Original Article

Outcomes of Telepharmacy on Asthma Control at Ratchaburi Hospital

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Abstract:

Objective: This study aimed to assess clinical, humanistic and economic outcomes of telepharmacy in asthma patients.

Material and Methods: A quasi-experimental research design, with one-group pretest-posttest, was conducted to study telepharmacy. This real-time pharmaceutical care using communication technology was conducted in 29 asthma patients, over 12 weeks. Clinical outcomes were evaluated; including, asthma control, drug-related problems, adherence to use of inhaled corticosteroids (ICS), ICS-side effects, emergency room visits and hospitalizations due to acute exacerbation. Patient satisfaction was used to assess humanistic outcomes, and cost-saving was used to assess economic outcomes.

Results: Clinical outcomes showed statistically significant improvement in the number of well-controlled patients; increasing from 34.48% to 89.66% (p-value<0.01). ICS adherence improved from the mean percentage of number of times patients forgot to use ICS; which decreased from 5.86±18.67 to 0.21±0.74 (p-value<0.01). The mean number of drug-related problems decreased from 1.45±0.91 to 0.21±0.41 (p-value<0.01), and the mean number of ICS-side effects decreased from 0.66±0.72 to 0.14±0.44 (p-value<0.01). A total of 51.72 % of patients also required additional advice on inhaler techniques by a pharmacist. The mean number of emergency room visits and hospitalizations, due to acute exacerbation, decreased to zero by the end of the study. Humanistic outcomes revealed that patient satisfaction was at the 'very satisfactory' level (4.82±0.27 out of 5.00), and economic outcomes found that patients could save 49.99±34.90% compared to usual care.

Conclusion: This study shows that patients receiving telepharmacy have better outcomes in ICS adherence and asthma control, can prevent future risks (acute exacerbation, ICS-side effects), save costs and were very satisfied with telepharmacy overall.

Keywords: asthma control, inhalation technique, satisfaction, telepharmacy

Introduction

Asthma is a major health problem, with the number of patients expected to increase to 400 million by 2025, This will impact patient health and medical costs for patients, caregivers and the nation[1]. As a result of such problems, medical practice guidelines have been established to address preventing acute exacerbations, normalizing pulmonary function and reducing asthma-related death. However, hospital overcrowding and the coronavirus disease (COVID-19) pandemic has increased the risk of spreading pathogens. Therefore, hospitals had to suspend pharmaceutical care services, (such as; regular use of inhaled corticosteroids (ICS) and learning proper inhaler techniques) for asthma patients. Telepharmacy is a communication service that connects patients and pharmacists in real-time using modern technology to facilitate patients in receiving proper medication and advice[2]. Several studies have shown that telepharmacy has enabled pharmacists to effectively provide medical advice to patients by reducing barriers to those living in remote areas[3-7]. However, a published report on telepharmacy's outcomes for asthma control in Thailand has not been found. Therefore, the researchers conducted a study to assess telepharmacy's outcomes on asthma control in patients receiving the service from the hospital.

Material and Methods

This quasi-experimental research was performed using an experimental group, and carried out experiments based on a one group pretest–posttest design. It was approved by the Human Research Ethics Committee of Ratchaburi Hospital: project code RBHEC 031/64. The sample group was calculated from the G*Power program, based on previous studies[5] whose effect size was 0.6. From this, 29 samples were specifically selected according to the inclusion criteria of asthma patients (ICD-10; J45).

The patients must not have received pharmaceutical care for at least 1 year, be over 18 years of age, can read and understand Thai, had taken ICS for at least 1 month, could use and have a communication device that supports video conference and not have any co-morbidities; including: gastroesophageal reflux disease, major depressive disorder, schizophrenia, Alzheimer's disease, chronic obstructive pulmonary disease, pneumonia, active tuberculosis or lung cancer[8].

The COVID-19 pandemic resulted in asthma patients receiving insufficient pharmaceutical care. Other options; such as telepharmacy, may resolve this issue, as patients want an improved quality of life and reasonable expenses[9]. This study; therefore, assesses three outcomes: clinical, humanistic and economical, to demonstrate the feasibility of telepharmacy.

