Original Article

Appropriateness of Hospital Admissions of Gastroenteric Patients via Emergency Services

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Background and Purpose: To adapt and test the reliability and validity of the United States-Appropriateness Evaluation Protocol(US-AEP)instrument for screening emergency department admissions of gastroenteric patients in the context of a Taiwan hospital. **Methods:** A total of 341 patients(171 males; 170 females)receiving ED care in a 1,500-bed Christian Hospital located in central Taiwan were randomly selected. An appropriateness admission review of emergency department patients' medical records was reviewed by 2 physicians and 2 senior nurses based on Taiwanese version of the AEP(T-AEP). The percentage of inappropriate admission was calculated, the reliability, validity and practicality of T-AEP were evaluated, too. **Results:** 8.2% of hospital admissions were inappropriate. 63.2% of inappropriate admissions were related to diagnostic procedures and/or treatment that could have been done on an outpatient basis. The T-AEP proved to be valid [k=0.86; 95% confidence interval (CI), 0.77-0.95) and reliable (k = 0.8; 95% CI, 0.69-0.92]. **Conclusions:** The T-AEP proved to be both a valid and reliable screening instrument for monitoring the appropriateness of hospital admissions. Understanding the reasons for inappropriate admissions provides important data for follow up quality improvement actions. Our experience shows that the US-AEP can be adapted to local conditions in other countries.

Key words: appropriateness of admission,T-AEP, reliability, validity, practicality

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Introduction

After the National Health Insurance (NHI) was established in Taiwan in March 1995, the 43% newly insured utilization of outpatient physician visits and hospital admissions rose twofold[1], and the emergency department (ED) patients waited for admission were crowded in referral medical centers[2]. At the same time, few clinical guidelines were in place to assess the appropriateness of inpatient admissions,

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and most hospitals were not satisfied with the existing medical review process. In western countries, the focus of inpatient appropriateness studies has shifted from general clinical opinions to explicit criteria. Since 1981, Gertman and Restuccia developed Appropriateness Evaluation Protocol (AEP)[3] and was used in the United States,[4-5], then the United Kingdom[6], France[7], Spain[8], Italy[9], Switzerland[10], Israel[11], Turkey[12] and Belgium[13] have adapted the United States version of Appropriateness Evaluation Protocol (US-AEP) for reviewing the appropriateness of admission. An European version of the AEP, presented by the BIOMED I group on appropriateness of hospital use[14], has also been developed. The aims of our study were to 1) assess the feasibility of the AEP for application in Taiwan, 2) establish a Taiwanese version of the AEP (T-AEP), and 3) analyze the variables related to inappropriate admission. We believe that our findings provide useful information for hospital management and health policy.

Methods

A total of 341 patients (171 men; 170 women) receiving ED care in the Christian Hospital in central Taiwan were randomly selected in November 1999. We adapted the US-AEP instrument to assess the appropriateness of hospital admissions. To validate the instrument, our study utilized two stages. First, we selected 30 medical review physicians by stratified sampling from Bureau of NHI, and used the Delphi technique to collect their rating and comments of the feasibility of US-AEP and medical record availability in Taiwan. In order to reach the consensus, we also invited these physicians for a panel discussion in an exploratory study to assess the feasibility of the US-AEP in Taiwan [15]. The second stage tested the reliability and validity of the modified-AEP and established a Taiwanese version of the AEP for inpatient[16] and emergency department[17]. We invited two physicians and two registered nurses who were interested in this study to be our reviewer team. In order to improve the reviewers' reliability, reviewers were trained for 12 hours to fully understand the criteria of T-AEP and completed the following review procedures. First, the reviewers received an explanation about the application of all criteria in the T-AEP manual in Chinese and English that was translated from Restuccia's US-AEP manual printed by Boston University. Second, a baseline T-AEP instrument was evaluated by conducting a pilot study which 20 patients' charts were assessed by these 4 trained reviewers. Consensus among reviewers was achieved to eliminate discordant opinions.

After the training which was conducted by authors, reviewers read emergency department records to assess admission appropriateness. Because there was no existing benchmark for appropriateness of admission in Taiwan, two board-certified ED specialists who were selected by the chief of department repeated the same procedure for each record to verify the validity of the reviewers' audits. If the two ED specialists' evaluations differed, a third ED specialist was consulted to determine the final criteria to be used as the comparison reference. We blanked out the physicians' treatment plan by using a blinded technique, so both the reviewers and ED specialists did not know those ED patients whom were admitted. Validity was tested by comparing the assessments of reviewers based on the T-AEP with the implicit judgments of ED specialists. Sensitivity, specificity and practicality of the T-AEP were calculated. Reliability and validity were also evaluated by the Kappa coefficient (k).

