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Patient predictors of individual cost of integrated treatment program for alcohol problems at community hospitals in southern Thailand

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ABSTRACT

Objectives: To estimate the average cost of an integrated alcohol intervention program at community hospitals of Thailand and identify patient predictors and sources of variation of the program cost.

Methods: Activity-based costing was conducted under a societal perspective among 113 outpatient alcohol users (29 low-risk, 43 high-risk and 41 dependent drinkers), aged 15 years and older, at four community hospitals in southern Thailand. Multivariate regression models were performed to identify individual-level determinants of cost components.

Results: The average cost per low-risk, high-risk, and dependent drinkers were 516 (16 USD), 2,961 (94 USD), and 5,325 baht (168 USD), respectively, of which labor and patient costs were the major components. Regardless of drinking risk level, past-year functional disturbance lasting more than 20 days ($\beta = 0.215$, $p = 0.035$) and increasing number of previous treatment episodes ($\beta = 0.035$, $p = 0.046$) independently increased overall program cost. Variation in the program cost was mainly caused by length of hospital stay followed by staff time for screening and delivering interventions.

Conclusion: The study underlines the important role of pretreatment alcohol-related problems and human resources in alcohol intervention programs. Efforts should be focused on adequacy of treatment for the very first episode of alcohol problems to reduce the high healthcare costs.

1. Introduction

Alcohol use disorder and related consequences, such as diseases, cancers, productivity loss, traffic accidents, violence and0 crime are major health concerns to a society, incurring great economic burden globally, especially for lower-income countries (Gmel and Rehm, 2003; Leifman and Edgren-Henrichson, 2000; Rehm et al., 2009). To relieve the burden, an accessible and affordable community-based treatment program for alcohol use disorder that is integrated into an existing health system is warranted (Monteiro, 2011; World Health Organization, 2008).

In response to such a need, the Integrated Management of Alcohol Intervention Program (i-MAP) in the Health Care System was launched in 2011 by the Thai Health Promotion Foundation and the Department of Mental Health of Thailand. It aims to deliver a comprehensive care targeting healthcare service users with alcohol problems in Thailand through provision of guidelines and training for screening, brief and intensive interventions, detoxification and aftercare to healthcare personnel at different levels of expertise. To date, around 10% of 700 community hospitals across Thailand have integrated the program into their routine care (Kittirattanapaiboon and Chamroonsawasdi, 2013). The program has been shown to potentially return the social benefit at least twice of its investment even in a relatively short period and hence it is promising to expand the program nationwide (Tanaree et al., 2019). However, as resources needed for an alcohol treatment remain scarce and competitive with other health programs for the sake of the overall well-being of the population, knowledge on what could influence the program costs could avoid unnecessary spending on alcohol interventions (Babor et al., 2010).

Globally, the direct healthcare cost of alcohol-attributable diseases contributes a substantially high percentage of social costs due to alcohol use in high-income and middle-income countries (Rehm et al., 2009; Thavorncharoensap et al., 2009). Expenditure on treatment of alcohol use disorder alone in European countries was approximately 0.05% of GDP (Lievens et al., 2014), although this could be underestimated as it was based on the actual alcohol treatment rate which was generally low even in developed countries (Cohen et al., 2007). A number of contextual factors have been reported to influence the variation of these figures among countries, including prevalence of alcohol use disorder, funding policy, availability of treatment facilities and cost of living

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(Lievens et al., 2014; Patel, 2000). However, little is known about determinants and treatment components responsible for the cost variation among individuals receiving treatment for alcohol problems.

Very few studies have investigated predictors of cost of alcohol treatment. Previous study at detoxification centers explored the relationship of patient variables and alcohol-related costs at different periods (pre-treatment, treatment, and post-treatment phases) and found that older age, being female, and increasing consumption of drinks per drinking day were associated with higher social costs prior to treatment, while health status and previous detoxifications were not associated with cost at any period (Parrott et al., 2005). However, the authors did not clearly distinguish which cost components and service types were included in each phase. It was possible that participants might have received other collateral services for the alcohol problems which could be potential confounders.

