Burgess & Mellis 2015; Plakht et al 2013).

CONCLUSION

For students to successfully achieve their learning objectives, they require informative feedback that is timely and descriptive. Clinical supervisors, working with students at the point of patient care, are best equipped to provide this timely feedback for continued student reflection and growth. Supporting health professionals to deliver feedback that is meaningful enables students to practice and progress through their learning. Investing in health professional development as clinical supervisors is not only essential, but crucial to support student competence.

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Bioelectrical impedance analysis as a marker of nutritional status in chronically ill patients

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KEYWORDS

nutritional risk, albumin, phase angle, chronic disease.

ABSTRACT

Objective
The aim of the study was to evaluate different methods of nutritional status analysis like basic anthropometric data, laboratory data and bioelectrical impedance analysis (BIA) with phase angle (PA) in patients with chronic diseases.

Setting
Clinic for Internal Medicine, Department of Nephrology, University Clinical Centre Maribor, a tertiary referral centre in Slovenia, Europe.

Subjects
Patients with chronic disease and increased nutritional risk (≥1 fulfilled NRS 2002 criterion) at the time of inclusion in the study.

Results
Patients had chronic kidney disease (93%), arterial hypertension (80%), active infection (33.3%), heart failure (23.3%), diabetes mellitus (20%), active malignancy (10%), autoimmune disease (6.6%), history of stroke (6.6%), chronic obstructive pulmonary disease (3.3%) and/or liver cirrhosis (3.3%). Mean serum albumin was 33.6±5.7 g/L, mean BMI 25.6±4.4 kg/m2 and mean PA 4.4±1.2°. No correlation between serum albumin and BMI was found. Lower PA was associated with lower serum albumin (p=0.045) and advanced age (p=0.043). The department nurses conducted nutritional education for all patients included in the study. Study was performed in accordance with the Strengthening the reporting of observational studies in epidemiology.

Conclusion
Results of the study show the importance of nutritional risk assessment in all chronically ill patients. BIA is a promising method of determining nutritional status. PA values have important diagnostic, therapeutic and prognostic implications as they are a marker of body cell mass, membrane function and metabolic health. A multifaceted approach to assess malnutrition in patients with chronic diseases is important, followed by a prompt nutritional intervention.

INTRODUCTION

Malnutrition is a general term indicating a state of nutrition in which a deficiency, excess or imbalance of energy, protein and other nutrients causes adverse effects on body composition, function and clinical outcome (Poulia et al 2012). It can be the result of poor nutritional intake, impaired utilisation or loss of nutrients, or may stem from several acute or chronic diseases. Malnutrition affects 7-16% of patients out of hospital (Leistra et al 2009) and is even more common in hospitalised patients (Leistra et al 2013). Additionally, nutritional status often deteriorates during a hospital stay (Allard et al 2016), which leads to higher rates of complications, increased morbidity and mortality (Kyle et al 2013; Poulia et al 2012).

The first step to successfully treat malnutrition is the appropriate diagnosis. To recognise patients at risk, several screening tools have been proposed. The Nutritional Risk Screening 2002 (NRS-2002) is the tool proposed by the European Society for Clinical Nutrition and Metabolism (ESPEN). It includes four questions about the following parameters: body mass index (BMI) <20.5 kg/m2, presence of weight loss in the past three months, presence of low dietary intake in the past week and the severity of illness. A positive response to any of these questions warrants further nutritional assessment (Poulia et al 2012).

Nutritional status can be assessed by several different methods. Most clinicians currently rely on global clinical assessment and anthropometric parameters, such as body weight, height, waist circumference, and BMI. There are several laboratory parameters which can be used to assess nutritional status, most commonly serum albumin level (Bharadwaj et al 2016). These parameters give us no information on body composition and have therefore several limitations to their application. More advanced modalities on nutritional status assessment and body composition analysis include imaging techniques, such as density assessment, anthropometry, dual energy X-ray absorptiometry (DEXA), computed tomography (CT), magnetic resonance imaging (MRI), nuclear magnetic resonance (NMR) spectroscopy or the use of isotopes. These are, however, expensive, time consuming, and in most hospitals, unavailable for routine use (Jones et al 2009).

Body impedance analysis (BIA) is the most commonly used method to calculate body composition due to its high accuracy, safety, portability and low cost. It provides information on fat mass, muscle mass and hydration status, which is especially useful in chronic kidney disease (CKD) and heart failure patients. It is based on the principle of bioelectrical impedance (the vector sum of resistance and reactance). Although monofrequency BIA (50 kHz) has been the most used method to date, multi-frequency BIA (5-100 kHz) has arisen as a method with more developed and complex theoretical bases, giving us better information on the distribution of water between intra- and extracellular spaces (Caravaca et al 2011).

Phase angle (PA) value determined by BIA is an indicator of cell membrane damage and body cell mass (Varan et al 2016). Higher values represent higher cellularity, cell membrane integrity and better cell function (Norman et al 2012). In healthy subjects, age and gender are the major determinants of PA (Zhang et al 2014). Since it is based on body cell mass, it can be used as an excellent reference for several physiological processes, including energy expenditure and proteolysis. Recent studies have shown that lower levels of PA are associated with increased nutritional risk, higher morbidity and mortality in chronic diseases, cancer and surgical patients (Varan et al 2016; Mushnick et al 2003).

The aim of this study was to use different methods of nutritional status analysis, including basic anthropometric data, laboratory data and BIA with PA in patients with different chronic diseases, who were at risk for malnutrition according to the NRS 2002 screening tool.

STUDY DESIGN AND METHODS

Thirty patients that were hospitalised in the Department of Nephrology, Clinic for Internal Medicine of University Clinical Centre Maribor, in a three-month period (November 1 2016 - January 31 2017), were included in the study.

Patients were mostly admitted from the internal medicine emergency department, some were transferred from other departments and hospitals. The inclusion criteria were increased nutritional risk (≥1 fulfilled NRS 2002 criterion) at the time of admission to the hospital and the presence of at least one chronic disease prior to the hospital admission. Institutional electronic information system was used to check patients' previous chronic diseases. The most common comorbidity was CKD (stages 1-5), including those on renal replacement therapy. Other observed chronic diseases were arterial hypertension, diabetes mellitus, heart failure, chronic obstructive pulmonary disease, liver cirrhosis, malignant disease, autoimmune disease, a history of stroke and/or the presence of an active infection. All patients were given written informed consent before inclusion in the study.

The study was performed in accordance to the STROBE guidelines (STrengthening the Reporting of OBservational studies in Epidemiology). The study was approved by the University Clinical Centre Maribor ethics committee. Informed consent was obtained from each patient.

BMI and BIA parameters, such as muscle mass, fat mass and PA, were used in the nutritional assessment of included patients. To perform bioelectrical impedance, multi-frequency segmental body composition analyser *Tanita, MC780*® (Croatia) was used. The apparatus has a measuring platform which requires standing position of the subject for correct measurement. Patients unable to walk or stand were therefore excluded from the study due to their inability to stand on the measuring platform. The measurements were made on an empty stomach, between 8-12 AM, by the department nurses.

Glomerular filtration rate (GFR) was estimated by using the Chronic Kidney Disease Epidemiology Collaboration equation. By drawing peripheral venous blood, standard laboratory data, such as serum creatinine, haemoglobin, albumin and C-reactive protein (CRP) levels were measured.

Statistical analysis was performed using the SPSS Statistics 22 for Windows. The data was expressed as means ± standard deviations or percentages. Associations between different methods of nutritional status analysis data were tested by the Spearman's correlation coefficient. A p-value < 0.05 was considered statistically significant.

RESULTS

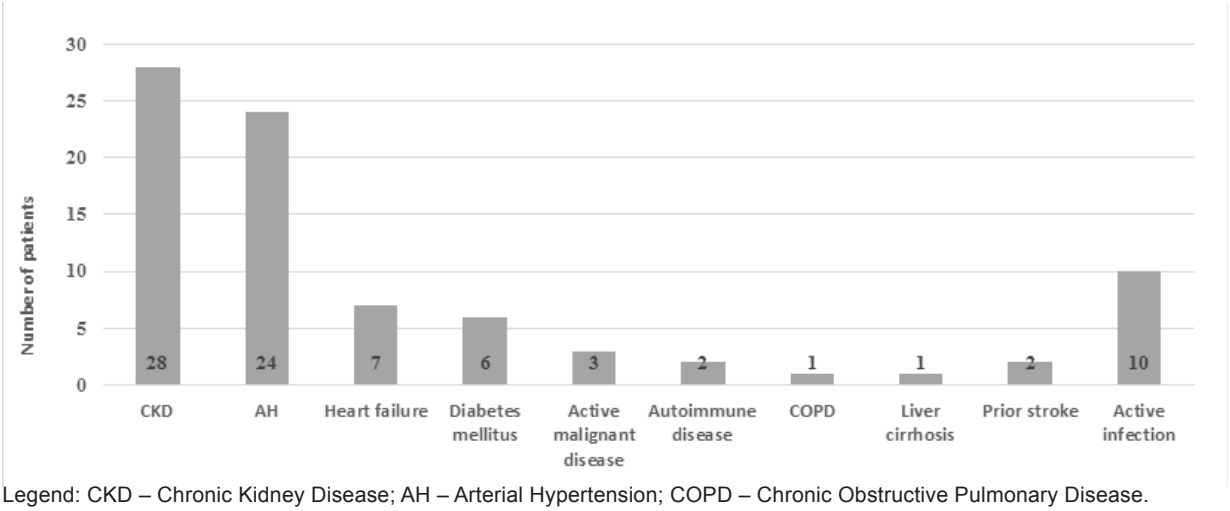
Thirty patients were included in the study, most of them were male (20/30, 66.7%). Their average age was 70.8±17.2 years. Nearly all of them had one fulfilled NRS-2002 criterion (28/30; 93.3%), two patients (6.7%) had two or three fulfilled NRS-2002 criteria, respectively.

