Outcomes of Nutrition Status Assessment by Bhumibol Nutrition Triage/Nutrition Triage (BNT/NT) in Multicenter THAI-SICU Study

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Objective: *The objective of the study is to evaluate the nutrition assessment tool used by Bhumibol Nutrition Triage/Nutrition Triage (BNT/NT) for patient outcomes in a surgical intensive care unit (SICU).*
Material and Method: *All data were retrieved from the THAI-SICU database. A total of 1,685 patients from three medical centers were participants in the nutrition project and were enrolled onto this study. The parameters needed for BNT/NT scoring were recorded including body mass index (BMI), weight change, energy delivery, age, and disease severity. The BNT/NT calculation was classified into 4 groups as BNT/NT I to IV. An adjusted odds ratio (OR) with 95% confidence interval (CI) of mortality and sepsis occurrence were reported. Results were classed as being statistically significant at $p<0.05$.*
Results: *Regarding the nutrition assessment classification, the patients admitted to SICU were classified as BNT/NT class I48.6%, class II 30.0%, class III 9.3%, and class IV 12.1%. There were statistically significant differences between classes in terms of BMI, weight change, energy delivery and disease severity. In addition, the BNT/NT classification was also significantly associated with ICU mortality [OR (95% CI): 1.51 (1.25-1.83); $p<0.001$], 28 day mortality [1.47 (1.23-1.74); $p<0.001$], and sepsis occurrence [1.41 (1.25-1.60); $p<0.001$].*
Conclusion: *Most of the patients admitted to SICU had a low nutrition risk BNT/NT class I and II. The higher BNT/NT scores were associated with mortality and sepsis occurrence in SICU.*

Keywords: *Nutrition assessment, Nutrition outcome, Surgical intensive care unit, Mortality, Sepsis*

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Many nutrition screenings and assessment tools are recommended for in-hospital patients[1], the tools being developed in different settings and different countries. In Thailand, the results of a nationwide survey showed that the most commonly popularized nutrition assessment tools were Bhumibol Nutrition Triage/Nutrition Triage (BNT/NT), Nutrition Alert Form (NAF), and Subjective Global Assessment (SGA), respectively[2,3]. Both BNT/NT and NAF were developed by Thai nutrition experts[4,5]. Although the BNT/NT was used in the highest proportion of units, about 40% of responder units in this survey, the validation of these tools on surgical intensive care patients (SICU) was still not well defined[3]. Therefore, the objective of this study is to validate the BNT/NT on the SICU outcomes in high risk surgical patients who were admitted to the SICU.

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Material and Method

The authors retrieved the data from the THAI-SICU database. The nutrition assessments of Bhumibol Nutrition Triage/Nutrition Triage (BNT/NT) parameters were recorded in isolated case record forms. Details of the study and the centers who enrolled were reported as the reference to previous report of THAI-SICU study methodology[6]. Although the number of enrolled centers included nine University-based hospitals across Thailand, only 3 of these centers collected the actual nutrition case record forms. Data from a total of 2,249 patients were collected in these centers. Of these, a total of 563 patients were excluded because of incomplete records for nutrition assessment variables. The BNT/NT assessment tool version from the year

2012 (modified from version 2009) was used for the present study (Appendix). Patient demographic data, diagnostic categories, disease severity according to acute physiologic and chronic health II score (APACHE II score) and admission albumin levels were recorded. Regarding the nutrition variables, appetite loss, weight change, detail of energy delivery, and disease severity were graded using the BNT/NT score. The ICU outcomes including ICU mortality, 28-day mortality and new occurrence of sepsis were retrieved from the THAI-SICU database. The institute ethics committees of all enrolled centers approved thisTHAI-SICU study.

The BNT/NT scoring system is classified into 4 classes (Class I, score 0-4; Class II score 5-7; Class III score 8-10; and Class IV score >10) (Appendix). The BNT/NT class I is defined as no nutrition risk at this moment in time. The BNT/NT class II is defined as slight nutrition risk. The BNT/NT class III is defined as moderate nutrition risk. The BNT/NT class IV is defined as severe or high nutrition risk.

The data was analyzed using STATA version 12.0 (STATA Inc., College Station, TX). The four classifications of BNT/NT are categorical data so the Chi-square test was used for the analysis of this data. As regards the continuous data, the parametrically distributed data were analyzed using the ANOVA test and non-parametrically distributed data were analyzed using the Kruskal-Wallis test. A multivariable logistic regression was used for the analysis and adjustment of the imbalance of baseline patient characteristics. Multi-collinearity associations between the variables were tested by the variance inflation factor (VIF). This method, in combination with the clinical assumptions, were the considered factors for selecting the variables into the regression model. The result was reported as adjusted odds ratio (OR) with 95% confidence intervals. The statistically significant differences were defined as having a *p*-value of less than 0.05.