The objectives of this study were to estimate the average cost of the i-MAP under a societal perspective in primary care services of Thailand, and to identify patient predictors and treatment components as contributors of the cost variation among drinkers. Such knowledge could suggest feasible targeted interventions, in addition to universal policies, to minimize the financial burden of alcohol problems that are optimal to the local context.

2. Material and methods

2.1. Study setting and participants

The study was conducted at four community hospitals (Singhanakhon, Satingphra, Bangklam and Rattaphum hospitals) in Songkhla province of Thailand between January and April 2017, which covered both normal and two festive periods (the international and Thai New Year long weekends). Outpatients aged 15 years and older with concurrent alcohol use were consecutively enrolled and stratified by drinking risk level. Those with concurrent major psychiatric disorders, other substance use, or explicit cognitive disabilities were excluded. Of 131 participants from initial enrollment, informed consent was obtained from 113 participants (29 low-risk, 43 high-risk, and 41 dependent drinkers), yielding a response rate of 88%. This study was approved by the Office of Human Research Ethics Committee, Prince of Songkla University, Thailand.

2.2. The i-MAP protocol at community hospitals

At least annually, each visiting outpatient is screened for recent alcohol consumption. Those who report having at least one drink in the past three months are subsequently assessed for risk of drinking problems with the Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al., 1993). Low-risk drinkers (score < 8) receive a single brief education session on the effects of alcohol and simple advice to stop drinking or avoid excessive drinking. High-risk drinkers (hazardous or harmful users as defined by an AUDIT score of 8–19) receive six sessions of brief intervention (BI) aiming to help them eliminate their harmful drinking practices (Raistrick, 2006). Probably dependent users (score ≥ 20) receive six sessions of either motivational enhancement therapy (MET) or cognitive-behavioral therapy (CBT) aiming to help them abstain from drinking and addictive behaviors and enhance constructive coping strategies (Raistrick, 2006). Medically assisted detoxification and hospitalization are offered to those with severe alcohol withdrawal or those needed. Other interventions, such as family and group therapies, are delivered as appropriate to the address additional needs and problems.

2.3. Resources and cost estimation

Resources were collected among subjects using an activity-based approach. After each visit, key personnel completed activity record forms including type of provided activity (e.g. screening, BI, CBT, physician and pharmacist consultant), time spent, number and position of involved personnel, place where each activity was provided, medications, medical devices, and length of hospital stay (in case of admission). Drinkers were asked about their travel and waiting time, whether they were accompanied by family members, and direct and indirect out-of-pocket expenses. As resources hereby include only those used in addition to the routine practice, we excluded resources used in the pre-implementation phase (e.g. preparation, training and piloting) and other shared resources (e.g. space and electricity) as they were assumed to be distributed evenly among all drinkers and nondrinkers.

Major cost components, comprising labor costs, medical costs (including laboratory cost) and patient's costs, were estimated from units of resources multiplied by the corresponding unit costs using the national standard prices (e.g. average salaries and minimum labor wage for staff and patient's time, respectively). Cost of each participant was estimated over the complete course of treatment corresponding to his/her drinking risk level, e.g. a one-day session of brief education for low-risk drinkers and six sessions, typically over 2–3 months, of psychological/medical care for high-risk drinkers. A detailed costing methodology has been reported in our previous publication (Tanaree et al., 2019).