All of them had at least one concomitant chronic illness, most commonly CKD (28/30; 93.3%). Mean serum creatinine was 172.1±85.7 μmol/L, mean estimated GFR was 53.4±26 ml/min/1.73 m2. One patient was on haemodialysis for seven years prior to the study (1/30; 3.3%). The second most common concomitant chronic disease was arterial hypertension (24/30; 80%), followed by heart failure (7/30; 23.3%) and diabetes mellitus (6/30; 20%). Active malignant disease was present in three patients (10%), two of them had colorectal adenocarcinoma, and one had a prostate adenocarcinoma. One patient with colorectal carcinoma was in-between cycles of chemotherapy; none of the other patients were receiving radiotherapy or other oncological treatment regimens at the time of the study. Autoimmune disease was present in two patients (6.6%), both

had systemic lupus erythematosus. Chronic obstructive pulmonary disease and liver cirrhosis were observed in one patient (3.3%). Two patients had a history of a cerebrovascular event prior to the inclusion in the study (6.6%). Most of the patients had no active infection at the time of the study (20/30; 66.7%). Those with an infection had an inflammation of the biliary tract (5/10; 50%), a respiratory tract infection (4/10; 40%) or an upper urinary tract infection (1/10; 10%).

Most common comorbidities of included patients and basic descriptive statistics are shown in tables 1 and 2.

Table 1: Comorbidities of included patients.



Legend: CKD – Chronic Kidney Disease; AH – Arterial Hypertension; COPD – Chronic Obstructive Pulmonary Disease.

Table 2: Basic descriptive statistics of included patients.

Parameter	Minimum value	Maximum value	Mean value ± SD
Age (years)	31	94	70.8 ± 17.2
NRS 2002	1	3	1,1 ± 0.4
Serum creatinine (µmol/L)	62	763	172.1 ± 185.7
eGFR (CKD-EPI equation; ml/ min/1.73 m2)	6	90	53.4 ± 26
Serum haemoglobin (g/L)	82	152	115 ± 19.4
CRP (mg/L)	3	359	52.2 ± 83.6
Albumin level (g/L)	17.8	44.4	33.7 ± 5.7
BMI (kg/m2)	18	35	25.6 ± 4.4
Fat mass (kg)	3	29	16.9 ± 7.7
Muscle mass (kg)	34	72	53.5 ± 10.4
Phase angle (°)	3	7	4.4 ± 1.2

Legend: SD – standard deviation; NRS – nutritional risk screening; eGFR – estimated glomerular filtration rate; CKD-EPI equation - Chronic Kidney Disease Epidemiology equation; CRP – C-reactive protein; BMI – Body Mass Index.

Mean serum albumin was 33.7±5.7 g/L, mean BMI was 25.6±4.4 kg/m2, mean fat mass was 16.9±7.7 kg, mean muscle mass was 53.5±10.4 kg and mean PA was 4.4±1.2° (table 2). No correlation between serum albumin and BMI was found. There was also no significant correlation between muscle mass, fat mass and serum albumin. Higher fat mass and muscle mass were associated with higher BMI ($p<0.0001$). Lower PA was associated with lower serum albumin ($p=0.045$) and advanced age ($p=0.043$), however, no correlation was found between muscle mass, fat mass, BMI and phase angle values.

All the patients in the study, and their relatives where possible, received nutritional education by the department nurses.

DISCUSSION

Chronic illnesses and advanced age are the most important risk factors for malnutrition (Correia et al 2014). Several studies have shown correlation between malnutrition and CKD (Muscaritoli et al 2009), severe heart failure (Rahman et al 2016; Amare et al 2015) and liver disease (Purnak and Yilmaz 2013). It is estimated that nearly half of patients with malignant disease develop a syndrome of cachexia, with anorexia, progressive loss of adipose tissue and skeletal muscle mass (Aoyagi et al 2015). Several autoimmune diseases are linked to progressive wasting, especially autoimmune thyroid disease (Kawicka and Regulska-Ilow 2015). Patients with advanced chronic obstructive pulmonary disease are in a state of undernutrition, referred to as pulmonary cachexia (Itoh et al 2013). Patients who suffered stroke are likely to develop malnutrition during the acute phase of the stroke, and later during the rehabilitation stage of the disease (Bouziana and Tziomalos 2011). Muscle mass wasting is a hallmark of diabetes mellitus as well (Chevalier and Farsijani 2014). Protein-energy malnutrition is an independent risk factor predicting decreased length of overall survival and survival at home in geriatric patients (Correia et al 2014). Studies have repeatedly shown that clinical malnutrition is generally associated with increased morbidity and mortality both in acute and chronic illnesses. Longer length of hospital stay and higher treatment costs are reported in malnutrition. Since it has been demonstrated that proper nutritional care can reduce the prevalence of hospital malnutrition and costs, nutritional assessment is mandatory to recognise malnutrition early and initiate timely nutritional therapy (Norman et al 2008).

The BIA is one of the newer techniques for determining body composition and nutritional status. It is especially useful in patients with disturbed hydration and/or altered distribution of extra - and intracellular water, which is the case in many chronic illnesses (for example CKD, liver cirrhosis, heart failure and obesity). The most clinically established impedance parameter is the PA. The PA differs across categories of sex and age. In patients over 70 years old, the normal PA is approximately 5.5° in women (5.6±1.0°) and 6° in men (6.2±1.0°) (Barbosa-Silva et al 2005). Included patients were older adults (average age 70.8 years) and had several comorbidities. The study was performed at the Nephrology department were the most common concomitant illness was CKD. All patients were at increased nutritional risk (≥1 fulfilled NRS criterion). Their lower PA values (average 4.4, range from 3°, to 7°) are therefore understandable.

Lower PA values are associated with adverse prognosis in several diseases. Gupta et al (2004a) evaluated 52 patients (aged 29-79 years) with colorectal carcinoma and concluded that PA values were better at predicting survival than nutrition assessment methods commonly used in clinical practice. In another study, Gupta et al (2004b) confirmed the importance of PA as a prognostic indicator in patients with pancreatic cancer. Abad et al (2011) evaluated 164 dialysis patients (127 on hemodialysis and 37 on peritoneal dialysis) and found that PA is a good predictor of long-term survival in dialysis patients.

According to Araujo Antunes et al (2012), higher values of PA were prognostically favourable in HIV positive patients. In patients with liver cirrhosis, low PA values were associated with shorter survival times, according to a study by Belarmino et al (2017).

Authors, Varan et al (2016), performed a cross sectional study on 120 older adults (average age 75±7.27 years; mean PA 4.2±1.8°) and found statistically significant correlation between lower PA and higher malnutrition risk. According to their data, PA correlated with serum albumin and advanced age, which is similar to this study, where statistically significant correlation between PA and albumin level and between lower PA and advanced age was found.

Since PA and albumin level is influenced by the intracellular to extracellular water ratio, the lower values seen in older patients and in those with several chronic illnesses are thought to reflect a reduction in skeletal mass and hence intracellular water which may be compounded by oedema/extracellular accumulation with aging and poor health (Kyle et al 2012). According to Perna et al (2014), lower PA is linked to reduced relative muscle mass in the elderly. The results of the presented study did not confirm this, as no statistically significant correlation between PA and muscle mass was found. This is most likely due to a small sample size and different measuring technique used in their study (BIA vs Dual Energy X-Ray Absorptiometry - DXA).

No statistically significant correlation between serum albumin and muscle mass was found. Serum albumin is a potential marker of nutritional risk, but it is non-specific and can be reduced in several other conditions, such as in response to physiological stress, in CKD, liver disease and inflammation. Limited longitudinal research available on this topic questions the use of serum albumin measures for this purpose (Snyder et al 2012).