Tools included: A. TeleHealthRegion7, a website that supports video conferences and can record data in real time. The website www.telehealthregion7.com, which allows users to register Pharmaceutical care, was provided for 15-20 minutes each time, and patients received pharmaceutical care four times throughout the study: at baseline, week 4, week 8, and week 12 of the study. Patients were required to verify their identity via the program's electronic system with their applied name and password (the last four digits of their identification card number). In compliance with the pharmacy council of Thailand regulations[10], medications were delivered by the postal delivery system. In comparison, B. educational material was available on the official "Ratchaburi Tele pharmacy" website with a rich menu; including video demonstrations of telehealthregion7 procedures, a Zoom program, postal delivery channels and hospital contact channels. C. Data is collected on recorded forms; such as, how often patients forget to use ICS and how many drug-related problems they encountered. Additionally, it evaluates the side effects they experience, how often they visit the

emergency room and how often they are hospitalized. D. Inhaler techniques and asthma control levels are assessed using assessment forms[11]. E. Humanistic outcomes were assessed using patient satisfaction questionnaires by assigning patients weight satisfaction scores; based on the guidelines for the 5-point Likert scale, whose range is 0.8, resulting in a satisfaction level ranging from satisfied, dissatisfied and very dissatisfied. Five questions were tested for validity using the Index of Item-Objective Congruence: the IOC was 1.00, and the Cronbach's Alpha Coefficient was 0.85. F. An expense report form collects data on a patient's expenses. Telepharmacy and usual care were compared, based on patient perspectives to assess economic outcomes. Travel, postage, food and accommodation are considered direct costs. The indirect costs of hospital treatment include: productivity losses and wage losses for patients and caregivers. The percentage of cost savings is calculated and converted into a mean value using the difference between usual care and telepharmacy costs for each patient's expenses.

Details in the consultation were: A. causes and avoidance of triggers, B. basic medication knowledge, side effects and prevention, C. inhaler techniques and D. an asthma action plan. Results were followed at: 4, 8 and 12 weeks.

Statistical analysis

Descriptive statistics were used to analyze the general characteristics of the patients, inhaler techniques, satisfaction, emergency room visits, hospitalizations due to acute exacerbations and cost-savings. The paired sample t-test was used to determine the significance of drug-related problems, ICS adherence, and ICS-side effects; if the data were of a normal distribution, but switched to the Wilcoxon signed-rank test if the data were of an abnormal distribution. The McNemar test was used to determine the significance of asthma control.

Results

The general data showed that 29 patients participated in the study; according to the criteria. The mean age was 47.38±13.76 years, mean length of the illness was 10.14±11.54 years and 72.41% were female. The most used controller was Salmeterol 25 mcg/Fluticasone propionate 125 mcg Inhaler: accounting for 72.41%, while the most used reliever was Salbutamol Evohaler: accounting for 82.76% (Table 1).

Clinical outcomes included: A. The number of well-controlled patients was found to be statistically significant, as they increased from 34.48% at baseline to 89.66% at the end of the study (p-value<0.01). B. The mean number of drug-related problems decreased significantly; from 1.45±0.91 at baseline to 0.21±0.41 at the end of the study (p-value<0.01). However, when classified by subgroups, one patient was found to have a recurrence of oral candidiasis from ICS at the end of the study. This was found when an in-depth interview discovered that after week 8, the patient had a high level of anxiety from a miscarriage (Figure 1). C. ICS-adherence increased, which can be determined by the mean percentage of times patients forgot to use ICS, which significantly decreased from 5.86±18.67 at baseline to 0.21±0.74 at the end of the study (p-value<0.01). D. The mean number of ICS-side effects showed a statistically significant decrease from 0.66±0.72 at baseline to 0.14±0.44 at the end of the study (p-value<0.01), E. The mean number of emergency room visits and hospitalizations decreased from 1.50±1.00 at baseline to zero at the end of the study. F. 51.72% of patients also required additional advice to correct inhaler techniques at critical steps (Metered dose inhaler's critical steps: hold the inhaler upright and shake 3 to 4 times, breathe in deeply and slowly through the mouth and at the same time press down firmly on the canister, then hold your breath for at least 10 seconds. Accuhaler 's critical steps: hold the device horizontally, while sliding the lever until it clicks, breath out; away from the inhaler, and