Results

A total of 1685 patients were used for the present study. Nearly half of the patients were classified as no nutrition risk by the BNT/NT classification, so were in class I (48.6%). The most frequent nutrition risk classification was mild risk (BNT/NT II, 30.0%). Nearly 20% of patients were classified as a combination of moderate and severe risk (BNT/NT class III, 9.3% and IV 12.1%). Regarding the patient characteristics (Table 1), there were significant differences between BNT/NT classifications including age ($p<0.001$), body weight ($p<0.001$), height ($p<0.001$), body mass index ($p<0.001$), diagnostic categories ($p = 0.001$), APACHE II score

Table 1. Patient characteristic categorized by BNT/NT classification

Variables	BNT/NT I (n = 820)	BNT/NT II (n = 505)	BNT/NT III (n = 156)	BNT/NT IV (n = 204)	*p*-value
Age, year, (IQR)	61 (48-73)	68 (56-78)	71 (58-80)	66.5 (51.5-76.5)	<0.001
Body weight, kg, (IQR)	60 (52-69)	56 (48-65)	54 (45-65)	55 (45.5-65)	<0.001
Height, cm, (IQR)	160 (155-167)	160 (153-165)	160 (150-165)	160 (155-165)	<0.001
Body mass index, kg/m^2, (IQR)	23.1 (20-25.8)	22.2 (19.5-25.3)	21.6 (18.2-25.4)	21.5 (18.7-25.1)	<0.001
Male (%)	485 (59.15)	273 (53.95)	80 (51.28)	121 (59.31)	0.113
Diagnosis (%)					
Cardiovascular	172 (20.98)	88 (17.43)	16 (10.26)	25 (12.25)	0.001
Respiratory	99 (12.07)	72 (14.26)	25 (16.03)	21 (10.29)	
Abdominal	215 (26.22)	203 (40.20)	86 (55.13)	89 (43.63)	
Head-neck	42 (5.12)	11 (2.18)	3 (1.92)	3 (1.47)	
Sepsis	15 (1.83)	10 (1.98)	4 (2.56)	10 (4.90)	
Trauma	58 (7.07)	22 (4.36)	1 (0.64)	10 (4.90)	
Metabolic	24 (2.93)	6 (1.19)	1 (0.64)	6 (2.94)	
Hematological	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.49)	
Renal	81 (9.88)	33 (6.53)	7 (4.49)	18 (8.82)	
Obstetrics-gynecology	35 (4.27)	17 (3.37)	3 (1.92)	1 (0.49)	
Musculoskeletal and skin	56 (6.83)	36 (7.13)	9 (5.77)	14 (6.86)	
Others	23 (2.80)	7 (1.39)	1 (0.64)	6 (2.94)	
APACHE II score (IQR)	10 (6-14)	13 (9-19)	16 (12.5-20)	14 (9-20)	<0.001
Albumin at admission, g/dL, (IQR)	3 (2.4-3.6)	2.7 (2.1-3.3)	2.5 (2-3.1)	2.5 (2-3.1)	<0.001