BIA is a promising method of determining fluid balance, nutrition status and it can also be used as a prognostic tool in patients with several chronic illnesses. By providing us with information on body composition it by-passes several weaknesses of other commonly used tools, such as BMI. In the future, more work should be done on detecting patients at risk for malnutrition. Patients at risk should be monitored more closely and they should also undergo nutritional education and if indicated, receive dietary supplements. Studies have shown that prompt intervention can decrease the rate of protein-energy wasting and have favourable prognostic implications (Ocepek et al 2017). There are not enough dietitians and nutritionists available to serve the entire healthcare industry. Nurses therefore play a very important role in nutritional risk assessment, education and in a potential intervention. They are an integral part of patient care, including nutritional assessment and should be properly educated in this field of practice (Henning 2009).

The presented study has several limitations. It is a small, single centre, cohort study, which was performed in only one out of several internal medicine departments in University Clinical Centre, Maribor. The study was performed in a Nephrology department, patients with CKD were therefore over-represented in the sample of included patients.

Patients unable to walk or stand, who are especially at risk for muscle wasting, were not included in the study due to the BIA measurement requirements. The study, however, also has some important advantages. It is one of the first studies researching the role of BIA in this part of Europe and it highlights the importance of nutritional status assessment by using different diagnostic modalities. All the patients in the study received nutritional education, performed by trained nurses. Due to the importance of social support, patients' relatives were also part of the nutritional education. Further monitoring, additional nutritional risk assessment and potential therapeutic interventions of the patients will be done through outpatient clinics.

CONCLUSION

Nutritional risk assessment should be made on all patients with chronic diseases. Currently, the best way is a multifaceted approach, including measuring body weight, height, BMI, serum albumin and performing a body composition analysis. PA values have important diagnostic, therapeutic and prognostic implications. Patients at risk and their relatives if possible should undergo nutritional education by trained professionals. Common reassessments of the nutritional status and prompt intervention in case of increased nutritional risk are important in all chronically ill patients.

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Quality Control Circle improves self-monitoring of blood glucose in Type 2 diabetic patients

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KEY WORDS

Quality control circle, diabetes mellitus, blood glucose monitoring, frequency

ABSTRACT

Objective
To determine the effect of quality control circle (QCC) activity on self-monitoring of blood glucose (SMBG) in type 2 diabetic patients.

Design
Pre-test Post-test study.

Setting
Outpatient clinic of a tertiary hospital in Eastern China.

Subjects
A total of 110 insulin-treated type 2 diabetic patients.

Interventions
Quality control circle.

Main outcome measures
Quality of self-monitoring of blood glucose and blood glucose control in patients.

Results
At the end of QCC activity, the proportion of patients performingregular SMBG and the frequency of SMBG were significantly increased. The incidence of using expired test strips, incorrect timing of blood glucose monitoring, improper operation and non-calibration of meters were all significantly decreased. Consequently, the levels of glycosylated hemoglobin,one-week fasting blood glucose, and one-month incidence of hypoglycemia were significantly decreased in these patients.

Conclusion
The QCC activity plays an active and beneficial role in improving SMBG and blood glucose control in patients with diabetes. This activity should be promoted in future clinical work.

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The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

INTRODUCTION

A quality circle or quality control circle (QCC) refers to a group of workers who do the same or similar work, or perform work complementary to each other. QCC activities have played important roles in the management of major enterprises in the United States of America, Europe, Japan and other developed countries. In recent years, QCC activities have been applied to management in various fields. The health care industry is of no exception. In daily hospital management, the QCC applies scientific analysis methods to find the crux of problems so as to develop corresponding implementation plans and goals and carry them out through different stages. QCC activities have been practiced in the management of medical quality (Wang et al 2013), wait time between continuous surgery (Zhang et al 2015), surgical site infection (Liu and Wang 2016) and hand hygiene compliance (Chen et al 2016) in Chinese hospitals. A previous study evaluated the effect of QCC on 1,103 type 1 diabetic patients receiving an intensive insulin treatment. Their results showed significant decrease in levels of glycosylated hemoglobin, incidence rates of severe hypoglycemia and ketoacidosis (Muller et al 1999).

The prevalence of diabetes mellitus continues to increase worldwide(International Diabetes Federation 2016; NCD Risk Factor Collaboration 2016). In China, a 10-fold increase in the prevalence of diabetes mellitus has been observed in the thirty years between 1980 and 2010 (Ma et al 2017). It is estimated there were as many as 114 million diabetic patients in China in 2010, and half of the Chinese adults had pre-diabetes mellitus(Xu et al 2013;Yang et al 2010).The complications and mortality associated with diabetes mellitus place a large economic burden on patients and the health care system (NCD Risk Factor Collaboration 2016; Diabetes Prevention Program Research 2012; Yang et al 2010). In contrast to the high prevalence,inadequate attention has been paid to self-monitoring of blood glucose(SMBG) in diabetic patients in China. Many diabetic patients demonstrate poor compliance and lack of systematic management of SMBG (Qin et al 2017; Zeng et al 2014).

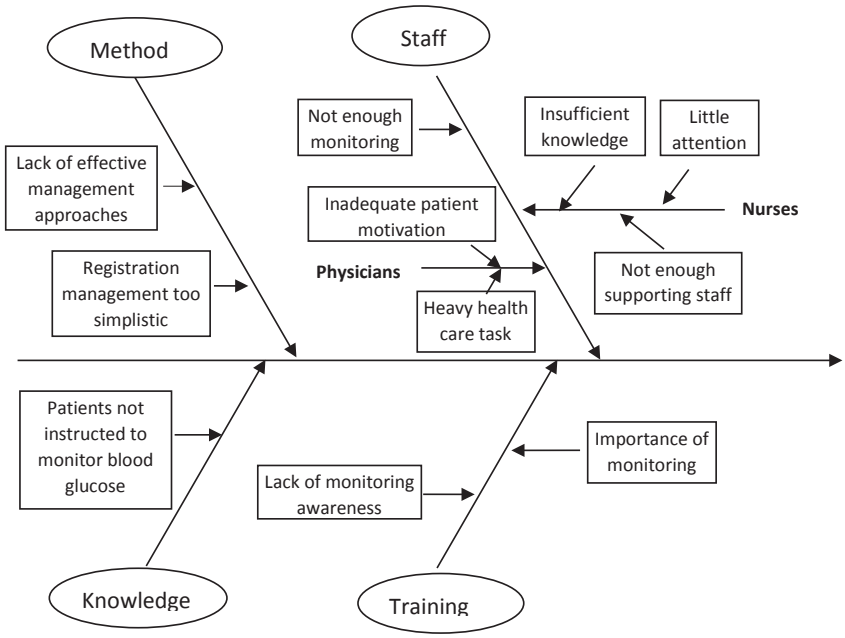
Type 2 diabetes mellitus is a chronic systemic disease. In addition to drugs, diet and exercise are important for the patients' treatment. SMBG is a simple and accurate reflection of the efficacy of treatment. This operation should be a part of treatment from the beginning of care. This study was designed to determine whether the QCC activity could improve the SMBG and blood glucosecontrol in type 2diabetic patients.

METHODS

The QCC was formed following the procedures described previously (Wang et al 2013). Nine experienced nurses from a total of 18 nurses working in the Department of Endocrinology self-selected to become members of the QCC. Of them, fourhad a Bachelor degree and five others had an Associate degree. One nurse was elected as the manager responsible for planning and organising the activities, anda senior nurse worked as a counselor to supervise activities of QCC. The QCC activity was initiated by the manager and participated by all nine members.The QCC activities were performed during July-December of 2016. The activity was held monthly within the Department. This study was approved by the Medical Ethics Committee of the hospital.

Based on the rationality, urgency, supervisors' suggestions, feasibility, expected outcomes, and ability to implement QCC members, to improve the SMBGin insulin-treated type 2 diabetic out-patients was selected as the theme for the QCC. The QCC was named as sugar control circle. The factors causing no or irregular SMBG were analysed from the aspects of staff, knowledge, methods and training (figure 1).

Figure 1: Factors of causing no or irregular self-monitoring of blood glucose in patients.



Inclusion criteria

All insulin-treated type 2 diabetic patients who had regular monthly doctor's visits during the last two years.

Exclusion criteria

Patients with incomplete orno records of SMBG,and patients without finishing the six-month QCC activity were excluded.

Based on the identified factors causing no or irregular SMBG in the patients, the following countermeasures were put forward to solve the issues in lack of SMBG in diabetic patients:

1. At the beginning of the study; all patients attended education sessions to understand the importance of controlling the blood glucose and the correct technique of SMBG.
2. Text message or other communication approaches were established to remind patients to monitor glucose every day.
3. Records of SMBG in diabetic patients were collectedduring each doctor's visit.
4. Members of QCC met monthly to check patients' records, identify problems and their causes, and bring about solutions.