Table 1 General characteristics

| General characteristics	n=29
Age (years) (Mean±S.D.)	47.38±13.76
Length of the illness (years) (Mean±S.D.)	10.14±11.54
Female (n%)	21 (72.41)
Inhaler (n%)	
Controller	
Salmeterol 25 mcg/Fluticasone propionate 125 mcg Inhaler	21 (72.41)
Salmeterol 50 mcg/Fluticasone propionate 250 mcg Accuhaler	5 (17.24)
Budesonide160 mcg/Formoterol 4.5 mcg Turbuhaler	1 (3.45)
Budesonide 200 mcg Inhaler	1 (3.45)
Salmeterol 25 mcg/Fluticasone propionate 125 mcg Inhaler + Budesonide 200 mcg Inhaler	1 (3.45)
Reliever	
Salbutamol Evohaler	24 (82.76)
Ipratropium/Fenoterol Metered Aerosol	5 (17.24)
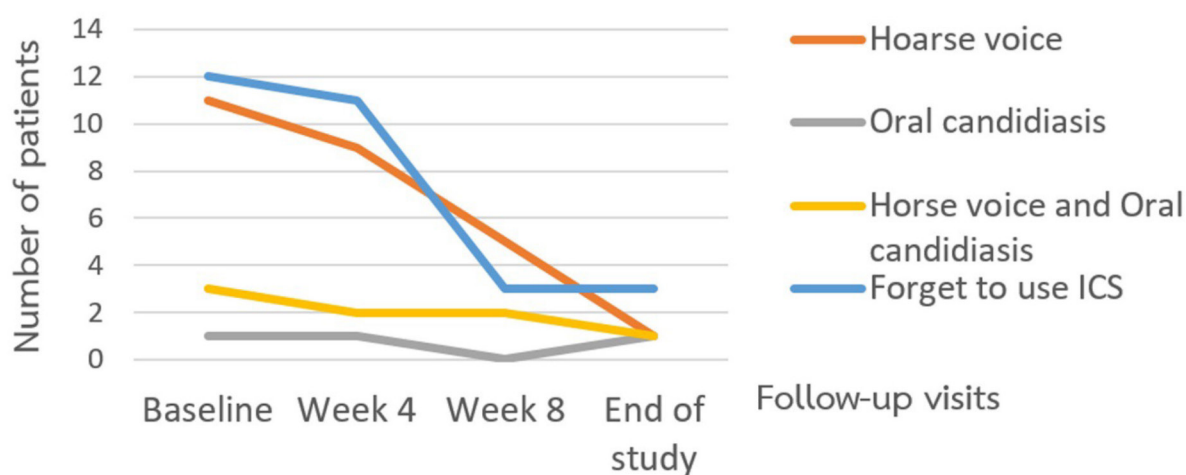
Figure 1 The number of patients experiencing problems with treatment every 4 weeks

Table 2 Clinical outcomes of telepharmacy at baseline and at the end of the study

Clinical outcomes	n=29		p-value
	Baseline	End of the study	
Number of well-controlled patients (n%)[a]	10 (34.48)	26 (89.66)	<0.01*
Number of drug-related problems (Mean±S.D.)[b]	1.45±0.91	0.21±0.41	<0.01*
Percentage of the number of times patients forgot to use ICS (Mean±S.D.)[b]	5.86±18.67	0.21±0.74	<0.01*
Number of ICS-side effects (Mean±S.D.)[b]	0.66±0.72	0.14±0.44	<0.01*
Number of emergency room visits and hospitalizations in patients (Mean±S.D.)	1.50±1.00	0.00±0.00	

