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COMPARISON OF THE EFFICACY OF IN-PERSON VS. VIRTUAL INHALER EDUCATION IN TERMS OF ADHERENCE, INHALER TECHNIQUE AND SYMPTOM CONTROL AMONG ASTHMA OPD PATIENTS: RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Background. Virtual inhaler education is increasingly being explored as a means of delivering asthma education in settings with limited access to healthcare, with the goal of reducing asthma exacerbations. As such, inhaler education has become a central focus in efforts to optimize treatment outcomes. This study aims to compare the efficacy of in-person versus virtual inhaler education, specifically in terms of correct technique retention and medication adherence.

Objectives. To compare and assess the efficacy of in-person inhaler education versus virtual inhaler education in improving correct technique retention, medication adherence and GINA symptom control tool assessment among asthma patients seen at the Lung Center of the Philippines Outpatient Department.

Methodology. A total of 39 asthma patients from the Outpatient Department of the Lung Center of the Philippines (LCP) were enrolled in a randomized clinical trial conducted from December 2023 to February 2024. Participants were followed for four weeks, during which asthma symptom control, medication adherence, and inhaler technique retention were assessed. Data were analyzed using the Mann-Whitney U test for between-group comparisons and the Friedman test for within-group changes over time.

Results. Demographics between the two groups were largely similar with no significant differences in age (p=0.696), gender (p=1.000), height (p=0.287), weight (p=0.091), BMI (p=0.124), educational attainment (p=0.744), or inhaler type usage (p=0.483). Findings suggest that both groups yielded comparable results in enhancing asthma symptom control. However, it was not statistically significant after 4 weeks (P-value=0.373-in-person inhaler group; P-value=0.203-virtual inhaler group). Virtual healthcare delivery is potentially effective in providing asthma education. In-person education consistently resulted in significantly lower scores in the adherence questionnaire indicating better adherence compared to virtual (P=0.032). Lastly, it was noted that both groups exemplified improvement in correct technique with P-value=0.003 for the in-person group and P-value=0.001 for the virtual group.

Conclusion. Virtual education is non-inferior to in-person education in asthma control and correct technique retention while in-person education is more effective in promoting adherence.

Keywords: Virtual inhaler education, asthma symptom control, medication adherence, correct technique retention, GINA symptom control, inhaler technique

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INTRODUCTION

Asthma is a chronic and prevalent respiratory disease which causes significant burden, disability and mortality and can have significant emotional, social and financial impacts.[1] There are several factors that can result to inadequate asthma control. One such factor is non-adherence to proper inhaler technique which will lead to frequent exacerbations and worse, eventual death. According to GINA 2024, asthma affects approximately 10.4% of the global population, with a prevalence rate of 504.28 per 100,000 people in young adults, as observed from 1990 to 2019. In addition, according to the National Nutrition and Health Survey (NNHeS), the overall prevalence of adult asthma in the Philippines is approximately 8.7%.

Meanwhile, inhaled therapy is considered as the cornerstone treatment in asthma wherein the medication is delivered directly in the lungs for optimal efficacy and safety. However, up to 94% of patients with asthma and COPD do not use their inhalers correctly, and they often need multiple education sessions to maintain their adherence to the proper technique.[2]

In view of this, efforts in the improvement of adherence to guidelines in inhaler techniques had been developing over the years. Many people cannot use inhalers properly hence proper technique should be taught in order to achieve asthma control. To address the problem, a virtual teach-to-goal intervention was designed to facilitate patient's adherence to the medication. In-person teach-to-goal technique had been demonstrated to help improve the adherence of patients in the proper way of using their inhalers.[3]

In the midst of the pandemic, face to face activities had been limited due to safety precautions. Hence, a shift from in-person to virtual teach-to-goal technique is now being tested and explored. Because the association between COVID-19 severity and chronic medical conditions such as asthma has been suggested, a common concern during the pandemic is the risk that in-person asthma education program poses.[4]

Locally, the Lung Center of the Philippines Asthma Club established virtual asthma education to minimize the covid risk of its asthma patients and educators. With the virtual inhaler technique, the overall cost will be lessened especially for patients living far away from hospitals. This would allow them to improve their medication use skills even if they are not able to attend the in-person inhaler technique sessions.

Knowledge of proper inhaler technique has a vital role in effective asthma treatment. Hence, effort in helping patients perform the correct technique is evolving. Traditional face-to-face education has been proven effective in improving asthma control.[5] However, it was deemed time-consuming, costly, and often laborious. Hence, a newly developed video-based inhaler technique education method was evaluated and was found to be a suitable substitute for face-to-face education on inhaler technique (dry powder inhalation capsule) in patients with stable asthma, particularly in elderly patients and patients with well-controlled asthma as demonstrated in the study of Park et. al. in 2018.