The efficacy of QCC was evaluated based on changes in the following indicators before and after the activity:

1. frequencies of SMBG and the way of using glucose meters in patients. This information was obtained through survey during QCC activity, and cross-validated by the medical record;
2. blood glycosylated hemoglobin, morning fasting blood glucose levels, one-month incidence of hypoglycemia in patients;

3. scores of intangible results for members, including self-growth, engagement, personal ability, team spirit, communication and articulationskills and the use of the QCC(Wang et al. 2013).The intangible results were arbitrarily scored with 1~5points (1 - very poor; 2 - poor; 3 - fair; 4 - good; 5 - excellent) by each QCC member.

Statistical analysis

Data were analysed using the SPSS17.0 software package (SPSS Inc, Chicago, IL)(Chen et al. 2016).Quantitative data were presented as mean ± standard deviation. The t-test was applied to examine their differences before and after QCC activity. The qualitative data was expressed as percentage. The $\chi 2$ test was used to compare their differences before and after the QCC activity.A $P<0.05$ was considered to be statistically significant.

FINDINGS

A total of 110 insulin-treated type 2 diabetic patients were recruited in this study. The medical records showed that 59 patients (53.64%) did not perform regular SMBG. Of them, 17 patients (28.81%) were unconcerned with the need for SMBG due to lack of knowledge about diabetes; 13 patients (22.03%) neglected SMBG because of inadequate attention to the treatment; 23 patients (38.98%) had irregular SMBG owing to forgetfulness, inconvenience and intolerance to pain. These three factors accounted for 89.83% of patients who lacked regular SMBG.

Our result revealed that the proportion of patients withregular SMBGincreased from 46.37% before the QCC activity to 93.64% after the activity ($P<0.001$). The frequencies of SMBG were significantly increased in patients at the conclusion of the QCC activity, as compared with those before the QCC activity (table 1).

Table 1: Frequencies of self-monitoring of blood sugar before and after the QCC activity.

Frequencies of blood monitoring	Prior to QCC (n=110)	After QCC (n=110)	P value
Yes	51 (46.37)*	103 (93.64)	<0.0001
1~15/month	32 (29.09)	42 (38.18)	
≥15 /month	19 (17.27)	61 (55.45)	

* Data were presented as number (%).

After the QCC activity, the incidence of using expired test strips($P<0.0001$), incorrect timing of blood glucose monitoring($P<0.0001$), improper operation and non-calibration of blood glucose meters ($P<0.0001$), and incorrect recording of blood glucose values ($P<0.0001$) were all significantly decreased (table 2).

Table 2: The use of glucose meters before and after the QCC activity.

Indicators	Prior to QCC (n=110)	After QCC (n=110)	P values
Use of expired test stripes	34 (30.91)	4 (3.64)	<0.0001
Incorrect timing of monitoring	67 (60.91)	22 (20.00)	<0.0001
Improper operation of meter	35 (31.82)	11 (10.00)	0.0001
No calibration of meter	89 (80.91)	26 (23.64)	<0.0001
Incorrect recording of blood glucose	54 (49.09)	17 (15.45)	<0.0001

Compared to data prior to the QCC activity, levels of glycosylated hemoglobin (P<0.001),one-week fasting blood glucose(P=0.001), and the one-month incidence of hypoglycemia (P=0.039) were significantly decreased after the QCC activity (table 3).

Table3: Glycosylated hemoglobin, fasting blood glucose levels and one-month incidence of hypoglycemia before and after the QCC activity.

Indicators	Before QCC (n=110)	After QCC (n=110)	P values
HbA1c (%)	6.36 ± 0.23	5.74 ± 0.60	<0.001
Fasting blood glucose levels (mmol/L)	10.39 ± 3.23	9.06 ± 3.11	0.001
One-month incidence of hypoglycemia (%)	33 (33.00)	19 (17.27)	0.039

After the QCC activity, self-growth (P<0.0001), personal ability (P<0.0001), team spirit (P<0.0001), communication and articulation skills (P<0.0001) and the use QCC (P<0.0001), were significantly improved in QCC members (table 4).

Table 4: Scores the intangible results in QCC members (nurses) before and after the end of QCC activity.

Intangible results	Before QCC (n=9)	After QCC (n=9)	P values
Self-growth	2.44±0.78	4.23±0.86	<0.0001
Engagement	1.29±0.38	3.29±0.42	<0.0001
Personal ability	2.59±0.42	4.04±0.56	<0.0001
Team spirit	2.22±0.38	4.23±0.58	<0.0001
Communication and articulation skills	2.23±0.21	4.22±0.36	<0.0001
Use of QCC	1.15±0.28	3.98±0.74	<0.0001

DISCUSSION

The QCC was first introduced by Japanese doctor Kaoru Ishikawa. The QCC activities solve problems in accordance with scientific procedures and continue to improve the overall quality of management (Feng et al 2017; Chen et al 2016). This current study determined the effect of the QCC activity organised by a group of nurses on the SMBG in type 2 diabetic patients.The results revealed that QCC improved SMBG and blood glucose control in these patients.

The first finding in this study was that type 2 diabetic patients improved their SMBG after the completion of the QCC activity. A significantly higher proportion of patients perform SMBG and these patients demonstrated a significant increase in the frequencies of SMBG. On the other hand, using expired test strips, incorrect timing blood glucose monitoring, improper operation and no calibration of glucose meters, and incorrect recording of blood glucose occurred significantly less in these patients. We speculate that participation in QCC activity helped patients to change their traditional concept of treatment,realise the importance of SMBG, andenhance their awareness of self-monitoring. The patientswere therefore more willing to fully mobilise and empower their self-discipline,and move from passively to actively accepting the treatment. Participation in QCC activity thus improves the SMBG in these patients.Similar to these findings, several previous studies have reported the beneficial effects of QCC on management in various fields in China (Chen et al 2016; Liu and Wang 2016; Zhang et al 2015; Wang et al 2013).

As a chronic systemic disease, blood glucose monitoring is particularly important for patients with type 2 diabetes. The American Diabetes Association recommends that SMBG is a must for diabetic patients prescribed drug treatment, and a powerful weapon in the control of ideal blood glucose levels (Chamberlain

et al 2016). Clinical application guide of blood glucose monitoring in China (Chinese Diabetes Society 2015) also recommends daily monitoring of blood glucose for diabetes patients. The data in this study provided strong evidence supporting the importance of regular and correct SMBG during the treatment of patients with type 2 diabetes. With the improvement in SMBG after participation in QCC activity, the patients demonstrated a significant decrease in the levels of glycosylated hemoglobin and fasting blood glucose. In addition, the one-month incidence of hypoglycemia was also significantly decreased in these patients.These results imply that SMBG assists to enhance the efficacy of blood glucose reducing treatments, stabilise blood glucose levels and effectively reduce complications of diabetes. Improvement in SMBG thereby has its potential to enhance the overall health of the patients.

This study demonstrated that intangible results of members (nurses) improved after participation in the QCC activity. During the QCC activity, members cooperated collectively, drew upon useful opinions and developed themes for the project. The factors causing no or irregular SMBG were identified and corresponding approaches were developed by members in this QCC activity. All members of QCC evaluated and confirmed the process to ultimately achieve the desired outcomes (Zhang et al 2015). Members in QCC automatically and spontaneously participated in the management of patients' SMBG. The QCC activity allowed members to alter working attitudes, become more active, inspire their team awareness, and fully mobilise their initiative. Indeed, self-growth, engagement, personal ability, team spirit, communication and articulating skills, and use of QCC were all significantly improvedin members after their participation in the QCC.

The limitations of this study include a non-random study design without a control group. There is a possible selection bias in patients who participated in the QCC. It is noted among all insulin-treated type 2 diabetic patients who had regular monthly doctor's visits during the last two years, only nine patients were excluded from the study due to no interest in this activity (n=6) or incompliancewith the study (n=3). Another limitation is that other confounding information related to blood glucose control including drug treatment was not included. In addition, the intangible outcomes were not scored objectively. Though no control group was included, this study found the QCC activity lasting for six months improved SMBG and blood glucose control in type 2 patients within six months. Before the activity, a high proportion of these patients performed no or irregular SMBG for two years.

CONCLUSION

The QCC activityplays a positive role in the patient's SMBG. Itimproves the frequencies and corrects the improper way of monitoring, and consequently enhances the efficacy the treatment. It also improves team awareness and empowerment in health care teams. QCC is a worthwhile process that should be promoted in clinical work in the future.

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Validity and reliability of the Teamwork Evaluation of Non-Technical Skills tool

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KEY WORDS

Teamwork, TENTS, instrument validation, observational tool

ABSTRACT

Background
TENTS (Teamwork Evaluation of Non-Technical Skills) is a valuable team performance, 13 item observational assessment tool that has been used in clinical settings, but validity and reliability have not been tested.

Objective
This study conducted validity and reliability tests on the TENTS observation tool.

Method
This study used a convenience sample of 109 teamwork event observations conducted in an academic medical center in the United States of America (USA). Five different events were observed; new admissions, transfers to and from other units, rapid response team events, morning rounds, and medical procedures. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted and the Cronbach's alpha coefficients of the inventory were obtained.