[a]McNemar Test, [b]Wilcoxon signed-rank test, and * there were statistically significant changes. (p-value<0.05)
ICS=inhaled corticosteroids
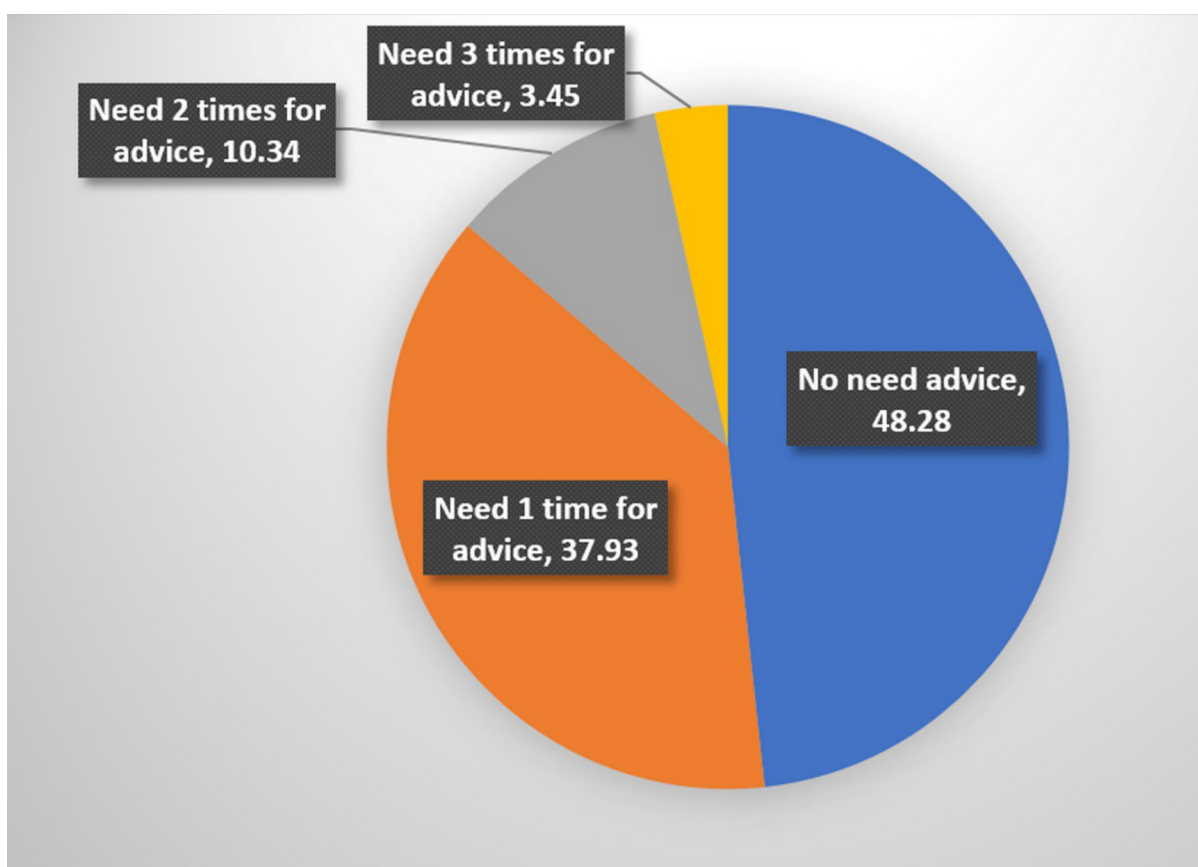
Figure 2 Percentage of patients receiving additional advice by the pharmacist, until they used their inhaler correctly (n=29)

then breathe in deeply and forcefully through the mouth. Turbuhaler's critical steps: hold the device upright, while twisting the grip at the base by twisting it around and then back until a click is heard, breathe out; away from the inhaler, and then breathe in deeply and forcefully through the mouth.) (Figure 2) (Table 2).

Humanistic outcomes were assessed with satisfaction, using the 5-point likert scale; wherein, the meaning consists of 1.00–1.80=very dissatisfied, 1.81–2.60=dissatisfied, 2.61–3.40=neither satisfied nor dissatisfied, 3.41–4.20=satisfied and 4.21–5.00=very satisfied. From this is was found that patients were overall satisfied with telepharmacy at the level of: very satisfied 4.82±0.27 (Table 3).

Economic outcomes were assessed by measuring the costs of the same patient when receiving telepharmacy and usual care treatment. It was found that within 12 weeks telepharmacy had a cost savings of 49.99±34.90% (Table 4).