Results

Demographic data (Table 1)

Table 1. Demographics of study subjects, N=341.

Variables		No. of cases	Percent (%)
Gender			
	Female	170	49.9
	Male	171	50.1
Age			
	18~29	73	21.4
	30~39	53	15.5
	40~49	56	16.4
	50~59	51	15.0
	60~69	48	14.1
	over 70	60	17.6
	Mean, 49.2	SD, 19.7	
Severe disease			
	No	299	87.7
	Yes	42	12.3
Department			
	Gastroenterology	80	23.5
	General Surgery	72	21.1
	ED patient but not admitted	189	55.4
Utilization (Usage of NHI services)	Less than 15 times	130	38.1
	15~25	87	25.5
	25~50	93	27.3
	over 50	31	9.1
	Mean, 24.7	SD, 19.53	

The mean age was 49.2 years (SD = 19.7), with patients 60 years of age and older comprising 31.7% of the sample. Forty-two patients (12.3%) had a severe illness such as cancer. The number of patients admitted was 152 (44.6%), including 80 (23.5%) admitted to the Gastroenterology Department, and 72 (21.1%) to General Surgery. Medical care services included physician visit, emergency and admission were utilized 24.7 times (SD = 19.53) per year on average, and the most frequent service was utilized slightly less than 15 times (38.1%).

Table 2. Reliability of T-AEP reviewers, N=341.

	Physician A	Physician B	RN A	RN B
Physician A	1.00	0.84	0.79	0. 81
Physician B		1.00	0.79	0.88
RN A			1.00	0.76
RN B				1.00

The value in the each cell is the Kappa value, indicating interrater-reliability of T-AEP reviewers.

Table 3. The consensus of T-AEP reviewers and ED specialists.

		T-AEP reviewers			
		Physician A	Physician B	RN A	RN B
ED specialists	Sensitivity (%)	88.9	95.1	87.0	94.4
	Specificity (%)	94.2	95.5	93.5	92.6
	Kappa	0.830	0.905	0.817	0.905

App., appropriateness; Inapp., inappropriateness
Comparison of ED specialists' assessments compared with actual patients admitted. Sensitivity=91.7(%); Specificity=92.1(%); Kappa=0.84

Reliability

For reliability testing (Table 2), the reviewers' used Cohen's Kappa =0.8, 95% CI, 0.69~0.92. This method meets the guidelines for reproducibility by Landis and Koch[18].

Validity

The T-AEP proved to be valid (k=0.86; 95% CI, 0.77-0.95), with a sensitivity of 87% ~ 95.1% and a specificity of over 92.6% (Table 3).

Practicality (Table 4)

We used a 5-POINT Likert scale to rate the completeness of each medical record, and analyzed the results using Kendall's tau-b. The results showed that the judgments of the reviewers were influenced by poor documentation in the medical record. The override of T-AEP in our study is about 3%. The mean time for admission review was about 3 minutes. The range of review time was 1.03~3.49 minutes, and varied according to the reviewer and the complexity of the diseases.

Frequency of T-AEP admission criteria (Table 5)

The most common admission criterion selected by the reviewers for "Clinical Services" was "Sur-

Table 4. Practicality of T-AEP, N=341.

Relationship between documentation and appropriateness (Kendall's tau-b)	
Variables	Value
Physician A	-0.38[1]
Physician B	0.12
Nurse A	-0.24[1]
Nurse B	0.015
Override T-AEP	No.
Physician A	8 (2.3)
Physician B	5 (1.5)
Nurse A	7 (2.1)
Nurse B	3 (0.9)
Review time (minutes)	mean (SD)
Physician A	2.38 (0.75)
Physician B	1.03 (0.25)
Nurse A	3.49 (0.98)
Nurse B	1.92 (0.82)

[1] $P < 0.01$

gery or procedure scheduled within 24 hrs requiring anesthesia or use of equipment available only in a hospital" (n=180; 17.86%). The most common admission criterion for "Patient Conditions" was "Severe electrolyte blood gas abnormality or acute and severe biochemistry lab with abnormality" (n=197; 19.54%).

