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Cost–benefit analysis of psychiatric pharmaceutical care with shared decision-making intervention in complicated schizophrenic patients

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ABSTRACT

Objective: This study aims to evaluate the net benefits of psychiatric pharmaceutical care with shared decision-making (PCC-SDM) intervention in complicated schizophrenic patients for resolving drug-related problems (DRPs). **Methods:** Eligible inpatients for 3 months. Data were collected using an Integrated Hospital Medication Management with SDM (IHoMe-SDM) following PCC-SDM six steps: (1) data collection, (2) choice and option talk, (3) decision talk, (4) pharmaceutical care plan, (5) patients education, and (6) monitoring. Cost analysis was conducted by activity based costing. Economic evaluation was calculated as cost saving, cost avoidance, and net benefits with the view of health-care provider and reported in USD (THB). **Results:** Thirty patients were enrolled. There were 43 DRPs including non-adherence, adverse drug reaction (ADRs), drug interaction, and medication reconciliation (27, 13, 1, and 2, respectively). Total cost of the intervention was $192.35 USD (5810.93 THB). Total cost saving was $1626.63 USD (49,140.77 THB). Cost avoidance was $632.64 USD (19,112.00 THB). Net benefits were $2066.93 USD (62,441.84 THB). Clinical outcomes were the reduction of ADRs and readmission. **Conclusion:** PCC-SDM intervention among the patients with complicated schizophrenia offers a positive net benefits indicating that this program is an efficient choice for improving clinical outcomes of DRPs.

Keywords: Cost benefit, psychiatric pharmaceutical care, shared decision-making

INTRODUCTION

Current psychiatric pharmaceutical care (PPC) included medical history review, adverse drug reaction evaluation, laboratory evaluation, appropriate current medication evaluation, drug-related problem (DRP) identification, counseling for preventing patient, and psychiatrist from adverse drug reaction (ADR) due to anti-psychotic drugs, providing knowledge of drug therapy for solving problems and preventing ADRs, and monitoring outcome of treatment and the cooperation of the patients.[1] However, PPC at the psychiatric hospital reported rehospitalization rate of 28 days with an average of 20 cases/month. The most common reasons for rehospitalization were non-compliance and non-adherence of patients from psychiatric hospital reported. A systematic review revealed that the most common pharmaceutical care activities were identifying, correcting, and preventing DRPs caused by antipsychiatric drug use. These activities were unilateral, lacking of coordination between the patient and the multidisciplinary team to provide holistic care.[2]

Shared decision-making (SDM) was processed between patients and health-care providers who participated in examination, treatment, and self-care to achieve health goals. The SDM was performed by exchanging information and knowledge between patients and health-care providers to make decisions.[3] The SDM by pharmacist was processed between patients and pharmacist participating in making decision on medical treatment options. Pharmacist explained the risks and benefits of each option to patients and made decisions based on the patient's treatment goals.[4] The SDM by pharmacists increased patients' knowledge of their used medication. The patients can inform the side effects of the drugs, leading to an increase in medical compliance.[5,6] In addition, the medication error was reduced due to the awareness of the potential benefits

and the risks of medication use.[4] The SDM process consisted of three steps including:[7] (1) Choice talk: Pharmacists explained the details of diseases, treatment, drugs, and the goal of the treatment to the patients. (2) Option talk: Pharmacists informed medical treatment options to the patients, and (3) decision talk: Decision-making based on the treatment goal of the patients.

Integrated Hospital Medication Management System 2017 (IHoMe 2017)[8] is a tool for solving systemic problems, consisting of two main topics: Problem list and management plan. The problem list is to identify the problem by patient perspective, provider perspective, and drug system problem. The management plan is a pharmaceutical care plan as well comprehensive care, integrated care, coordinated care, continuing care, and therapeutic relationship. IHoMe-SDM in this study was developed by experts' opinion and focusing on a patient-centered approach using the IHoMe 2017 implementation of SDM, gap analysis, and sharing patient information to the health-care provider team and community care team. This is tool performance verify by pilot case study.[9]

PCC-SDM intervention by IHoMe-SDM is a new intervention for complicated schizophrenia patients who have DRPs. In the previous studies, SDM was not used in PPC processes, and cost–benefit studies have not been performed.[1] Therefore, cost–benefit analysis aimed to know the benefit incurred from providing PCC-SDM intervention services. Besides, the information can be utilized in economics and PPC-SDM planning accordingly.

MATERIALS AND METHODS

Study Design

This study is a cross-sectional study.