Table 2. Nutrition assessment parameters in BNT/NT

Variables	BNT/NT I (n = 820)	BNT/NT II (n = 505)	BNT/NT III (n = 156)	BNT/NT IV (n = 204)	*p*-value
Appetite loss					
Yes	105 (12.80)	229 (45.26)	107 (68.59)	77 (37.75)	<0.001
No	683 (83.29)	246 (48.62)	40 (25.64)	96 (47.06)	
Not sure	32 (3.90)	31 (6.13)	9 (5.77)	31 (15.20)	
BMI score					
Score 0	513 (62.56)	295 (58.30)	71 (45.51)	116 (56.86)	<0.001
Score 1	226 (27.56)	126 (24.90)	47 (30.13)	53 (25.98)	
Score 2	48 (5.85)	50 (9.88)	17 (10.90)	17 (8.33)	
Score 3	33 (4.02)	35 (6.92)	21 (13.46)	18 (8.82)	
Weight change					
Timing of weight loss (%)					
≤1 week	12 (1.46)	15 (2.96)	4 (2.56)	5 (2.45)	<0.001
2-3 week	11 (1.34)	28 (5.53)	10 (6.41)	10 (4.90)	
1-2 months	22 (2.68)	85 (16.80)	40 (25.64)	28 (13.73)	
3-5 months	27 (3.29)	66 (13.04)	33 (21.15)	16 (7.84)	
>5 months	20 (2.44)	33 (6.52)	20 (12.82)	13 (6.37)	
Uncertain time	728 (88.78)	279 (55.14)	49 (31.41)	132 (64.71)	
Weight change score (%)					
Score 0	707 (86.22)	247 (48.81)	37 (23.72)	18 (8.82)	<0.001
Score 1	61 (7.44)	77 (15.22)	16 (10.26)	12 (5.88)	
Score 2	31 (3.78)	66 (13.04)	24 (15.38)	23 (11.27)	
Score 3	21 (2.56)	116 (22.92)	79 (50.64)	151 (74.02)	
Energy delivery before ICU admission					
Route of delivery					
Oral	790 (96.34)	453 (89.53)	140 (89.74)	157 (76.96)	<0.001
Tube feed (Enteral)	12 (1.46)	30 (5.93)	8 (5.13)	8 (3.92)	
IV (Parenteral)	10 (1.22)	6 (1.19)	1 (0.64)	0 (0.00)	
Combined	6 (0.73)	10 (1.98)	3 (1.92)	35 (17.16)	
No	2 (0.24)	7 (1.38)	4 (2.56)	4 (1.96)	
Time of delivery					
≤7 days	21 (2.56)	21 (4.15)	6 (3.85)	12 (5.88)	<0.001
8-14 days	15 (1.83)	27 (5.34)	7 (4.49)	13 (6.37)	
>14 days	665 (81.10)	371 (73.32)	123 (78.85)	68 (33.33)	
Uncertain time	119 (14.51)	87 (17.19)	20 (12.82)	111 (54.41)	
Estimated in percent (IQR)	100 (80-100)	75 (50-100)	50 (25-75)	50 (25-55)	<0.001
Energy delivery score					
Score 0	756 (92.20)	270 (53.36)	36 (23.08)	11 (5.39)	<0.001
Score 1	54 (6.59)	176 (22.13)	50 (32.05)	18 (8.82)	
Score 2	8 (0.98)	53 (10.47)	60 (38.46)	158 (77.45)	
Score 3	2 (0.24)	7 (1.38)	10 (6.41)	16 (7.84)	
Score 4	0 (0)	0 (0)	0 (0)	1 (0.49)	
Disease severity score					
Acute disease score					
Score 0	756 (92.20)	118 (23.32)	73 (46.79)	12 (5.88)	<0.001
Score 1	14 (1.71)	335 (66.21)	2 (1.28)	2 (0.98)	
Score 2	24 (2.93)	19 (3.75)	55 (35.26)	15 (7.35)	
Score 3	26 (3.17)	34 (6.72)	26 (16.67)	175 (85.78)	
Chronic disease score					
Score 0	404 (49.27)	123 (24.31)	19 (12.18)	7 (3.43)	<0.001
Score 1	150 (18.29)	68 (13.44)	4 (2.56)	18 (8.82)	
Score 2	143 (17.44)	112 (22.13)	38 (24.36)	27 (13.24)	
Score 3	123 (15.00)	203 (40.12)	95 (60.90)	152 (74.51)	

Table 2. cont.

Variables	BNT/NT I (n = 820)	BNT/NT II (n = 505)	BNT/NT III (n = 156)	BNT/NT IV (n = 204)	*p*-value
Age score					
Score 0	546 (66.59)	267 (52.77)	70 (44.87)	112 (54.90)	<0.001
Score 1	211 (25.73)	159 (31.42)	43 (27.56)	59 (28.92)	
Score 2	63 (7.68)	80 (15.81)	40 (25.64)	31 (15.20)	
Score 3	0 (0.00)	0 (0.00)	3 (1.92)	2 (0.98)	

(p<0.001) and admission albumin level (p<0.001).

Regarding nutrition assessment variables (Table 2), while only 13% of BNT/NT I had a history of appetite loss, around 40-70% of patients, who were classified as having a nutrition risk (BNT/NT class II-IV) had this history. The higher classes of BNT/NT had weight loss over a longer period and a statistically significant weight change score (p<0.001). Regarding the energy delivery before admission to ICU, around 75-96% of patient had an oral route for energy intake. However, although there was less than 5% of patients in BNT/NT class I-III had a combination of enteral nutrition (EN) and parenteral nutrition (PN) before ICU admission, 17.2% of the BNT/NT class IV had this combination. The estimated energy intake was significantly lower in the moderate and severe nutrition risk groups (BNT/NT III and IV) (Table 2). These observations led to a significant difference between the energy delivery score according to BNT/NT class. Both acute and chronic diseases had similar BNT/NT classification (Table 2). Of these, the most common diseases and comorbidities were cancer, heart disease, diabetic mellitus, kidney disease, respiratory disease and sepsis, respectively (Table 3).