Result
The EFA results indicated the TENTS tool consisted of three factors; communication, leadership, and cross-monitoring. These three factors accounted for 46.30% of the total variance and their internal consistencies (Cronbach's α) were .71–.79 (.88 overall).

Conclusion
TENTS is a valid and reliable instrument for observing a variety of clinical teamwork events. EFA and CFA demonstrated that the tool is well-aligned with long-standing essential teamwork components described in the literature and in the TeamSTEPPS™ system.

INTRODUCTION

Several studies have identified teamwork as a crucial factor for reducing medication-related errors, improving care quality, and patient safety (Wheeler et al 2018; Pellegrin et al 2017; Xu et al 2017; Hicksand et al 2014). The Agency for Healthcare Research and Quality developed TeamSTEPPS™, ("TeamSTEPPS 2.0 Online" 2018 DEC) an evidence-based teamwork program that is designed to optimize patient outcomes by improving health care professionals' communication and teamwork skills. However, evaluating the outcomes of TeamSTEPPS™ training is difficult without a proper instrument.

The Teamwork Evaluation of Non-Technical Skills (TENTS) tool was designed and developed by Hohenhaus et al (2008) to measure teamwork performance and has been used in clinical studies (Fraino and Sneha 2015; Sheppard et al 2013; Mayer et al 2011). After obtaining permission from the original author (Hohenhaus et al 2008), the original TENTS tool was modified to eliminate redundancy and add clarity to item meaning and was used while conducting interdisciplinary team event observations during research to evaluate the impact of TeamSTEPPS™ training. The purpose of this study is to test TENTS validity and reliability through a literature review and factor analysis using the observation data.

BACKGROUND

There are two ways in the literature to measure teamwork. One is via the use of retrospective self-evaluation questionnaires, the other is independent observation and evaluation of team performance during team events. This study focuses on the independent observation and evaluation of individual or team performance.

Eleven teamwork evaluation instruments identified in the literature are listed in table 1. Most of the identified teamwork observation tools were designed to evaluate team performance, and two tools were designed to evaluate individual team members during team meetings (Jalil et al 2014; Lamb et al 2011).

Current teamwork observation tools have limitations. The instruments may have limited applicability to all clinical settings. For example, six instruments are limited to use in critical care settings, such as the emergency department or intensive care units, two are designed for use in the operating room (Hull et al 2011; Mishra et al 2009), two are specific to meetings (Jalil et al 2014; Lamb et al 2011), and one for the delivery room (Guise et al 2008). Also, the rating scales used in the instruments vary from one another. Some instruments use qualitative analysis (quality of behavior), others focus on quantitative analysis (frequency of behavior), and one focuses on both frequency and quality (Weller et al 2011). However, Weller et al (2011) only used one question to evaluate the overall quality of the teamwork. Finally, the reliability and validity of these instruments has not been thoroughly tested. Seven out of 11 instruments provide inter-rater reliability, but only five provide internal consistency, only Cooper et al (2010) provided both. All instruments provide content validity, but only two teamwork observational instruments used exploratory factor analysis (EFA) to investigate construct validity (Kolbe et al 2013; Cooper et al 2010). The results indicated that the Teamwork in Multidisciplinary Critical Care Tool (Weller et al 2011) has three factors and the Team Emergency Assessment Measure (Cooper et al 2010) has one factor. Teamwork observational instruments have been tested during actual live events, video events, simulated events (Sawyer et al 2013; Guise et al 2008; Malec et al 2007) or both video and live events (Jalil et al 2014). Among these, actual live events are the most suitable for determining the feasibility and accuracy of observational instruments; however, less than half of the instruments have been tested during actual live events. Observers require focus and familiarity with an instrument when using it for evaluation during actual live events; video events can be viewed multiple times and thus are easier to evaluate compared to actual live events. In simulated events, team members' actions can be anticipated, and thus simulated events are also easier to evaluate than actual live events. Lastly, most teamwork observation instruments only partially

measure TeamSTEPPS™ concepts. For example, the Oxford Nontechnical Skill in Operating Room (Mishra et al 2009) focused on problem-solving and decision-making and did not focus on mutual support. Only the Team Performance Observation Tool (Sawyer et al 2013) has been developed according to TeamSTEPPS™; however, the Team Performance Observation Tool only tested for internal reliability and content validity.

Table 1: Summary of teamwork observational tools

Name of Instrument	Developing authors	Applied Field	Validity	Reliability	Rating score	Rating professional	Live event/ Video
Clinical Teamwork Scale	(Guise et al 2008)	Specificity (delivery room)	Content	Inter-rater, Test-retest	Quality	Team	simulation
The Framework for Observing Coordination Behavior in Acute care teams (Co-ACT)	(Kolbe et al 2013)	Critical care	Content	Inter-rater	Frequency	Team	Video
Explicit Professional Oral Communication Observation Tool	(Kemper et al 2013)	Critical care	Content	Inter-rater Reliability	Frequency	Team	Live
Multidisciplinary Team Performance Assesment Tool	(Lamb et al 2011)	Specificity (Tumor board meeting)	Content	Inter-rater	Quality	Individuals	Video
Mayo High Performance Teamwork Scale	(Malec et al 2007)	Critical care	Content, Construct	Inter-rater	Frequency	Team	Simulation
Oxford Nontechnical Skill in Operating Room	(Mishra et al 2009)	Specificity (Operation room)	Content, Concurrent	Internal consistency	Quality	Team	Live
Observational Teamwork Assessment for Surgery	(Hull et al 2011)	Specificity (Operation room)	Content	Internal consistency	Quality	Team	Live
Team Performance Observation Tool	(Sawyer et al 2013)	Critical care	Content,	Internal consistency	Quality	Team	Simulation
Teamwork in Multidisciplinary Critical Care Tool	(Weller et al 2011)	Critical care	Construct (EFA)	Internal consistency	Frequency Quality	Team	Live
Team Emergency Assessment Measure	(Cooper et al 2010)	Critical care	Construct (EFA)	Inter-rater, Test-retest, Internal consistency	Frequency	Team	Video
Team Performance Assessment of Multidisciplinary Tumor Boards	(Jalil et al 2014)	Specificity (Tumor board meeting)	Content, Construct	Inter-rater	Quality	Individuals	Live, Video

The TENTS does not have these limitations. It can be used in multiple settings and for multiple team events. TENTS can be used to measure the team performance across healthcare professionals or of one health care professional. The tool measures the quality of multiple team behaviors. Since TENTS was developed based on the concepts of TeamSTEPPS™, this study may provide the needed construct validity by using EFA and also convergent validity by using CFA.

INITIAL INSTRUMENT DEVELOPMENT

Salas et al (2008) identified five core concepts of teamwork; team leadership, mutual performance monitoring, backup behavior, adaptability, and team orientation. Team leadership refers to the designated or situational team leaders who monitor team activities, cultivate a positive team atmosphere and provide feedback to achieve optimum team performance. Mutual performance monitoring is the ability of team members to monitor their own and other team members' performance. To balance self-monitoring with awareness of others, members must understand one another's roles and responsibilities. Backup behavior occurs when team members anticipate and provide support to other team members. Adaptability is crucial for teamwork as team members respond to rapidly changing and diverse situations. Finally, team orientation is a focus on the success of the collective team that facilitates the open sharing of knowledge and opinions while incorporating the expertise, preferences, and personal goals of all members. These five core concepts of teamwork are aligned with the four core concepts of TeamSTEPPS™; leadership, mutual support, situation monitoring and communication. An observation measurement tool also aligned with these concepts is needed.

The instrument was developed by Hohenhaus et al (2008) to measure four dimensions: communication, leadership, situation monitoring, and mutual support. It contains 21 items and five scale points ranging from "expected but not observed" (0) to "observed and good" (4). The last two of the 21 items measure overall leadership and teamwork. These items were developed using the four core concepts of the TeamSTEPPS™ program. The instrument provides detailed expressions of the scale to enable comprehensive observation. For example, when evaluating the difference between "observed and acceptable" (3) versus "observed and good"(4),the description of good (4) -"the performance is consistent and can be used as a positive example for others", provides a clear definition to distinguish between the two scores.

METHOD

Sample and Participants

Five event types were observed and evaluated using the instrument, new admissions, transfers to and from other units, rapid response team events, morning rounds, and medical procedures such as bronchoscope, stomach scope or take off ECOM, etc. (see table 2).

Each event involved at least two different health care professionals. For example, new admissions usually involved physicians and nurses familiar with each other performing an inital assessment and developing a treatment plan. Transfers to and from other units involved physicians and nurses unfamiliar with each other sharing information about the patient. Rapid response team events involved physicians, nurses and a respiratory therapist responding to urgent patient situations all over the hospital and interacting with many other unfamiliar team members. Morning rounds usually involved physicians, nurses, a pharmacist and sometimes a nutritionist gathering daily to determine treatment and care plans for patients. Medical procedures involved physicians, nurses and an anesthesiologist or technician forming a team again with a mix of familiar and unfamiliar team members.