Population and Sample

Thirty cases of inpatients with (International Classification of Diseases 10 diagnosis codes F20–29) complicated schizophrenia who have risk of self-harm, community violence, and rehospitalization in a psychiatric hospital were recruited into the study. Inclusion criteria were patients aged between 18 and 60 years old, with well cognitive function, and without severe psychotic symptoms. Patients can read, write, and communicate in Thai language and sign the consent form.

Study Protocol

PCC-SDM intervention by IHoMe-SDM was conducted after the patients have passed the inclusion criteria. The present study consisted of six steps, as follows:
Step 1: Data collection using IHoMe-SDM form
Step 2: Choice talk and option talk
Step 3: Decision talk
Step 4: Pharmaceutical care planning for continuous care
Step 5: Patients education on the diseases and medication
Step 6: Evaluation of effectiveness and monitoring treatment outcomes.

Data Collection

Data have been collected from inpatients in a psychiatric hospital for 3 months starting from October 1, 2018, to December 30, 2018.

Cost analysis

Activity-based costing (ABC) analysis of the multiple stage approach was taken in five steps:[10] (1) Cost product identification, (2) activity analysis, (3) cost driver analysis, (4) unit cost calculation, and (5) PPC-SDM costing calculation (product costing).

Cost savings

Cost savings based on the PCC-SDM were defined as the reduced cost which was calculated by subtracting the direct medical costs after applying an intervention from the direct medical costs before an intervention. Cost savings was calculated[11] by the following equation:

Cost savings = Direct medical costs before an intervention – Direct medical costs after an intervention

Cost avoidance

Cost avoidance was calculated from the probability of the adverse drug event (ADE) multiplied with the cost of each ADEs. The probability of ADEs calculated using the following method from Mutnick *et al*.[12] Cost avoidance was calculated[13] using the following equation:

Cost avoidance = Probability of ADEs × Cost of each ADEs

- Probability of the ADEs was obtained from expert opinion[12-14]
- Cost of each ADEs was based on the average cost of treatment per visit of all groups of diagnosis-related group (DRG) determined by the National Health Security Office (NHSO) in the fiscal year 2017.

Cost benefit

The total benefit was the total cost of PPC subtracted from the sum of cost avoidance and cost saving. The net benefits were calculated by the following equation:[15]

Net benefits = Total benefit – The total cost of PPC

= (Cost saving + Cost avoidance) – The total cost of PPC

Sensitivity analysis

The sensitivity analysis was performed using the one-way and two-way deterministic sensitivity analysis (DSA), assessing the effect of changing all the input variables and was presented as tornado diagram.[16]

Statistical Analysis

All data were entered into Microsoft Excel for analysis of descriptive summary statistics. The cost analysis was conducted with the view of health-care providers' perspective. The USD and THB exchange rate on December 3, 2020, was 30.21 THB/USD.

Ethics Approval

This study was reviewed and approved by the Khon Kaen University Ethics Committee for Human Research (HE612187) and Psychiatric Hospital Ethics Committee for Human Research.

RESULTS

General Characteristics

Thirty complicated schizophrenia patients were included into the study and general characteristics were reported, as shown in Table 1. The clinical psychiatric pharmacists have made 43 interventions of which 38 (81.93%) interventions were accepted by a psychiatrist. DRPs listed in Table 2 included failure to receive medication, ADRs, drug interaction (DI), and medication reconciliation (MR). DRPs of all were resolved by PPC-SDM intervention.

Economic Analysis

Cost analysis was performed using an ABC analysis. The hiring cost of clinical psychiatric pharmacist per month was averaged at $960.28 USD (29,010.00 THB) per pharmacist (salary, professional license fee, and others). The cost of materials, including office materials, telephone bills, and electricity bills, was $2.08 USD (62.93 THB). Investment cost of equipment and building depreciation was $0.29 USD (8.78 THB). PCC-SDM intervention cost was $5.57 USD (168.23 THB) per visit. The costs of ADRs intervention, DI intervention, and MR intervention were $2.76 USD (83.27 THB) per visit, $1.14 dollars (34.29 THB) per visit, and $2.51 USD (75.89 THB) per visit, respectively, as shown in Table 2. The total cost of clinical psychiatric pharmacist intervention was $192.35 USD (5810.93 THB).