Regarding the multivariable regression analyses, although there were statistical differences between the BNT/NT groups regarding patient characters including body weight, height and body mass index the authors found that these variables had a multicolinearity association (VIF >10). The authors selected only the body mass index into the model because of the representative body weight and height association. After the models were adjusted by age, body mass index, admission APACHE II score, diagnostic categories and albumin level the nutrition risk of patients (BNT/NT class II, III and IV) had significantly higher adjusted odds ratio comparison with the no nutrition risk patients (BNT/NT class I) on ICU mortality, 28-day mortality and new sepsis occurrence (Table 4).

Discussion

There are several variables on the different screening and assessment tools[7]. The systematic review by van Bokhorst-de van der Schueren et al reported there were about 28 categorical variables used in nutrition screening and assessment tools worldwide[1]. In 2012, the consensus statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition recommended that the clinical data for supporting the diagnosis of malnutrition should document the clinical characteristics into six categories including adequacy of energy intake, weight loss, loss of body fat, loss of muscle mass, fluid accumulation, and reduced grip strength[8]. The European Society of Parenteral and Enteral Nutrition (ESPEN) recommended three screening tools including the Malnutrition Universal Screening Tool (MUST), Nutrition Risk Screening 2002 (NRS 2002), and Mini Nutrition Assessment (MNA) for the elderly[9]. These tools are widely available in European countries. In Thailand, the three most commonly used nutrition tools are BNT/NT, NAF and SGA respectively[3]. As regards the BNT/NT, this tool has had be developed and revised in many versions since 2000 by Dr. Vibul Trakulhoon. The older name was BNT and was changed into NT in 2011 when the scoring system in the tool was altered although the same variables were used. The THAI-SICU study was initiated in the year 2010 and the variables were collected as in the previous version of BNT and these variables were scored using NT (Appendix). Therefore, the authors have called this the BNT/NT in this study. Regarding the variables, there were statistically significant differences between the BNT/NT variables as demonstratedin Table 2.

The scores of BNT/NT in the 2011 version are the summation of six category scoring parameters which consisted of the BMI score, weight change score, energy delivery score, acute disease score, chronic disease score, and age score (Appendix and Table 2).

Table 3. Severity of disease and comorbidity based on BNT/NT definition

Conditions	All, n total	Level I, n (%)	Level II, n (%)	Level III, n (%)
Cancer	496	136 (27.42)	224 (45.16)	136 (27.42)
Heart diseases	282	150 (53.19)	98 (34.75)	34 (12.06)
Diabetic mellitus	252	116 (46.03)	113 (44.84)	23 (9.13)
Kidney diseases	235	56 (23.83)	85 (36.17)	94 (40.00)
Respiratory diseases	149	46 (30.87)	68 (45.64)	35 (23.49)
Sepsis	114	5 (4.39)	55 (48.25)	54 (47.37)
Recent surgery within 1-2 weeks	62	14 (22.58)	28 (45.16)	20 (32.26)
Cirrhosis	52	10 (19.23)	24 (46.15)	18 (34.52)
Neurological disorders	52	29 (55.77)	18 (34.62)	5 (9.62)
Ascites	31	2 (6.45)	16 (51.61)	13 (41.94)
Peritonitis	30	4 (13.33)	15 (50.00)	11 (36.67)
Generalized edema	29	10 (34.48)	12 (41.38)	7 (24.14)
Trauma (general)	19	5 (26.32)	6 (31.58)	8 (42.11)
Head injury	18	4 (22.22)	6 (33.33)	8 (44.44)
Bed sore	14	10 (71.43)	3 (21.43)	1 (7.14)
Spine injury	13	5 (38.46)	4 (30.77)	4 (30.77)
Pancreatitis	8	2 (25.00)	2 (25.00)	4 (50.00)
HIV	5	1 (20.00)	3 (60.00)	1 (20.00)
Burns	4	1 (25.00)	0 (0.00)	3 (75.00)
Short bowel	3	2 (66.67)	1 (33.33)	0 (0.00)