The events were observed mostly in a pediatric intensive care unit or a surgical intensive care unit, and rapid response team events were observed all over the hospital. The final 109 events were used for data analysis. One observer was recruited to observe all the events. A program director periodically observed events alongside the observer to ensure that the observer maintained the same evaluation standard for all events. The interrater agreement was .90 at the beginning and at the middle of the observation period that spanned one year.

Table 2: Types of observed events (N= 109)

	Frequency	Percent %
New admissions	59	54.1
Medical procedures	12	11.0
Morning rounds	3	2.8
Rapid response teams	16	14.7
Transfer to and from other units	19	17.4
Total	109	100.0

Procedure

Prior to beginning the analysis, four experts were invited to examine the content validity of the tool, two of whom were clinical experts and two of whom had PhDs in nursing. Some items were deleted because of redundancy or if they had been only rarely observed.

The remaining items were confirmed using exploratory factor analysis (EFA) and confirmative factor analysis (CFA). EFA used principal axis factor analysis and promax rotation with Kaiser Normalization. All eigenvalues were greater than 1.00. Items with factor loadings greater than .40 were retained and item–item and item–total correlations were between .30 and .70 (Pett et al 2003).

Two-stage CFA, employing first- and second-order confirmatory factor models, was performed using the EFA model to confirm the structure of the subscale produced through EFA. The model was confirmed using the following criterion: items with factor loadings greater than .50 were considered significant. Goodness-of-fit was defined by a normed fit index (NFI), goodness-of-fit index (GFI), comparative fit index (CFI), and Tucker–Lewis index close to or greater than .90 (Kline 2015).

Internal consistency was confirmed using the Cronbach's alpha coefficients of the overall scale and subscales. Internal reliability was confirmed by a Cronbach's alpha greater than .70 (Nunnally and Bernstein 1967). The analyses were conducted using IBM SPSS AMOS version 18.

FINDINGS

Content Validity

Before use in the observational study and evaluation of its content validity, the TENTS tool was modified with permission from the original author (Hohenhaus et al 2008). The experts consulted in the present study indicated that "speak up" and "ask questions" are similar concepts and suggested deleting "speak up." In addition, they suggested the other three items, "support others," "secure additional resources," and "backup behavior," are similar concepts, and thus suggested deleting two of these items. "Support others" and "secure additional resources" were subsequently deleted. "Uses appropriate critical language," "employs conflict resolution," and "debrief completed" were also deleted because they could not be observed during or when applied to most of the observation events. The other two items, "overall communication" and "overall teamwork," were not included in the factor analysis because they were not necessary for determining individual factors, only for obtaining an overall rating of the events.

Event Characteristics

The following five event types were observed: new admissions (n = 59, 54.1%), transfers to and from other units (n = 19, 17.4%), rapid response team events (n = 16, 14.7%), morning rounds (n = 3, 2.8%), and medical procedures (n = 12, 11.0%).

Exploratory Factor Analysis (EFA)

The Kaiser–Meyer–Olkin test result was greater than .60 (.87) and that of the Bartlett's test of sphericity was significant ($\chi 2 = 504.92$, df = 78, $p < .001$). Both results indicated adequate sampling and a suitable correlation matrix for EFA (Pett et al., 2003). The item measures for sampling adequacy were all higher than .60, which also indicated adequate sampling (Pett et al 2003). In each subscale, all item loadings were greater than .40 and item–item and item–total correlations were all between .70 and .30; therefore, no items were deleted. The final solution was constructed based on the factors of communication, leadership, and cross-monitoring. Communication (five items) represented all attitudes, information, and skills related to team communication; leadership (four items) represented the leadership-related behavior of the leader; while cross-monitoring (four items) represented the team members' interaction behaviors. These three subscales accounted for 37.9%, 4.3%, and 4.1% of the variance respectively (see table 3)

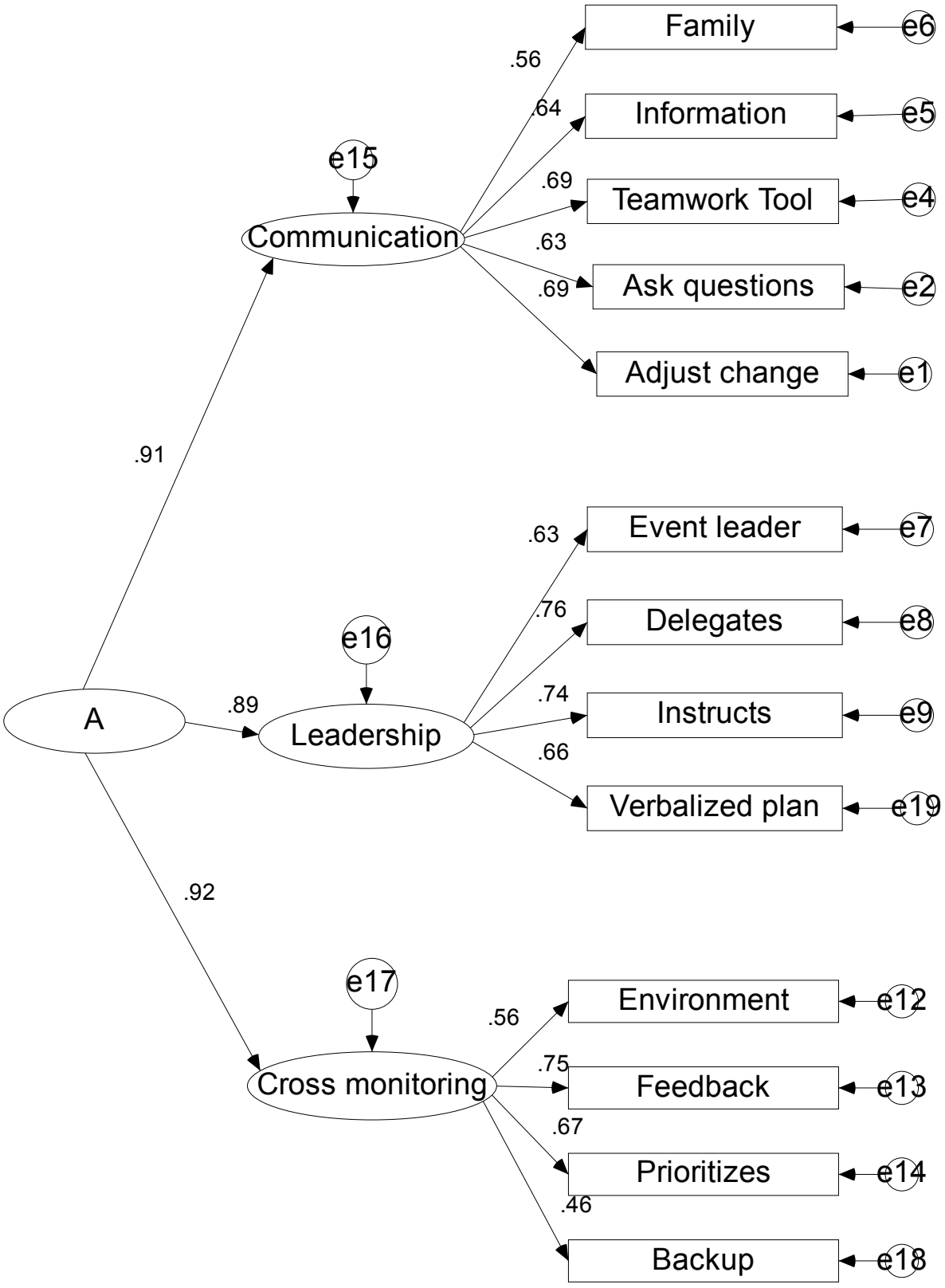
Table 3: Means, Standard deviation, and Pattern Factor Loadings of the TENTS

Original Factor	EFA factor	Mean	Standard deviation	Factor Loading	α
	Factor 1: Communication				.77
Communication	Utilizes teamwork tools	2.70	.78	.82	
Communication	Sends and receives appropriate information	2.75	.67	.64	
Communication	Sends and receives information to/ from patient/family	3.44	.77	.52	
Communication	Asks questions	3.51	.55	.45	
Situation monitoring	Verbalizes adjustments in plan as changes occur	3.13	.83	.43	
	Factor2 : Leadership				.79
Leadership	Instructs as appropriate	3.28	.68	.82	
Leadership	Delegates as appropriate	3.10	.73	.69	
Leadership	Establishes event leader	3.19	.73	.59	
Leadership	Verbalizes plan: States intentions, recommendations and timeframes	2.98	.82	.40	
	Factor 3:Cross monitoring				
Situation monitoring	Uses back-up behavior	3.48	.63	.63	
Situation monitoring	Visually scans environment	2.87	.90	.59	
Mutual support	Prioritizes appropriately	2.95	.71	.48	
Communication	Utilizes feedback between team members	3.05	.77	.41	.71
					.88

*The bold words of each item indicate the labels used in the CFA

The factor loading of "backup behavior" was lower than .50 (.46). All other items (12) were significant, with factor loadings greater than .50. The goodness-of-fit was determined using the NFI (.85), GFI (.91), CFI (.97), and Tucker–Lewis index (.96), all of which were close to or greater than .90 (figure 1).