2.4. Pretreatment variables and covariates

At first visit, socio-demographic (age, sex, marital status and employment status) and clinical characteristics (AUDIT score, number of previous treatment episodes, past-year legal involvement and number of days with functional disturbance) and presence of an accompanying relative were collected from drinkers using a self-administered questionnaire. Age was categorized into 15–34, 35–44, 45–54 and 55+ years. Marital status was defined as either married, single or others (divorced or widowed). Previous treatment and past–year legal involvement were derived from the questions "Roughly how many times during your lifetime did you receive any form of counseling or treatment from a healthcare professional because of your drinking behaviors?" and "Roughly how many times during the past 12 months did you get arrested or stopped by the police because of your drinking behaviors?", respectively. Past-year functional disturbance was derived from the question "Roughly how many days during the past 12 months were you completely unable to work or perform your daily activities because of your drinking?". We categorized the inability to work or maintain daily activities for more than 20 days (the sample mean) as having significant functional disturbance due to drinking.

2.5. Statistical analysis

Average costs were stratified by demographic characteristics and drinking risk level. Due to the positive-skewed distribution of costs, 95% confidence intervals were generated using a bootstrap method (Barber and Thompson, 2000). Sources of unit prices reported before the year of the study (2017) were inflated using the consumer price index (Bank of Thailand, 2017).

Multivariate regression models were performed to identify pretreatment factors predicting increased overall cost and each cost component and to identify sources of cost variation among the sample. Multilevel models (mixed effects with random intercept) were fitted and associated assumptions (e.g. the homogeneity of the variance and normal distribution of the residuals) were checked for the log transformation of overall cost, labor cost, and patient's opportunity cost. As the medical cost contained multiple zero observations, the Tobit model was used to deal with the latent variable that differentiates the zero observations without the need to exclude them, i.e. drinkers who did not receive medication and laboratory tests would still be included in the model (Collis et al., 2010). All data were entered into EpiData 3.1 and analyzed using R.

Table 1
Average cost of the i-MAP by baseline general characteristics.

	Percentage	Average cost (mean)*	95% CI*
Age group (years)			
15 - 34	15.9	1,321	697 - 1,925
35 - 44	31.0	3,562	2,689 - 4,452
45 - 54	31.0	3,810	2,556 - 4,967
55 +	22.1	3,163	2,280 - 4,053
Marital status			
Single	20.4	2,862	1,581 - 4,129
Married	61.1	2,969	2,324 - 3,601
Other[a]	18.6	4,293	2,933 - 5,678
Employment status			
Employed	78.8	2,758	2,230 - 3,279
Unemployed	21.2	4,808	3,386 - 6,178
Presence of an accompanying relative			
Yes	43.3	4,465	3,480 - 5,443
No	56.6	2,220	1,769 - 2,667
Days of past–year functional disturbance			
0 – 20	82.3	2,577	2,099 - 3,045
> 20	17.7	6,059	4,428 - 7,720
Past-year legal involvement			
None	76.1	2,878	2,319 - 3,436
Any	23.9	4,197	2,797 - 5,596
Previous treatment for alcohol-related problems			
None	57.5	2,089	1,638 - 2,557
Any	42.5	4,689	3,671 - 5,666

CI: confidence interval.
* 1 USD = 33.1 Thai baht (based on exchange rate in 2017).
[a] Divorced / widowed.

3. Results

3.1. Average cost of the i-MAP by general and clinical characteristics

Participants were almost exclusively male (99%) with a mean age of 46 years (SD = 11.5). All drinking subgroups were similar in terms of age, although higher-risk groups tended to be older. Almost 70% of participants had comorbidities such as non-communicable disease(s) (i.e. hypertension and diabetes), 20% had other specific condition(s) (e.g. respiratory disease) and 10% had sustained injuries from a motor vehicle accident. Participants with higher treatment cost were aged 45–54 years, either widowed or divorced, had been functionally disturbed > 15 days, unemployed, received prior treatment for alcohol-related problems and had experienced legal consequences during the past year (Table 1).

The average cost per low-risk drinker, high-risk drinker and dependent drinker were 516 (16 USD), 2,961 (94 USD), and 5,325 (168 USD; 3,810 or 120 USD for outpatient and 9,861 or 310 USD for hospitalized cases) baht, respectively. Across all drinking risk levels, labor cost was the major component, constituting 30–50% of total drinker costs, followed by patient's opportunity cost and out-of-pocket expenses (Table 2).