Table 4. Treatment outcomes divided by nutrition assessment categories

Outcomes	Value	Adjusted OR*	95% confidence interval	*p*-value
ICU mortality, n (%)				
BNT/NT I	42 (5.12)	1.00	-	
BNT/NT II	60 (11.88)	1.86	1.11 to 3.11	0.018
BNT/NT III	37 (23.72)	3.77	2.02 to 7.00	<0.001
BNT/NT IV	32 (15.69)	2.99	1.58 to 5.66	0.001
BNT/NT All	171 (10.15)	1.51	1.25 to 1.83	<0.001
28 days mortality, n (%)				
BNT/NT I	55 (6.71)	1.00	-	
BNT/NT II	83 (16.44)	2.06	1.32 to 3.20	0.001
BNT/NT III	47 (30.13)	4.04	2.34 to 6.96	<0.001
BNT/NT IV	43 (21.08)	2.55	1.43 to 4.53	0.001
BNT/NT All	228 (13.53)	1.47	1.23 to 1.74	<0.001
Sepsis occurrence, n (%)				
BNT/NT I	154 (18.78)	1.00	-	
BNT/NT II	166 (32.87)	1.63	1.22 to 2.19	0.001
BNT/NT III	75 (48.08)	3.04	1.99 to 4.62	<0.001
BNT/NT IV	84 (41.18)	2.31	1.52 to 3.50	<0.001
BNT/NT All	479 (28.43)	1.41	1.25 to 1.60	<0.001

OR = odds ratio

* The outcomes were adjusted by age, body mass index, admission APACHE II score, diagnosis categories and albumin level

Acute disease and chronic disease severity were categories in level 3 (Table 3). These parts of the disease severity score are the prominent features compared to the other screening tools. The severity level is defined

using the details of each disease. However, the opinions in the focus group discussion on the nationwide survey reported that these factors may be difficult to evaluate by non-physician personnel[2]. The other advantageous feature of the BNT/NT is the inclusive suggestions of a nutrition care plan and nutrition follow-up suggestion. According to the BNT/NT scoring system, nearly 80% of all SICU patients enrolled onto the study were at a low risk of malnourishment (BNT/NT I and II). In fact only approximately 20% of patients required close follow-up.

Regarding the multivariable logistic regression analysis, the body weight and height had a multicolinearal association with BMI. Therefore, the adjusted model uses the BMI on the model as well as the difference value of baseline characters (age, APACHE II score, diagnosis categories and albumin level). The results demonstrate that the higher BNT/NT classifications were significant associated with higher ICU mortality, 28 day mortality, and sepsis occurrence (Table 4). The mortality and morbidity outcomes of nutrition risk by BNT/NT were similar to previous studies using different tools and led to worse outcomes[10-12].

The present study was the first report of BNT/NT classification on the outcome in SICU. However, there were some limitations in the study. Firstly, most of weight change and energy delivery scores were estimated by the patients and their relatives. The recorded data were defined as uncertain time range between 10-90% on both variables of weight change and amount of energy delivery (the weight loss timing, 30-90% and energy deficit timing, 10-60%, Table 2). Secondly, the study was verified using the BNT/NT version 2010-2011 and it could not be extrapolated to the last version dated 2013. The 2013 version sums the eight score parameters. The BNT/NT version 2013 added the muscle loss score, body fat loss score, fluid accumulation, and muscle strength score. However, the 2013 tool did not include the BMI score as in the previous version. Thirdly, the present study did not collect the nutrition management during the hospital stay and the other nutrition related complications. The higher nutrition risk patients might have the possibility of obtaining nutritional support. This might be the reason for the mortality and septic occurrence rates being lower and the lower OR on the BNT/NT IV than BNT/NT III in this study. In addition, other related complications such as wound healing, and pressure ulcer occurrence were not reported in this study. Finally, in the present study the nutrition anthropometric measurement parameters (e.g. triceps skinfold and mid-arm circumference) were not collected in addition to the body composition. The present study could not, therefore, demonstrate the association of BNT/NT with these nutrition assessment parameters. However, an association between the BNT/NT score and the admission albumin level was found in this study.

Conclusion

Most of the patients admitted to SICU had low nutrition risks according to the BNT/NT score. The BNT/NT score were associated with mortality and sepsis occurrence in SICU.

What is already known on this topic?

Malnourished patients in hospital have higher morbidity and mortality. Most studies used the nutrition assessment tool which was developed in Western countries.

What this study adds?

The higher levels of BNT/NT are associated with worse outcomes in SICU patients.

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Potential conflicts of interest

None.