The causes of inappropriate admissions (Table 6)

Our results showed that 8.2% of admissions were inappropriate. The most common reason for inappropriate admission identified by the reviewers was "Any needed diagnostic procedures and/or treatment can be done on an outpatient basis." This category accounted for 64.7% of the reviewers' and 92.3% of the ED specialists' judgments for inappropriate admissions. The second major reasons identified by the reviewers were 1) "Patient will be observed in ER for admission (stay more than 6 hours)" (35.2%), and 2 "Premature admission" (7.7%), chosen by the ED specialists.

Discussion

Previous studies[8, 13,14, 19-21] suggested that the US-AEP should be modified before use in different countries. The value of *k* found in our study that the reliability analysis (0.76-0.88) was higher than the values reported by previous investigators using the US-AEP in the US (0.59-0.73)[5], and in Israel (0.59-0.63)[11]. We proved that the US-AEP had to be modified in order to meet local needs, because of differences in practice style and the availability of resources in Taiwan. Furthermore, we held meetings to discuss any discordance of judgments among reviewers, and to understand the differences. For example, the reviewers reached agreement regarding debridement and concussion as not necessary for hospitalized admission. This showed that the inter-rater reliability was influenced by the completeness of criteria and the reviewers' perceptions.

The degree of sensitivity and specificity observed in this study was compared with that reported in Turkey. The sensitivity (87-95.1%) and specificity (over 92.6%) of T-AEP achieved in this study were similar to the study reported by Kaya [22]. The *k* values found in the validity analysis ranged from 0.82 to 0.91(95% CI, 0.77-0.95), These values were higher than the study reported by Tsang and Severs ($k = 0.62$)[23]. In order to verify the validity of reviewers, given the limitation of resources, only two ED specialists repeated the same procedure for each record, and most of their conclusions formed the reference for admission in our study. Although there was general con-

Table 5. The frequency of T-AEP admission criteria chosen by reviewers.

Item of T-AEP	AEP criteria	Counts (%)	Rank
7	Severe electrolyte blood gas abnormality or acute and severe biochemistry lab. Abnormality.	197 (19.54)	1
11	Active bleeding.	187 (18.55)	2
1	Surgery or procedure scheduled within 24 hr requiring anesthesia or use of equipment available only in a hospital.	180 (17.86)	3
18	Acute abdomen pain with laboratory, sono, x ray abnormality.	132 (13.10)	4
2	Vital sign monitoring every 2 hrs or more often for critical patient (include cardiac monitoring).	105 (10.42)	5
5	Intravenous medications (antibiotics treatment) and/or fluid replacement for patients with acute infections.	96 (9.52)	6
15	Sudden onset of unconsciousness or disorientation (coma or unresponsiveness).	42 (4.17)	7
3	Requires continuous observation for life-threatening toxic reaction such chemotherapeutic agents, etc.	16 (1.59)	8
14	Blood pressure: systolic<90 or>200mmHg or diastolic or>120mmHg. No systemic disease influenced the heart and blood pressure and attached the EKG, physical exam and Laboratory Data. WHAT IS MEANT BY "ATTACHED?" (It is the original AEP criteria)	15 (1.49)	9
4	Intermittent or continuous ventilator use at least every 8 hrs for respiratory failure patient with complications.	9 (0.89)	10
8	Persistent fever 38.5 (p.o) for more than 3 days.	9 (0.89)	11
17	Acute or progressive sensory, motor, circulatory or respiratory embarrassment sufficient to incapacitate the patient (inability to move, feed, or breathe, with the accompanying laboratory data).	7 (0.69)	12
13	Pulse rate<50 or>150 per minute (US- AEP:>140).	6 (0.6)	13
19	RTS (revised trauma score) <11.	3 (0.3)	14
6	Intramuscular antibiotics at least every 8 hrs.	2 (0.2)	15
12	Wound dehiscence or evisceration.	1 (0.1)	16
16	ECG evidence of acute ischemia; must be suspicion of a new AMI.	1 (0.1)	17

The counts are the summation of four reviewers.
Acute and severe biochemistry lab. Abnormality ：Na<123 、>156 K<2.5 、>5.6 HCO_3<20 、>36 GOT 、GPT>500 Lipase>2 倍 PaO_2<50 或 PaO_2<60 & $PaCO_2$<35 $PaCO_2$>75 或 $PaCO_2$>60 & PH<7.3

Table 6. Reasons of inappropriate ED admission.