3.2. Patient predictors of individual cost of the i-MAP

Table 3 presents results of the multivariate regression model for overall cost and each cost component. By controlling for socio-demographic characteristics and drinking risk level, higher overall i-MAP cost was significantly associated with having past-year functional disturbance more than 20 days ($\beta = 0.215$, s.e. = 0.101, $p = 0.035$) and increasing number of previous treatment episodes ($\beta = 0.035$, s.e. = 0.017, $p = 0.046$). In the sub-analyses on major cost components, higher medical cost was significantly associated with older age, unemployment and increasing number of previous treatment episodes. Higher patient's opportunity cost was significantly associated with presence of past-year legal involvement and being accompanied by a family member. None of the patient's variables was associated with the increased labor cost.

3.3. Sources of variation of individual cost of the i-MAP

Table 4 presents results of the multivariate regression model including treatment components of overall cost, controlling for age, drinking risk level and being accompanied by a family member. Increasing duration of hospitalization ($\beta = 0.151$, s.e. = 0.021, $p < 0.001$) had the greatest impact on overall i-MAP cost, followed by increased staff time for screening ($\beta = 0.286$, s.e. = 0.103, $p = 0.007$) and delivering interventions ($\beta = 0.034$, s.e. = 0.015, $p = 0.025$), and increased patient time ($\beta = 0.012$, s.e. = 0.004, $p = 0.006$). None of number of laboratory tests and medication was significantly associated with overall i-MAP cost.

4. Discussion

A large body of evidence has shown an association between patient-level factors and clinical outcomes of alcohol treatment. Socio-demographic determinants such as age, gender, income, employment, and alcohol-related measures such as baseline consumption, dependence severity and prior treatment history, are among the most predictive factors of treatment outcomes (Adamson et al., 2009; Aguiar et al., 2012; Bottlender and Soyka, 2005). On the other hand, individual-level factors that are associated with high healthcare cost of non-communicable diseases include age, socioeconomic status, disease severity and complication, prior treatment and hospitalization (Limsrivilai et al., 2017; Mapel et al., 2005; Michaud et al., 2003; Wang et al., 2010). Unfortunately, less is known about which individual and alcohol-related determinants specifically affect cost of treatment of alcohol problems.

Table 2
Cost breakdown of the i-MAP by baseline drinking risk level.

	Average cost (95% CI)*		
	Low - risk (n = 29)	High - risk (n = 43)†	Dependent (n = 41)
Labor cost (staff time)	204 (152 - 255)	1,445 (1,204 - 1,688)	1,538 (1,312 - 1,765)
Laboratory cost	82 (11 - 149)	127 (61 - 190)	419 (278 - 556)
Medicine	5.4 (1.2 - 9.8)	68 (40 - 95)	208 (146 - 268)
Out-of-pocket expenses	77 (66 - 88)	461 (393 - 532)	461 (393 - 532)
Opportunity cost (patient time)	147 (118 - 177)	862 (716 - 1,011)	1,186 (1,054 - 1,311)
Total	516 (393 - 642)	2,961 (2,550 - 3,367)	5,325 (4,273 - 6,403)[a]

CI: confidence interval.
[a]Includes cost of hospital stay (n = 12).
* 1 USD = 33.1 Thai baht (based on exchange rate in 2017).
† Hazardous and harmful use.

Table 3
Multivariate regression models of the patient predictors of overall cost and major cost components[†].