Table 1: General characteristics of patients with complicated schizophrenia included in the study

General characteristics	N (30)	Percent
Gender		
Male	25	83.33
Female	5	16.67
Age (years)		
Between 18 and 25	3	10.00
Between 26 and 35	12	40.00
Between 36 and 45	9	30.00
Between 46 and 60	6	20.00
Health insurance		
Universal coverage	29	96.67
Self-payment	1	3.33
Education		
Primary school	9	30.00
Junior high school	11	36.67
High school	9	30.00
Bachelor's degree	1	3.33
Diagnosed		
F20.0 Paranoid schizophrenia	5	16.67
F20.3 Undifferentiated schizophrenia	4	13.33
F20.9 Schizophrenia, unspecified	19	63.33
F29 Unspecified non-organic psychosis	2	6.67

Cost saving was resulted from ADRs reduction and readmission rate after PCC-SDM intervention. The reduction of ADRs intervention from four interventions to one intervention could save the cost by $8.39 USD (253.42 THB). PCC-SDM intervention reduced readmission rate from 11 admissions to four admissions (admission cost of F20 was $264.81 USD [8000.00 THB]). The average admission cost was $264.81 USD/visit (8000 THB/visit) was multiplied by the relative weight of 0.8606, yielding the total admission cost of $227.90 USD (6884.80 THB). This could save $1559.29 USD (48,193.60 THB), as shown in Table 3. The cost saving from using the remaining drug was $22.96 USD (693.75 THB). The total cost saving was $1626.63 USD (49,140.77 THB).

Cost avoidance and PCC-SDM intervention by the clinical psychiatric pharmacist ADEs prevented seven patients, that is, two patients with neuroleptic malignant syndrome, two patients with pneumonia, two patients with severe extrapyramidal symptoms, and one patient with hypertension. Seven experts gave opinions on the probability of ADEs in patients receiving intervention based on the probability of ADEs, as shown in Table 4.[13] Experts agreed on the severity scores, as shown in Table 3. The scores were ranked as no probability (N), very low (V), low (L), medium (M), and high (H), and were selected according to the median of the data.[12,13] This resulted in an average probability of ADEs equal to 0.4. The cost avoidance as a result of the multiplication of the probability of ADEs and the cost of each ADEs based on the DRG. The DRG was set by the NHSO for fiscal year 2017. The total cost avoidance was $632.64 USD (19,112.00 THB), as shown in Table 5.

PCC-SDM intervention by IHoMe-SDM had the total benefit of $2259.28 USD (68,252.77 THB) and the net benefit of $2066.93 USD (62,441.84 THB) [Table 6].

Table 2: Drug-related problem of patients with complicated schizophrenia included in the study and activity-based costing analysis

Drug-related problem	N (%)	Average time (S.D.)	Labor cost (USD/visit)	Materials cost (USD/visit)	Investment cost (USD/visit)	Total cost (USD/visit)
Non-adherence	27 (62.79)	50.30 (5.57)	5.49	0.08	0.01	5.58
Adverse drug reaction	13 (30.23)	27.92 (7.60)	2.75	0.01	< 0.00	2.76
Drug interaction	1 (2.33)	10.00 (-)	1.12	0.01	< 0.00	1.14
Medication reconciliation	2 (4.65)	24.00 (9.90)	2.49	0.03	< 0.00	2.52

Exchange rate of 1 USD was 30.21 THB (December 3, 2020)

Sensitivity Analysis

One-way sensitivity analysis, the inputs to the model were allowed to vary across their specified ranges from the labor cost varies between $167.18 and $250.41 USD (5050.41–7564.76 THB), the cost avoidance was $561.12–$858.79 USD (16,951.52–25,944.16 THB), and the cost saving was $488.08–$1811.49 USD (14,744.89–54,725.25 THB) [Table 7]. The sensitivity of net benefits was presented as a tornado diagram in Figure 1.

Sensitivity analysis was based on uncertain input variables, which were the probability of ADEs (cost avoidance), DRG with different each psychiatry hospital (cost saving), and the labor cost (pharmacists with different salaries) for the best case and the worst case scenario. Two-way DSA was performed by determining the best probability of best case of adverse events (best case) and the probability of worst case adverse events (worst case). The cost saving was calculated from the highest and lowest cost DRG. Labor costs were calculated from the highest and lowest pharmacists' wages. The best case was $2503.11 USD (75,619.00 THB) of net benefits which was calculated using the min labor cost, max cost avoidance, and max cost saving. The worst case was $798.80 USD (24,131.65 THB) of net benefits which was calculated using the max labor cost, min cost avoidance, and min cost saving, as shown in Table 7.