Item	Reasons	T-AEP reviewers (%)	Rank	ED specialists (%)
1	Any needed diagnostic procedures and/or treatment can be done on an outpatient basis.	22 (64.71)	1	24 (92.31)
6	Premature admission - one day or more before an inpatient procedure is already scheduled.	0	2	2 (7.69)
2	Patient will be observed in ED for admission (stay more than 6 hours).	12 (35.29)	3	0

sistency between ED specialists around the appropriateness of the initial admission decision, we suggested that an expert panel organized by third party like medical associations to validate those admissions could be more authoritative.

Regarding the practicality of T-AEP, our study's mean review time was only 1.03~3.49 minutes, compared with western country's studies of 7~10 minutes. Compared with 5% override in the US, T-AEP was less than 3%. We believe that T-AEP provides an easier and quicker review tool for ED admission. Our result regarding documentation differed from the Spanish study[24] was no significant effect of completeness of medical records on the determination of appropriateness of hospital days. Due to medical record documentation in Taiwan were considered less comprehensive and complete than those of the US, so appropriateness assessment might be influenced by poor medical record documentation (Table 4). Therefore, the issue of completeness of medical records needs further study.

The most common reason for inappropriate ED admission, "Any needed diagnostic procedures and/or treatment can be done on an outpatient basis" (Table 6) is consistent with Baneres' finding[25]. The next most frequent reason, "Patient stay more than 6 hours in ED will be observed for admission," may reflect ED physicians' concerns that patients' conditions are unstable, thus increasing the risk of potential legal problems if patients are discharged too soon. In addition to these reasons, other related factors of admission appropriateness, such as patients' sex, age, demographic variables, and disease conditions[26,27]are of interest for further studies.

Conclusions

The criteria of the US-AEP can be modified to local conditions, and the T-AEP may serve as a good screening instrument example for monitoring appropriate admissions and detecting possible causes of inappropriate admission. Developing a utilization review tool would require more resources, such as funds and time, based on the western experience.[28, 29] Therefore, a high-quality and reliable review instrument may not be developed in a short timeframe. Although the sensitivity and specificity of T-AEP were established for use in Taiwan, the instrument will need to be revised periodically due to the emergence of new medical technologies and the changing medical environments. Finally, we support computerization of the T-AEP for efficient medical reviews in

the near future.

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References:

1. Cheng SH, Chiang TL: The effect of universal health insurance on health care utilization in Taiwan. Results from a natural experiment. JAMA 1997; 278:89-93.
2. Shih FY, Ma MH, Chen SC, et al: ED overcrowding in Taiwan: facts and strategies. Am J Emerg Med 1999; 17:198-202.
3. Gertman PM, Restuccia JD: The appropriateness evaluation protocol: a technique for assessing unnecessary days of hospital care. Med Care 1981; 19(8):855-71.
4. Restuccia J, Shwartz M, Ash A, Payne S: An empirical analysis of the relationship between small area variations in hospital admission rates and appropriateness of admission. AHSR &FHSR Annual Meeting Abstract Book 1996; 11:54.
5. Suy AL, Sonnenberg FA, Manning WG: Inappropriate use of hospitals in a randomized trial of health insurance plans. N Eng J Med 1986; 315:1259-66.
6. O'Neill D, Pearson M: Appropriateness of hospital use in the United Kingdom: a review of activity in the field. I J Q Health Care 1995; 7:239-44.
7. Robain M, Lang T, Fontaine A, et al: Reliability and validity of the French version of the first part of the Appropriateness Evaluation Protocol (AEPf): pertinent criteria of hospitalization stay. Rev Epidemiol Sante Pub 1999; 47:139-49.
8. Lorenzo S, Sunol R: An overview of Spanish studies on appropriateness of hospital use. I J Q Health Care 1995; 7:213-8.
9. Fellin G, Apolone G, Tampieri A: Appropriateness of hospital use: an overview of Italian studies. I J Q Health Care 1995; 7:219-25.
10. Santos-Egimann B, Oaccayd F, Blanc T: Medical appropriateness of hospital utilization: an overview of the Swiss experience. I J Q Health Care 1995; 7:227-32.
11. Rishpon S, Luvacsh S, Epstein LM: Reliability of a method of determining the necessity for hospitalization days in Israel. Med Care 1986; 24:279-82.
12. Kaya S, Erdem Y, Dogrusoz S, Halici N. Reliability of a hospital utilization review method in Turkey. I J Q Health Care 1998; 10:53-8.
13. Lambert J, Panis GG, Verheggen FWSW, Pop P: To stay or not to stay. The assessment of appropriate hospital stay, a Dutch report. I J Q Health Care 2002; 14:55-67.
14. Lang T, Linerati A, Tampieri A, et al: A European Version of the Appropriateness Evaluation Protocol. Goals and presentation. The BIOMED I Group On Appropriateness of Hospital Use. I J Techno Assess Health Care 1999; 15:185-97.
15. Wen HC, Chung KP, Chie WC, Kuo HS, Yaung CL: An exploratory study on appropriateness of admission and hospital stay-modification of AEP. Formosan J Medicine 2001; 5:136-44.
16. Wen HC, Chung KP, Hsueh YS, Yaung CL, Chie WC: To evaluate an admission review tool -the reliability and validity of AEP. Formosan J Public Health 2001; 20(4): 291-300.
17. Wen HC, Yen HT, Tzeng YM, et al: The application of Appropriate Evaluation Protocol for patients' admission in Emergency Department. J Taiwan Emerg Med 2004; 6:403-13.