In 2015, Van den Wijngaart et al. conducted research among asthmatic children regarding virtual asthma clinic. They noted a significantly higher ACT scores in the virtual asthma clinic (VAC) group than in the control group (p=0.02). Within the VAC group, both asthma control (p=0.03) and quality of life improved significantly (p=0.04). They were able to conclude that virtual asthma clinics reduced the visits to the outpatient clinic by 50% whilst improving asthma control and quality of life among asthmatic children proving that virtual asthma clinics are non-inferior to the in-patient hospital consults.[6]

Another study done by Gregoriano et. al. 2018 emphasized the importance of correct inhalation of prescribed medication. In their study, incorrect inhalation technique ranged from 0 to 53% depending on the type of inhaler. COPD patients with incorrect device application had a higher CAT sum score compared to those with a correct device application (P=0.02). However, there was no significance found in asthma patients.[7]

Shiva and Valizadeh (2018) also did a study, this time using telegram based virtual education comparing it to in person education in adolescents with mild to moderate asthma. The RTC showed that there was no statistically significant difference between the groups in terms of the mean score for the quality of life and its domains.[8]

In the GINA guidelines 2022, there are categories in assessing the asthma control: 1) simple screening tool, 2) categorical symptom control tools and 3) numerical asthma control tools (ACQ and ACT scores). On the other hand, the Asthma APGAR tool and the consensus-based Royal College of Physicians (RCP) Three Questions' tool are considered as categorical symptom control tools being used in primary care setting.[9] Lastly, numerical asthma control tools for assessing symptom control are the asthma control questionnaire (ACQ) and asthma control test (ACT). ACQ scores range from 0-6 (higher scores mean worse) which include five symptom questions and has three versions (ACQ-5, ACQ-6 and ACQ-7).

The Asthma Control Test (ACT) has been validated to be of significant use in trials and in clinical practice. ACT is a self-administered tool for identifying poorly controlled asthma. It is a 5-item questionnaire with a 4-week recall on symptoms and daily functioning. The scores range from 5 (poor control of asthma) to 25 (complete control of asthma) with higher scores corresponding to greater asthma control. An ACT score of more than 19 means a well-controlled asthma. Hence, this is an appropriate measure of asthma control as stated in the study of van Djik et al. (2020).[10]

Indeed, improving asthma control by doing inhaler education is an important component in the overall asthma management. Hence, developing effective strategies with lower total cost, less effort and time-saving features, while taking advantage of advanced technology (virtual platform) are being explored and carried out.

The study aims to assess and compare the efficacy of in-person versus virtual inhaler education regarding correct technique retention, medication adherence and symptom control among asthma OPD patients.

General Objectives

The researchers aim to accomplish this general objective: To compare the efficacy of in-person vs. virtual inhaler education in terms of medication adherence and inhaler technique retention among asthmatic patients seen in the LCP OPD.

Specific Objectives

The researchers aim to assess the efficacy of in-person inhaler education versus virtual inhaler education in terms of correct technique retention, medication adherence and GINA symptom control tool assessment among asthma patients seen at LCP OPD.

The researchers also hypothesized that there is no significant difference in medication adherence, inhaler technique retention and symptom control between in-person and virtual inhaler education among OPD asthmatic patients.