	Overall cost[*]			Labor cost[*]			Medical cost			Patient cost[*]		
	β	s.e.	p-value	β	s.e.	p-value	β	s.e.	p-value	β	s.e.	p - value
Age group (ref: < 35 years)												
35 - 44	0.109	0.109	0.324	0.183	0.131	0.165	**567.71**	**191.97**	**0.003**	−0.133	0.111	0.234
45 - 54	0.018	0.118	0.876	0.029	0.140	0.836	**406.13**	**205.16**	**0.048**	−0.044	0.119	0.713
55+	0.010	0.124	0.938	0.014	0.148	0.923	403.72	214.10	0.059	−0.011	0.126	0.933
Marital status (ref: single)												
Married	0.131	0.100	0.869	0.080	0.118	0.503	−80.68	151.20	0.594	−0.052	0.101	0.606
Other[a]	0.173	0.116	0.193	0.165	0.138	0.233	75.51	165.12	0.647	−0.031	0.117	0.791
Unemployment	0.103	0.090	0.140	−0.195	0.107	0.072	**404.91**	**118.70**	**0.001**	−0.018	0.091	0.842
Presence of an accompanying relative	0.333	0.073	0.257	0.118	0.087	0.178	179.52	105.60	0.089	**0.597**	**0.074**	**< 0.001**
Past-year functional disturbance (> 20 days)	**0.215**	**0.101**	**0.035**	−0.022	0.120	0.855	113.71	134.40	0.398	−0.009	0.102	0.909
Past-year legal involvement	0.056	0.093	0.548	0.112	0.110	0.313	−15.29	114.16	0.893	**0.271**	**0.093**	**0.005**
Number of previous treatment episodes	**0.035**	**0.017**	**0.046**	−0.014	0.021	0.494	**50.40**	**21.76**	**0.021**	−0.015	0.018	0.398

[†] Adjusted for drinking risk level and hospital as random intercept.
[*] Log-transformed.
[a] Divorced or widowed, s.e. = standard error.

Table 4
Multivariate regression model of cost components predicting log-transformed overall cost.

	β	s.e.	p-value
Screening time (per hour)	**0.286**	**0.103**	**0.007**
Intervention time (per hour)	**0.034**	**0.015**	**0.025**
Physician time (per hour)	0.032	0.019	0.090
Pharmacist time (per hour)	0.039	0.031	0.208
Patient time (per hour)	**0.012**	**0.004**	**0.006**
Length of hospital stay (per day)	**0.151**	**0.021**	**< 0.001**
Laboratory test (per test)			
Complete blood count	−0.113	0.072	0.122
Electrolytes	−0.062	0.085	0.465
Blood urea nitrogen	0.201	0.126	0.116
Creatinine	0.056	0.093	0.551
Blood sugar	0.017	0.038	0.662
Liver function test	0.130	0.075	0.086
Medicine (per 10 units)			
Benzodiazepine	0.001	0.001	0.340
Antipsychotic	−0.004	0.003	0.162
Supplements	−0.001	0.001	0.281

*Adjusted for age, drinking risk level and being accompanied by family, s.e. = standard error.

To our knowledge, this is the first study estimating costs of alcohol program as a whole package in which sets of interventions were flexibly delivered to various groups of drinkers (Popova et al., 2011). As alcohol users are highly heterogeneous, adhering only to any single treatment regimen may not be suitable in real-life practice and health services should tailor interventions to alcohol users with different needs (Bradley and Kivlahan, 2014; Humphreys and Tucker, 2002). As opposed to studies that examined determinants at a macroeconomic level, our individual-level activity-based costing study could identify patient-level predictors and key resource components as the major sources of cost variation, and ensure the temporal order between these predictors and cost outcome.

Our cost estimates were less than that from a previous study in a large drug treatment center in Thailand which used a similar costing approach and found that the average costs of outpatient and inpatient treatments for alcohol dependence were 1,667-2,757 and 560-1,662 baht per day (34,440 baht over the 3-month course), respectively (Pathayanant and Ratniyom, 2011). Compared to our sample, patients treated in a tertiary care center are typically severe and need more intensive and extensive efforts, involving multidisciplinary care that is usually not available in primary care, e.g. clinical psychologist and occupational therapist. Nevertheless, among drinkers with less complicated conditions, primary care settings were not different from specialist settings in terms of effectiveness of alcohol interventions (Madras et al., 2009), hence should be the preferred setting when considering implementation cost.