References

1. van Bokhorst-de van der Schueren MA, Guaitoli PR, Jansma EP, de Vet HC. Nutrition screening tools: does one size fit all? A systematic review of screening tools for the hospital setting. Clin Nutr 2014; 33: 39-58.
2. Chittawatanarat K, Tosanguan K, Chaikledkaew U. Health Interventiona and Technology Assessment Program. The knowledge gap of nutrition assessment and treatment in Thai

government hospital [Internet]. 2013 [cited 2016 Jun 30]. Available from: http://www.hitap.net/documents/18954
3. Chittawatanarat K, Tosanguan K, Chaikledkaew U, Tejavanija S, Teerawattananon Y. Nationwide survey of nutritional management in an Asian upper-middle income developing country government hospitals: Combination of quantitative survey and focus group discussion. Clin Nutr ESPEN 2016; 14: 24-30.
4. Komindrg S, Tangsermwong T, Janepanish P. Simplified malnutrition tool for Thai patients. Asia Pac J Clin Nutr 2013; 22: 516-21.
5. Pibul K, Techapongsatorn S, Thiengthiantham R, Manomaipiboon A, Trakulhoon V. Nutritional assessment for surgical patients by Bhumibol Nutrition Triage (BNT) and Subjective Global Assessment (SGA). Thai J Surg 2011; 32: 45-8.
6. Chittawatanarat K, Chaiwat O, Morakul S, Pipanmekaporn T, Thawitsri T, Wacharasint P, et al. A multi-center Thai university-based surgical intensive care units study (THAI-SICU study): methodology and ICU characteristics. J Med Assoc Thai 2014; 97 (Suppl 1): S45-54.
7. Mueller C, Compher C, Ellen DM. A.S.P.E.N. clinical guidelines: Nutrition screening, assessment, and intervention in adults. JPEN J Parenter Enteral Nutr 2011; 35: 16-24.
8. White JV, Guenter P, Jensen G, Malone A, Schofield M. Consensus statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition: characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). J Acad Nutr Diet 2012; 112: 730-8.
9. Kondrup J, Allison SP, Elia M, Vellas B, Plauth M. ESPEN guidelines for nutrition screening 2002. Clin Nutr 2003; 22: 415-21.
10. Sorensen J, Kondrup J, Prokopowicz J, Schiesser M, Krahenbuhl L, Meier R, et al. EuroOOPS: an international, multicentre study to implement nutritional risk screening and evaluate clinical outcome. Clin Nutr 2008; 27: 340-9.
11. Loser C. Malnutrition in hospital: the clinical and economic implications. Dtsch Arztebl Int 2010; 107: 911-7.
12. Norman K, Pichard C, Lochs H, Pirlich M. Prognostic impact of disease-related malnutrition. Clin Nutr 2008; 27: 5-15.

Appendix

การประเมินภาวะทุโภชนาการ BNT/NT (Nutrition Assessment form BNT/NT)

วันที่ประเมิน ..... ชื่อผู้ป่วย ..... อายุ .....ปี, HN ..... AN .....

นน. (กก.) CBW ..... , UBW ..... , IBW ..... , estimated dry BW …….. , ส่วนสูง …… ซม.

(นน.ปัจจุบัน; CBW : Current body weight , นน.ปกติ; UBW : Usual body weight , นน.มาตรฐาน; IBW : Ideal body weight)

❷ ดัชนีมวลกาย (Body mass index:BMI) = ... (กิโลกรัม / เมตร^2) คะแนน

(International classification of adult BMI. Asian & Pacific population. WHO 2004)

(สปสช)

Underweight <18.5
Overweight ≥25

❸ การเปลี่ยนแปลงของน้ำหนัก (โดยไม่ตั้งใจ) คะแนน

❑ เท่าเดิม (คะแนน = 0)

❑ ลดลง.....% ในระยะเวลา ..... เดือน หรือ ..... สัปดาห์

ระยะเวลา	% ของน้ำหนักที่ ลดลง		
	เล็กน้อย	ปานกลาง	รุนแรง
คะแนน	1	2	3
1 สัปดาห์	< 1 %	1 – 2 %	> 2 %
2 – 3 สัปดาห์	< 2 %	2 – 3 %	> 3 %
1 เดือน	< 4 %	4 – 5 %	> 5 %
3 เดือน	< 7 %	7 – 8 %	> 8 %
> 5 เดือน	< 10 %	10 %	> 10 %

❑ เพิ่มขึ้น .....% ในระยะเวลา ..... เดือน

1 เดือน	≥ 5 %
6 เดือน	≥ 10 %

➡ คะแนน = 3

modified from Kovacevich DS. et tal. N. risk classification in PN Handbook. A.S.P.E.N.2009

IBW : Ideal Body Weight : ชาย = ส่วนสูง (ซม.) – 100 ; หญิง = ส่วนสูง (ซม.) – (105 หรือ 110)