Figure 1: A second-order confirmatory factor model of the Teamwork Evaluation of Non-Technical Skills Tool (TENTS)



Internal Consistency

The Cronbach's alpha coefficient was .88 for the overall scale, .77 for the first factor, .79 for the second factor, and .71 for the third factor. Thus, internal reliability was confirmed because all Cronbach's alpha coefficients were greater than .70.

DISCUSSION

This study evaluated the psychometric properties of the TENTS tool. Although the original design of the tool has four subscales (communication, leadership, situation monitoring, and mutual support), the EFA results in this study indicated the existence of only three because of the merging of mutual support and situation monitoring. Mutual support is defined by TeamSTEPPS™ as team members helping one another and is dependent on information obtained through situation monitoring, which is defined as the process of scanning to observe other team members and the environment. Although differentiating between mutual support and situation monitoring is simple, these concepts are related in that the interaction between situation monitoring and mutual support can be observed only when team members help or offer help. Therefore, the combination of mutual support and situation monitoring is similar to the concept of cross-monitoring, which refers to the process of scanning team members and their environment to assess their actions.

Three items—"speak up," "secure additional resources," and "support others"—all of which were in the subscale of mutual support in the Hohenhaus et al (2008) scale. "Speak up," was deleted because of the similarity with "ask questions", although "ask questions" was originally below "communication" subscale and "Speak up" was below the "mutual support/assertion" subscale. Hohenhaus et al. (2008) defined "ask questions" as team members feeling comfortable asking questions and "speak up" as team members' ability to express themselves in an appropriate manner. In the observations, a questioning sentence structure was often used to express differing views of the situation, therefore "speak up" was deleted.

"Secure additional resources" and "support others" were deleted because "backup behavior" represents these aspects of supportive behavior. In addition, "secure additional resources," "support others," and "backup behavior" were originally in the same subscale of "mutual support/assertion" and all involve asking for or offering help. "Secure additional resources" refers to asking other team members for help. "Support others" refers to providing help when help is required by another team member (Hohenhaus et al 2008), while "backup behavior" indicates team members' awareness of other team members' strengths and weaknesses and their provision of help in a timely manner (Hohenhaus et al 2008). With three slightly different concepts, team members engaged in cross-monitoring may accordingly backup each other, so "secure additional resources" and "support others" may not be necessary because team members directly offer help when required. Although the factor loading of the "back up" is .46 which is lower than .5, "back up" was retained in the model because it encompasses how team members perform situation monitoring and provide one another needed support. This is also considered an important factor related to cross-monitoring other team members' behaviors.

The CFA model identified similar underlying constructs as included in the original TENTS tool. The first construct was communication and it contained the 4 communication variables from TENTS and supported adding the additional "adjust change" variable that was originally included in situation monitoring. "Adjust change" is the behavior of team members thinking out loud to communicate while confirming a shared mental model as the event unfolds. The verbalization aspect of adjust change fits the communication construct. The construct of leadership contained the same variables as those in Hohenhaus et al (2008). The third construct, cross-monitoring, was similar to situation monitoring in the original TENTS. However, cross-monitoring considered not only situation monitoring but also all team members monitoring each other. Therefore, "prioritize" and "offer feedback" fit into this subscale.

TENTS has been successfully used to evaluate teamwork events in pediatric and surgical intensive care units and rapid response team events in a variety of hospital settings in real time. Although some items were deleted for being too similar to other items, the remaining items enabled the observer to better detect teamwork behaviors. During real-time events, a teamwork observer must immediately distinguish and score a team member's behaviors. This study's reduction of the number of items in TENTS enabled the observer to concentrate on team behavior performance rather than distinguish between various behaviors, thereby minimizing interrater bias and ensuring consistency. This study recruited only one observer and initially used interrater reliability to distinguish between the observer and program manager. The interrater agreement was .90 at the beginning and in the middle of this study.

LIMITATIONS

TENTS can only evaluate the performance of non-technical team skills and not that of clinical skills. Communication with patients or their family members is crucial for patient safety and can be enhanced through teamwork (Xu et al 2017). The original observation events were deleted when patient interaction was not possible and resulted in a smaller sample size. Most of the existing teamwork observational instruments were tested in intensive care units, the emergency care unit, or operating rooms (Hull et al 2016; Kolbe et al 2013; Weller et al 2011). TENTS also was tested mostly in intensive care units with a small number of events observed in general care units.

CONCLUSION

This paper reports on testing the TENTs using 109 event observations. A structure of content validity, reliability, EFA, and CFA was undertaken. To the best of our knowledge, this was the first study to use CFA to test a teamwork observational tool although the sample size was relatively small. The reduced number of items in the TENTS tool facilitated the observation of teamwork in this study. Findings indicate TENTS accurately measures the essential components of teamwork as described in the literature and emphasized in TeamSTEPPS™ and can be used in a variety of settings. A recommendation for future research is to test the use of TENTS as a measurement tool during interprofessional interactions with patients and their family members in general care settings.

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Fast-track rehabilitation and nursing care in post-anesthesia care unit on orthopedic patients

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KEY WORDS

orthopedic surgery, general anesthesia; fast-track rehabilitation; nursing

ABSTRACT

Objective
To assess the efficacy and outcome of fast-track rehabilitation (FTR) for orthopedic surgery patients.

Design
Randomised trial.

Setting
primary care.

Subjects and Methods
Two hundred and twenty patients undergoing orthopedic surgery under general anesthesia between November 2015 to March 2017 were randomly divided into traditional care (control, n=110) and fast-track rehabilitation (FTR, n=110) groups. Patients in the control group were given regular and routine care, while those in FTR group were cared for with multimodal rehabilitation. Demographic and data, postoperative hospital stays, surgical and general complications were assessed.

Results
One hour postoperative body temperature was higher in FTR group than in the control, and the incidence of restlessness, pain and 24 hour postoperative nausea and vomiting were significantly lower ($P < 0.05$, $P < 0.01$). The hospital stays were shorter following the FTR, but the difference was not statistically significant as compared with the control.

Conclusion
FTR can effectively reduce the complications and promote the recovery of the orthopedic patient.

INTRODUCTION

Fast-track surgery (FTS) initiated in the early 1990s aiming to reduce the length of hospital stays has been adapted in many hospitals (Esakov et al 2018; Kastelik et al 2018; Rao et al 2017). The main goal of this concept is to reduce the postoperative length of hospital stay (LOS) and accelerate the recovery of patients. To achieve this, a multidisciplinary team approach is implemented to maintain cardiovascular, pulmonary, gastrointestinal, neurological and humoral functions (Kehlet 2005) under the Consensus Guidelines for ERAS (Lassen et al 2009). This approach combines new technologies and methods with traditional care to reduce the postoperative stress response, complication rate and mortality, and hospitalisation costs (Na et al 2014; Anderson et al 2003). Based on syndrome medicine, a series of interventions can be implemented on preoperative, intraoperative and postoperative patients to minimize intraoperative stress and accelerate postoperative rehabilitation (Offodile et al 2018; Sizonenko et al 2018; Fierens et al 2012). Patients undergoing orthopedic surgery often have severe trauma and are slow to recovery (LeBlanc et al 2014). It is therefore important to develop pathways that reduce surgical stress and enhance rehabilitation for them. Post-Anesthesia Care Unit (PACU) care has been proposed to provide continuous monitoring of patients following anesthesia and surgery to reduce postoperative complications (Varadhan et al 2010; Jakobsen et al 2006). Several studies have shown that FTS rehabilitation improves patient's recovery. For example, it was found that adding a 15-minute-walk on the day of surgery did not increase pain in patients after total knee arthroplasty with enhanced recovery (Zietek et al 2015). Reduced length of stay, increased patient satisfaction and low revision rates together with improved health-related quality of life and functionality have been reported when FTS is implemented (Winther et al 2015). However, it is unclear if and how FTR in PACU would enhance the recovery of orthopedic patients. We investigated the recovery of orthopedic patients with FTR interventions in PACU, and report the role of nursing in the FTR.

PATIENTS AND METHODS

Two hundred and twenty patients undergoing orthopedic surgery under general anesthesia and moved to PACU with tracheal tubes between November 2015 and March 2017 at our hospital were selected for the study. All patients had limb fractures. Patients with pathological fractures and serious cardiovascular or other organ dysfunction were excluded. The patients were randomly divided into 110 cases in the control and the FTR groups using a random number table. The control group consisted of 46 male and 64 female, aged from 29 to 91 (57.76 ± 13.76) years with 24 cases of upper limb fracture and 86 cases of lower limb fracture. The operation time ranged from 55 to 220 (128.04 ± 69.29) minutes. There were 54 males and 56 females in the FTR group, aged from 25 to 88 (59.22 ± 15.74) years. 28 and 82 patients in the group had upper limb lower extremity fracture, respectively, and the operation time was 65 to 210 (120.26 ± 55.16) minutes. There was no significant difference in gender, age and operation time between the two groups ($P > 0.05$).