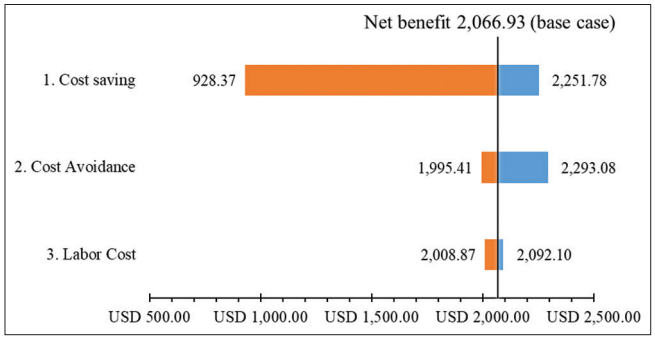

Figure 1: Tornado diagram of the one-way sensitivity analysis indicates that the outcome is most sensitive to variation in the expected cost saving

Table 3: Clinical outcome and cost saving

Clinical outcome	Before (visit)	After (visit)	Cost saving (USD)
Adverse drug reaction intervention	4	1	8.40
Readmission rate	11	4	1595.29

Exchange rate of 1 USD was 30.21 THB (December 3, 2020)

Table 4: Probability of ADE

Probability of an ADE	Probability score
No probability	0.00
Very low probability	0.01
Low probability	0.10
Medium probability	0.40
High probability	0.60

ADE: Adverse drug event

DISCUSSION

PCC-SDM increased the step of the workflow by the addition of SDM. The clinical pharmacists had more workload on pharmaceutical care of complicated schizophrenia patients in psychiatric hospital. This also increased the total cost of the intervention. Therefore, it is necessary to study the cost benefit. The cost–benefit analysis methods in this study modified from Gallaghe *et al*.[13] that studied the pharmacist intervention aimed to change patient management or therapy and add-on economic benefit to the hospital.

The most common DRPs (43 interventions) were failure to receive medication that was shown by pill counting and in-depth interview. ADRs were the second most common DRPs which is consistent with the study of Kanjanasilp and Ploylearmsang[1] and Kaeokumbong and Chaiyakum[17] reporting that the most common problems found in the anti-psychotic drug use of schizophrenia patients which were non-adherence and ADRs, respectively.

The psychiatrist responded very well to the advice of the clinical psychiatric pharmacist, which could be due to a good relationship and the clarity of the developed work instructions for PCC-SDM. This result agreed with the study of Puntakul and Topark-Ngarm[18] showing that MR was positively responded by physicians with 95.4% of all pharmacists.

This is the first study to present the new role of clinical psychiatric pharmacists in PCC-SDM and economic evaluation in Thailand. The study showed the beneficial of PCC-SDM in reducing the cost of pharmaceutical care by reducing readmission rate and ADRs. The limitation of this study was a small sample size. Therefore, it cannot be generalized. Future studies should increase the number of sample size and studied in patients with complicated in other diseases.

Table 5: ADE preventable and cost avoidance

ADE preventable	N	Probability of ADE	Diagnosis related group (USD)	Cost of ADE (USD)	Cost avoidance (USD)
Neuroleptic malignant syndrome	2	0.4	384.22	153.69	632.64
Pneumonia	2	0.4	149.91	59.96	
Severe extrapyramidal symptoms	2	0.4	212.43	84.97	
Hypertension	1	0.4	88.47	35.39	

Exchange rate of 1 USD was 30.21 THB (December 3, 2020). ADE: Adverse drug event

Table 6: Economic outcomes

Economic outcomes	Cost (USD)
PCC-SDM intervention cost	192.35
Cost avoidance	632.64
Cost saving	1626.63
Net benefits	2066.93

Exchange rate of 1 USD was 30.21 THB (December 3, 2020). PCC-SDM was PPC with shared decision-making. PCC-SDM: Pharmaceutical care with shared decision-making

Table 7: Inputs for two-way sensitivity analysis

Inputs	Sensitivity analysis (range)	Best case (USD)	Worst case (USD)
Labor cost	$2008.87–$2092.10	2503.11	798.80
Cost avoidance	$1995.41–$2293.08		
Cost saving	$928.37–$2251.78		

Best case of net benefits was calculated using the min labor cost, max cost avoidance, and max cost saving. Worst case of net benefits was calculated using the max labor cost, min cost avoidance, and min cost saving

CONCLUSION

Our results indicated that PCC-SDM intervention in complicated schizophrenia patients had a positive potential impact on cost saving, cost avoidance, and cost benefit. PCC-SDM intervention providing relevant insight into the potential benefits of having a clinical psychiatry pharmacist for reducing readmission and preventing patients from ADRs.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

AUTHORS' CONTRIBUTION STATEMENTS

C. Hongthong and N. Kessomboon designed the study, collecting the data, analyzed the data, wrote the manuscript in consultation with C. Chittasupho and discussed the results, and contributed to the final manuscript.

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