❹ ประวัติการได้รับสารอาหาร คะแนน

พิจารณาภาพรวมทั้ง ประเภท – ปริมาณ - คุณภาพ ของสารอาหาร และ ระยะเวลา ที่เปลี่ยนแปลง

ให้คะแนน 0 = ปกติ หรือ ไม่เปลี่ยนแปลง ไปจนถึง คะแนน 4 = รุนแรง

อาหาร หรือ สารอาหาร ที่ได้รับ	ระยะเวลาที่เปลี่ยนแปลง (วัน) ❑ คะแนน ที่เลือก		
❑กินเอง ❑TF ❑PN ❑standard IV ❑Combination TF : tube feeding , PN : Parenteral nutrition	≤ 7 วัน	8 – 14 วัน	> 14 วัน
❑ < 10 % (NPO , ได้รับแต่น้ำเกลือมาตรฐาน)	❑1 ❑2	❑2 ❑3	❑3 ❑4
❑ 10 – 25 % ของปริมาณปกติ หรือ แคลอรี ที่ต้องการ	❑0 ❑1	❑1 ❑2	❑2 ❑3
❑ 25 –50 % ของปริมาณปกติ หรือ แคลอรี ที่ต้องการ	0	❑0 ❑1	❑1 ❑2
❑ 50 –75 % ของปริมาณปกติ หรือ แคลอรี ที่ต้องการ	0	0	1
❑ 75 – 100 % ของปริมาณปกติ หรือ แคลอรี ที่ต้องการ	0	0	0

❺ ประเมินความรุนแรงของภาวะเจ็บป่วย เรื้อรัง คะแนน

ที่มี ผลกระทบ ต่อภาวะโภชนาการ และ เมตาบอลิซึม

(0 = ปกติดี , 1 = เล็กน้อย , 2 = ปานกลาง , 3 = รุนแรง) รายละเอียดตามคู่มือ

โรค และ โรคร่วม	คะแนน			
โรคมะเร็ง (Stage I = 0, II = 1, III = 2, IV = 3)	0	1	2	3
โรคปอด (TB, COPD,.....)	0	1	2	3
โรคหัวใจ	0	1	2	3
โรคไต (ไตวายเรื้อรัง ยังมีปัสสาวะ = 2, HD/PD= 3)	0	1	2	3
โรคตับ (HE = 3)	0	1	2	3
โรคเบาหวาน (FBS > 250 =2, DM ketosis/COMA =3)	0	1	2	3
HIV (ร่างกายทรุดโทรมชัดเจน = 3)	0	1	2	3
โรค / สภาวะ อื่นๆ(Diarrhea, EC-Fistula, Short bowel , ...)	0	1	2	3
ท้องมาน (มีประมาณระดับสะดือ = 2, เต็มท้อง =3)	0	1	2	3
ภาวะบวมน้ำ (บวมครึ่งตัว = 2, บวมทั้งตัว = 3)	0	1	2	3
แผลกดทับ (ลึกถึงไขมัน = 2, ลึกถึงกล้ามเนื้อ = 3)	0	1	2	3
แผลเรื้อรังอื่นๆ.....	0	1	2	3
ภาวะด้อยสมรรถภาพ ของกล้ามเนื้อ/ระบบประสาท	0	1	2	3
หมายเหตุ รวมคะแนนที่ได้ในข้อ ❺ ใส่ในช่องคะแนน				

❻ อายุผู้ป่วย : > 70 = 1 , > 80 = 2 , > 90 = 3 ..... คะแนน

❼ ประเมินความรุนแรงของ ภาวะเจ็บป่วย เฉียบพลัน คะแนน

ที่มี ผลกระทบ ต่อภาวะโภชนาการ และ เมตาบอลิซึม

(0 = ไม่มีผลกระทบฯ , 1 = เล็กน้อย , 2 = ปานกลาง , 3 = รุนแรง)

Stress : อุบัติเหตุ , บาดเจ็บ, การอักเสบ-ติดเชื้อ , Burn, ...	คะแนน			
Non neurological trauma, ...	0	1	2	3
Head injury (GCS : 15 = 0 , 14 -13 =1, 12 -8 = 2, 7-3 = 3)	0	1	2	3
Burn (ตื้น < 15% / ลึก >5% =2, ตื้น > 20% / ลึก >10% =3)	0	1	2	3
Sepsis (sepsis =1, severe sepsis =2, septic shock = 3)	0	1	2	3
Recent major operation (1- 2 wk.)	0	1	2	3
Acute pancreatitis, Hepatitis, Peritonitis,.....	0	1	2	3
Necrotizing fasciitis	0	1	2	3
Other threatening condition	0	1	2	3
หมายเหตุ คะแนนสูงสุดในข้อ ❼= 4 คะแนน, ถ้า <4 ให้ใส่คะแนนตามที่รวมได้จริง ประยุกต์จาก การวินิจฉัย ภาวะทุโภชนาการโดย ASPEN (JPEN / Vol.35, No.1, Jan 2011)				