THE FAST–TRACK PROCEDURE

The fast–track procedure is based on principles previously described (Husted 2012; Kehlet and Wilmore 2008) and was implemented by the nursing team. For patients in the control group, the traditional anaesthesia and PACU resuscitation cares were used. After surgery, the patients with tracheal tubes were sent to the PACU at 22 to 24 degrees celsius with a humidity of 50% to 60%, where they were connected to a connecting ventilator with a tidal volume of 8 to 10mL/kg, respiratory frequency of 12 times/ min at an oxygen flow rate of 1 to 2L/min. The patients were monitored for heart rate, respiration, arterial blood pressure and blood oxygen saturation using a multifunction monitor (MP30, Philipps, USA). Postoperative infusion liquid was heated to 37 degrees celsius and infused at a speed of 40 of 60gtt/min. Patients were prescribed analgesic agents

if the pain was unbearable. Once breathing spontaneously, the patients were intravenously injected with 0.02mg/kg of neostigmine (0.02 mg/kg) and atropine (0.01 mg/kg). After extubation oxygen (2-3 L/min) was supplied using nasal cannula till the Steward score was equal to or more than four, and the patient was sent back to the ward. For patients in the FTR group, the nursing team performed the following additional cares:

Body temperature Control

Once sent to the PACU, patient's axillary temperature was measured. If the temperature was < 36 degrees celcius, heating was given at 38 degrees celcius till the temperature reached 37 degrees celcius.

Infusion control

Infusion volume and rate were carefully controlled according to the change of vital signs of patients after operation to meet minimum effective perfusion. In general, the infusion rate was between 20 to 40gtt/ min to avoid excessive heart and lung burden.

Reducing extubation stimulation

Patients continued to use propofol after entering PACU till spontaneous breathing occurred, tidal volume and ventilation volume had restored to the normal range. The patients ceased to use the ventilator. If SpO_2 was > 0.95 and swallowing was observed, the tube was removed and propofol was then discontinued.

Pain care

Thirty minutes before extubation or operation, patients were given analgesics. After operation, analgesics were applied with enhanced and foreseeable pain care. The pain was evaluated as soon as the patients become conscious. If the pain score was two to three, the nurses would take measures to transfer patient's attention, such as playing light music or conducting psychological counseling. If the score was > four, appropriate analgesics were given. If necessary, the analgesic pump might be used for individualised analgesia.

Nausea and vomiting prevention

For patients undergoing lower extremity surgery, nerve block analgesia was applied to reduce opioid drugs that may cause nausea and vomiting. When necessary, antemetics such as droperidol were used.

Psychological intervention

Once conscious, the nurses were introduced to the patients, who would explain the details of surgery, location and time where he/she stayed, as well as the function of PACU to the patients. The purpose was to let patient to have a full understanding of surgery and postoperative care processes for better compliance and cooperation.

Evaluation method

Temperature at the completion of the operation and one hour after were compared. Riker sedation-agitation scale (SAS) and pain numeric rating (PNR) scale were used to assess the sedation-agitation and pain after extubation. The incidence of nausea and vomiting within 24 hours after operation was recorded.

ETHICS

The Declaration of Helsinki (World Medical Association 2008) ethical principles for research involving human subjects were applied. The study was approved by the ethics committee of the hospital. All patients were informed about the study's purpose, the voluntary nature of their participation, and the right to withdraw at any time. Oral informed or written consent was obtained from every participant.

STATISTICAL ANALYSIS

Data were analyzed using SPSS21.0 software. Measurement data were compared using the t test and rank sum test. χ^2 test was used to compare enumeration data. The significant level was set at 0.05.

FINDINGS

Temperatures in the two groups are presented in table 1. As shown, the average one hour post-operative temperature in the FTR group was significantly higher as compared to those in the control, while the temperatures immediately after operation were similar.

Table 1: Body temperatures of orthopedic patients immediately and one hour after surgery

Group	No. patients	Immediately after surgery	1 hour after surgery
Control	110	34.84±0.27	36.00±0.20
Fast-track rehabilitation	110	34.90±0.23	37.12±0.25
t		1.196	22.627
P		>0.05	<0.01

The scores of sedation-agitation and pain and the incidence of nausea and vomiting after extubation and hospital stay days are shown in table 2. These figures were significantly less in the FTR group than in the control group.

Table 2: Scores of sedation-agitation and pain, the incidence of nausea and vomiting after extubation and hospital stay days

Group	No. patients	Sedation-agitation	Pain	Nausea	Vomiting	Hospital stays (day)
Control	110	4.06±0.82	4.02±1.31	18 (16.4)	16 (14.5)	34.4±6.55
Fast-track rehabilitation	110	3.78±0.42	1.90±0.88	4 (3.6)	2 (1.8)	30.6±4.55
X^2/t		2.10	7.06	5.01	4.39	12.22
P		<0.05	<0.05	<0.05	<0.05	<0.05

DISCUSSION

Perioperative stress results from many aspects, including tension, anxiety, hunger, hypothermia, pain, anesthesia and infusion and each of them has an impact on the whole treatment and recovery effect. Applying the concept of FTR would optimize the efforts of medical treatments and nursing measures, reduce the stress and accelerate recovery (Fierens et al 2012; Basse et al 2002) . Several nursing care measures were implemented in our study as part of FTR care to accelerate patient's recovery. Psychological nursing is an important part of FTS. Since the operation causes injury of the body, the patient has the psychology of fear, tension, anxiety and depression. The study shows that 38.46% and 23.08% of fracture patients feel anxious and depressed, respectively (Tang et al 2008). Anxiety and depression often make patients less cooperative in the surgery and increase the risk of operation and postoperative complication rate (Brooke et al 2014). Appropriate psychological care helps relieve patients from the fear, anxiety and physiological stress, resulting in better recovery with less complications (Na et al 2014). In addition, psychological nursing helps develop a good nurse - patient relationship and reduce the emotional fluctuation, psychological and physiological stress of patients. In this hospital, much of psychological nursing is offered by senior nurses, who have been specifically trained or acquired relevant know-how during their career.

Preventing hypothermia after an operation is another important aspect of postoperative care. Perioperative hypothermia is a common complication of surgery, leading to 1.0 to 15 degrees celcius reduction of body temperature in 50% to 70% patients after surgery (Giuliano and Hendricks 2017). Hypothermia may cause a number of adverse reactions, such as incision infection, myocardial ischemia, adverse cardiac events, chills,

and coagulation dysfunction, and prolong and affect the effect of drugs, delay the awakening of anaesthesia and increase mortality. Maintenance of normothermia can reduce the influence of body temperature on coagulation mechanism, drug metabolism and oxygen consumption, and reduce low temperature-associated complications (Prunet et al 2012; Khan et al 2011). As part of FTR, controlled infusion on operation day and after operation is closely monitored by the nursing team in the hospital. It was noted that in the traditional surgical operation and post operation, large infusion is used to maintain desirable blood pressure. However, the postoperative stress would lead to increased secretion of antidiuretic hormones, resulting in water and sodium retention. Therefore, large infusion would aggravate cardiovascular burden. There is evidence that reduced liquid infusion is beneficial for reducing postoperative complications and shortening the postoperative hospital stay (Brandstrup 2006). Therefore, as long as the patient's vital signs are normal, the amount of fluid infusion should be restricted. Reducing pain-induced irritation is an important step in FTR care. Although preventive analgesia effectively reduces the stress response of patients (Buvanendran and Kroin 2009), this study found that nursing care also assists calm the patient's emotion and irritation and should be enhanced. Prevention of postoperative nausea and vomiting, which are common complications after surgery, is another part of nursing intervention to alleviate the negative emotions of patients. This can be achieved by providing a comfortable, clean environment, and if necessary, the use of prescribed antiemetics.

This study shows that by practicing the above-mentioned FTR care through the nursing team, the one hour post-operative temperature, scores of sedation-agitation and pain, the incidence of nausea and vomiting and hospital days were significantly reduced compared to traditional care, demonstrating these nursing measures are effective in accelerating the recovery of the orthopedic patient. The study shows that for orthopedic patient care in the PACU following general anesthesia, it is possible to shorten the hospitalisation time, improve patient satisfaction, minimise surgical stress, prevent and reduce the complications and promote postoperative rehabilitation through combined use of several care measures.

CONCLUSION

A FTR care helps improve the treatment outcomes of patients undergoing orthopedic surgery and the nursing team plays a pivotal role in implementing the program.

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