18. Landis JR, Loch GG: The measurement of observer agreement for categorical data. Biometrics 1977; 33:159-74.
19. Bentes M, Gonsalves ML, Santos M, Pina E: Design and development of a utilization review program in Portugal. I J Q Health Care 1995; 7: 201-12.
20. Kalant N: How valid are utilization review tools in assessing appropriate use of acute care beds? Canadian Medical Association Journal 2000; 162: 1809-13.
21. Tu, Jack V: Utilization review: Can it be improved? (commentary) Canadian Medical Association Journal 2000; 162:1824-5.
22. Kaya S, Vural G, Eroglu K, et al: Liability and validity of the Appropriateness Evaluation Protocol in Turkey. I J Q Health Care 2000; 12:325-9.
23. Tsang P, Severs MP: A study of appropriateness of acute care geriatric admissions and an assessment of the Appropriateness Evaluation Protocol. J Roy Coll Physicians Lond 1995; 29: 311-4.
24. Ramos-Cuadra A, Marion-Buen J, Garcia-Martin M: The effect of completeness of medical records on the determination of appropriateness of hospital days. I J Q Health Care 1995; 7:267-75.
25. Baneres J, Broquetas J, Anto JM: Inadequate hospital admissions and inactive days of hospital stay in patients with chronic obstructive pulmonary disease and lung neoplasms. Med Clin 1993; 100: 407-11.
26. Perneger TV, Chopard P. Sarasin EP, et al: Risk factors for a medically inappropriate admission to a Department of Internal Medicine. Arch Intern Med 1997; 157:1495-500.
27. Davido A, Nicoulet I, Levy A,Lang T: Appropriateness of admission in an emergency department: reliability of assessment and causes of failure. I J Q Health Care 1991; 3(4):227-34.
28. Goldfield N: Measuring and managing health care quality. Procedures, techniques, and protocols. ASPEN Publication, 1994: 125-46.
29. Restuccia JD: The evolution of hospital utilization review methods in the United States. I J Q Health Care 1995; 7:253-60.

急診腸胃疾病患者住院適當性之評估

溫信財[1]、顏鴻章[2,3]、季瑋珠[4]、高森永[5]、陶阿倫[6]

目的：使用修訂之台灣版住院適當性評估表(T-Appropriateness Evaluation Protocol, T-AEP)，檢定其信度、效度，以了解其做為篩檢急診腸胃疾病病患住院適當性工具之可用性。**方法：**以中部某醫學中心341接受急診照護病患(171男性；170女性)為研究對象，由二位專科醫師及二位護理師以「台灣版住院適當性評估表」判定其住院適當性，以估算急診不適當住院率，並檢測本研究工具之信度、效度及實用性。**結果：**不適當住院率為8.2%，其中63.2%之不適當住院原因，來自其病情可在門診接受治療；T-AEP在效度方面，k係數=0.86，95%信賴區間：0.77-0.95；信度方面，k係數=0.8；95%，信賴區間：0.69-0.92，二者均達到良好之水準。**結論：**證實T-AEP在篩選不適當急診住院上，為一有效且可信之工具，而分析病患不適當住院原因，可做為未來醫院品質改進的依據；本研究亦證實，原版AEP經修訂符合當地國情後，可適用於不同國家。

關鍵詞：入院適當性，台灣版住院適當性評估表，信度，效度，實用性

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