❽ สรุปคะแนน ข้อ ❷ + ❸ + ❹ + ❺ + ❻ + ❼ = ... คะแนน

ระดับภาวะทุโภชนาการ (คะแนน) : การปฏิบัติ

❑ BNT/NT-I (0 - 4) ไม่มี หรือ มีความเสี่ยง : ติดตามประเมินทุก 6 – 8 สัปดาห์

❑ BNT/NT-II (5 – 7) เล็กน้อย : ติดตามประเมินทุก 4 – 6 สัปดาห์

❑ BNT/NT-III (8 – 10) ปานกลาง : ควรเริ่มให้โภชนบำบัด ประเมินทุก 3-7 วัน

❑ BNT/NT-IV (> 10) รุนแรง : พิจารณาส่งปรึกษาทีมโภชนบำบัด

ผลการรักษากับการประเมินภาวะโภชนาการด้วยเครื่องมือ BNT/NT ในการศึกษาสหสถาบัน THAI-SICU

กวีศักดิ์ จิตตวัฒนรัตน์, อรอุมา ชัยวัฒน์, สัณฐิติ โมรากุล, สุณีรัตน์ คงเสรีพงศ์

วัตถุประสงค์: เพื่อประเมินภาวะโภชนาการที่ประเมินโดยวิธี BNT/NT กับผลการรักษาในหออภิบาลผู้ป่วยหนักศัลยกรรม

วัสดุและวิธีการ: ข้อมูลในการศึกษานี้ได้จากฐานข้อมูล THAI-SICU ผู้ป่วยจำนวน 1,685 คนจาก 3 สถาบัน เข้าร่วมในโครงการประเมินด้านโภชนาการและนำมาในการศึกษาดังกล่าว บันทึกตัวแปรที่นำมาใช้สำหรับการให้คะแนนตามแบบประเมิน BNT/NT ได้แก่ ดัชนีมวลกาย น้ำหนักที่เปลี่ยนแปลง พลังงานที่ได้รับ อายุ และความรุนแรงของโรค โดยคะแนนที่ได้จะทำการแบ่งผู้ป่วยเป็น 4 กลุ่มคือ BNT/NT ระดับ I ถึง IV รายงานความสัมพันธ์ของอัตราการเสียชีวิตและการติดเชื้อจากการปรับค่าของ odds ratio (OR) และความเชื่อมั่นที่ร้อยละ 95 โดยความแตกต่างอย่างมีนัยสำคัญทางสถิติเมื่อค่า $p<0.05$

ผลการศึกษา: ตามการประเมินภาวะโภชนาการ ผู้ป่วยที่เข้ารับการรักษาในหออภิบาลผู้ป่วยหนักศัลยกรรมแบ่งเป็น BNT/NT ระดับ I ร้อยละ 48.6, ระดับ II ร้อยละ 30.0, ระดับ III ร้อยละ 9.3, และระดับ IV ร้อยละ 12.1 โดยพบว่ามีความแตกต่างกันอย่างมีนัยสำคัญระหว่างกลุ่มของดัชนีมวลกาย น้ำหนักที่เปลี่ยนแปลง พลังงานที่ได้รับ อายุ และความรุนแรงของโรค นอกจากนี้การแบ่งด้วย BNT/NT ยังมีความสัมพันธ์กับอัตราการเสียชีวิตในหออภิบาลผู้ป่วยหนักศัลยกรรม [OR (ความเชื่อมั่นที่ร้อยละ 95): 1.51 (1.25-1.83); $p<0.001$], อัตราการเสียชีวิตที่ 28 วัน [1.47 (1.23-1.74); $p<0.001$] และการเกิดพิษติดเชื้อ [1.41 (1.25-1.60); $p<0.001$]

สรุป: ผู้ป่วยส่วนใหญ่ที่เข้ารับการรักษาในหออภิบาลผู้ป่วยหนักศัลยกรรมมีความเสี่ยงด้านโภชนาการตามการแบ่งของ BNT/NT ที่มีความเสี่ยงต่ำในระดับ 1 และ 2 ระดับคะแนนตามการแบ่งของ BNT/NT มีความสัมพันธ์กับอัตราการเสียชีวิตและการเกิดพิษติดเชื้อ