Our study complements the previous knowledge that, among the patient-level factors, unemployment and having a treatment history do not only worsen the clinical outcome (Adamson et al., 2009), but also increase the cost of alcohol treatment through more utilization of resources. Employment status and prior treatment were also found to predict high healthcare cost of other non-communicable diseases, such as diabetes (Wang et al., 2010), gastrointestinal disease (Limsrivilai et al., 2017), and chronic pulmonary disease (Mapel et al., 2005). Considering that the present study might be the first time that the interventions were fully delivered to participants (i.e. previous practice in the study sites might not be as complete as in the study period), having prior treatment might reflect the inadequacy and/or noncompliance with treatment in the prior episodes. Noncompliance with treatment was found to increase the risk of relapse and subsequent hospitalization (Moos and Moos, 2003; Novick et al., 2010), hence requiring more resources and cost of treatment (Sokol et al., 2005). Treatment of alcohol use disorder at the very first episode thus needs to be sufficient to avert subsequent complications and unnecessary healthcare spending.

In contrast, the association between alcohol-related problems and treatment outcomes is less clear. A recent systematic review found that none of the alcohol-related problems was associated with treatment outcome (Adamson et al., 2009), though it is possible that the predictive strength of alcohol-related problems in the included studies were alleviated by the low statistical power due to small sample size or the inclusion of concurrent psychiatric diseases and/or substance use. However, a more recent study found that more alcohol-related problems decreased the number of days of abstinence after treatment for alcohol dependence (Aguiar et al., 2012). Our study, in which important comorbidities were excluded, found that experiencing alcohol-related legal consequences and functional disturbance lasting more than 20 days significantly raised certain treatment cost components. These determinants generally indicate complicated conditions that require more time given for comprehensive interventions. Our finding that functional disturbance lasting more than 20 days was not associated with labor cost, medical cost or patient cost, despite being associated with overall cost, suggests that it might rather increase other cost components, particularly the cost of admission.

Our finding regarding source of cost variation is concordant with a previous study which found that costs of treatments for substance abuse were impacted by actual time spent on each activity (French et al., 2002). However, the authors concluded that the cost also highly depended on cost of living in each study site as well as salaries of staffs

with different levels of expertise. To address this issue, we applied national standard prices and wages for all resources including time spent by different types of staff so that the results would be as generalizable as possible. As opposed to other medical and psychiatric conditions, evidence on the effectiveness of pharmacological and instrumental procedures of addiction remains less conclusive than interpersonal therapies and laboratory tests are less sensitive than screening questionnaires in detecting alcohol problems (Heather et al., 2006). Time devoted by healthcare professionals hence seems to be most significant resource for alcohol treatments.

4.1. Limitations

First, the sample size of this study was small because the study did not initially aim to explore predictors of treatment cost. Hence either type I or type II errors might have occurred for certain determinants. Also some possible predictors of program cost, such as family history of alcohol-related problems, were not collected in the study. Additionally, our study was based on an ideal situation where the i-MAP program had been implemented without resource constraints, such as relatively scarce professional workforce in the mental health field, concurrent work burden, and limited daily mental energy of staff, taken into account. Moreover, some drinkers might have underreported their problems, or refused or failed to complete the program. Hence further studies should be conducted with these real-life constraints taken into account. In spite of these limitations, this study can help policymakers determine the optimal amount of resources that should be allocated and/or recruited to maximize the benefits of the program. Lastly, the almost exclusively male sample could limit generalizability and thus any conclusions inferred from the study should preferably be restricted only to the male population.

5. Conclusion

The study supports the impact of previous alcohol-related consequences on unnecessary social expenditure, regardless of initial drinking risk level, and emphasizes financial importance of human resources in alcohol interventions.

Disclosure statement

The authors report no conflict of interest.

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