Discussion

In this study, all patients completed the study period, and did not change their treatment plan; therefore, the results were likely to be derived from the knowledge of pharmacists via telepharmacy. The general characteristics showed that the most commonly used controller was the Salmeterol 25 mcg/Fluticasone propionate 125 mcg Inhaler, while the most commonly used reliever was the Salbutamol Evohaler: this being one of the reliever medications that can

Table 3 Results of patient satisfaction with telepharmacy

Question	Mean±S.D.	Interpretation
How effective is telepharmacy at replacing receiving services at the hospital?	4.83±0.38	Very satisfied
How easily can you access telepharmacy?	4.62±0.49	Very satisfied
How clearly can you understand inhaler techniques and asthma self-management through telepharmacy?	4.90±0.31	Very satisfied
How satisfied are you overall with telepharmacy?	4.93±0.26	Very satisfied
Overall	4.82±0.27	Very satisfied

Table 4 Compared costs of receiving service between telepharmacy and usual care within 12 weeks

Costs	Mean±S.D.			
	Usual care	Telepharmacy	Cost-saving	% Cost saving
Direct costs				
Travel costs	279.59±346.09	140.41±164.04	139.17±191.56	38.51±25.14
Food and accommodation costs	35.86±81.13	17.93±40.57	17.93±40.57	10.34±20.61
Postage costs		44.83±38.60	−44.83±38.60	
Indirect costs				
Productivity/wage loss	731.03±1880.56	201.72±294.13	529.31±1850.17	19.54±28.89
Total costs	1046.48±1905.51	404.90±379.34	641.59±1847.28	49.99±34.90

be used when the patient has acute exacerbation. All were selected according to the guidelines of the Global Initiative for Asthma (GINA) 2021[11] and GINA 2022[12].

Clinical outcomes, which included asthma control, ICS adherence (the number of times patients forget to use ICS decreased, meaning patients had greater ICS adherence), ICS-side effects and drug-related problems showed a statistically significant improvement. However, the recurrence of oral candidiasis was reported at the end of the study in 1 patient. In-depth interviews, conducted 8 weeks into the study, revealed that this patient had periods of anxiety. This is consistent with a previous study that reported that the incidence of oral candidiasis was statistically associated with anxiety[13].

This study was consistent with the previous studies that used telepharmacy to advise asthma patients, in which it was found that their asthma control and adherence to instructions increased[5,14].

In total, 51.72% of patients also needed additional advice at critical steps (critical steps are important steps; wherein, if inhaled incorrectly, will lead to ineffective doses or the target dose not being reached)[15-17]. Therefore, as a single piece of advice may not be adequate, it is better to standardize the advice of inhaler use to patients at least 2-3 times to ensure that patients inhale correctly. This was consistent with the mean number of emergency room visits and hospitalizations, possibly due to the right inhaler technique being learned in critical steps, repeating the practice every 4 weeks, avoiding triggers and being able to follow an asthma action plan.

Humanistic outcomes found that patients were very satisfied with telepharmacy (4.82±0.27). Additionally, a study that offered advice on inhaler techniques to Arkansas State's adolescent asthma patients via video conference found high levels of satisfaction[18]. Furthermore, some patients were informed that telepharmacy was a convenient way to consult with pharmacists. Though there could be additional

postage costs, money saved from not needing to travel reduced overall costs by 49.99±34.90%.

Limitations that need to be addressed. First, patients required a smartphone that can support Zoom applications, and that they can learn telepharmacy systems. Second, due to the research methodology, a quasi-experimental research design with a one-group pretest-posttest, this caused a lack of group comparison. Third, due to the inclusion criteria being of a non-blinded manner, in which patients were selected by non-probability sampling in addition to the duration of the study being only 12 weeks, the accuracy of outcomes may be reduced. Lastly, there was also the Hawthorne effect, because patients were followed up every 4 weeks; which could cause patients to take better care of themselves and achieve better outcomes.

Recommendations for applying this study to usual care may be to reduce the number of visits stable patients make to see a doctor at a hospital. Instead, they could use the postal medicine system and make appointments for pharmaceutical care from pharmacists via telepharmacy, which would also respond to congestion reduction policies.

Conclusion

The application of telepharmacy in pharmaceutical care in asthma patients caused patients to inhale using correct techniques, it decreased drug-related problems and increased ICS adherence. As a result, patients have reached asthma treatment goals; including, asthma control, preventing future risks (ICS-side effects and acute exacerbations), lowered the costs when compared to usual care and had very high levels of satisfaction.

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Conflict of interest

There are no conflicts of interest to declare.

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