METHODOLOGY

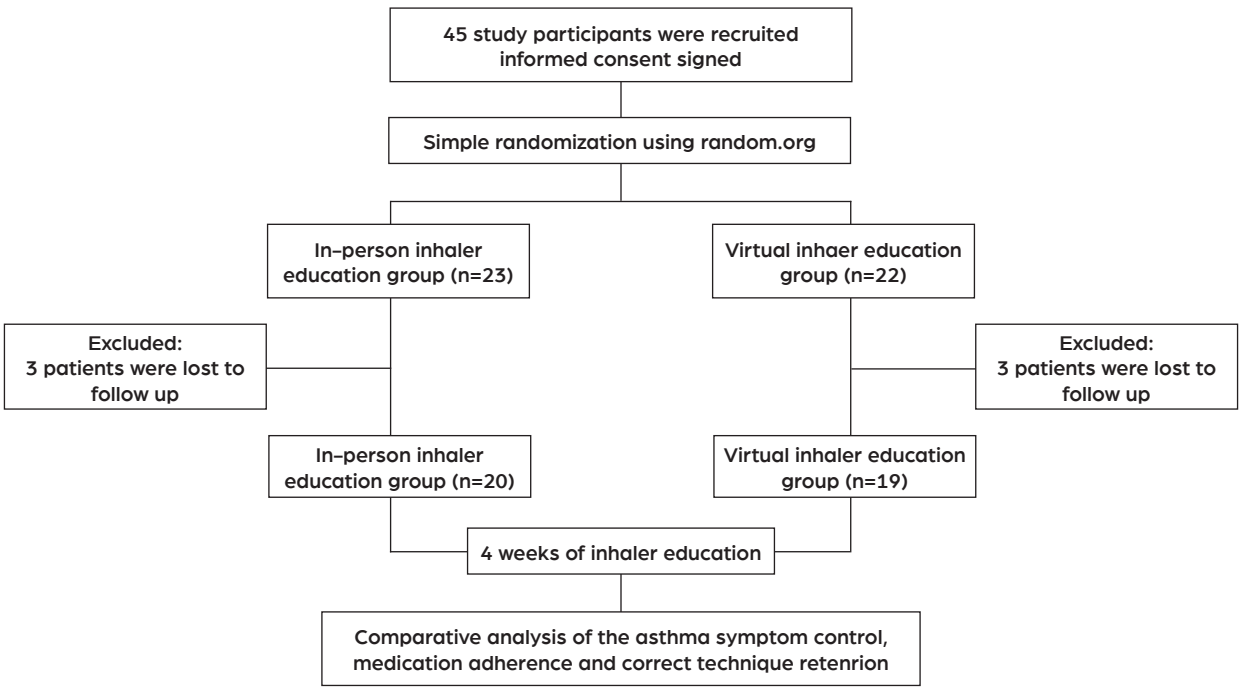
Selection of Subjects

Newly diagnosed patients and new members of the LCP asthma club with uncontrolled or partly controlled asthma seen at LCP OPD deemed eligible as stated in the inclusion criteria and who were willing to participate were included in the randomized clinical trial from December 2023-February 2024. At the charity OPD during Asthma clinic (every Tuesdays and Thursdays), the researchers get notified by the Pulmonary Fellows regarding the eligible patients. New patients from the Asthma Club were also included. After each club session, patients were interviewed and recruited, then the researchers screened the patients if deemed eligible following the inclusion-exclusion criteria. Informed consent was explained and was given to the patients prior to inclusion in the study. Patients who were lost to follow up were excluded from the analysis.

Enlistment and Randomization

Once patients were screened and deemed eligible to participate and informed consent has been signed, two groups were identified such as the experimental group and control group. Asthma patients at the outpatient department were assigned using simple randomization. An electronic randomizer was used to randomize patients into the control group (in-person inhaler education group) and experimental group (virtual inhaler group). A third party randomized the patients into the two groups. Odd numbers were assigned to the in-person group and the even numbers was assigned to the virtual group using the random.org electronic randomizer. This is to ensure that any observed differences between groups are not due to pre-existing differences, reducing the potential for the control group to be disadvantaged.

Figure 1. *CONSORT flow diagram (n=39)*



Inclusion criteria. Physician-diagnosed asthma patients either by history of typical variable respiratory symptoms (wheeze, shortness of breath, chest tightness and cough), pulmonary function test with pre- and post-bronchodilator test (defined as increase in FEV1 of 12% and >200 mL (greater confidence if increase is 15% and >400 mL with FEV1/FVC value of less than the lower limit of normal (<0.75-0.80) or peak flow test defined as average daily diurnal PEF variability >10% in two weeks), aged 19 years old and above who were prescribed with a controller in the form of an inhaler medication, have not attended any asthma education and are being managed and seen at LCP OPD and is living in Metro Manila and who are able to gain access on the internet and are able to effectively use the internet (skilled to use the internet or with supervision of a skilled one) will be included in the study.

Exclusion criteria. Pregnant patients, patients with diagnosed case or known to have any long-standing structural lung problem such as pulmonary tuberculosis, chronic obstructive pulmonary disease (COPD), destroyed or non-viable lungs, pulmonary hypertension, bronchiectasis, and interstitial lung disease.

Conduct of Procedure and Data Collection

The patients were assessed by the researchers. The study and the procedures were explained to the study participants then informed consent form was signed. The patients joined the study. The asthma control was documented through the consensus-based GINA symptom control tool. Then the virtual and in-person inhaler education was done by the researchers to the patients. For the virtual group, the patients were provided with a 1-2 minute-long recorded videos on how to properly use the inhalers. On the other hand, in the in-person group, the researcher personally taught the patients via one-on-one session.

The teach-to-goal checklist was provided to document the proper technique by performing the steps correctly and was accomplished solely by the researcher after the study participants underwent the return demonstration. To ensure that both groups received the same instructions and inhaler education, the same researcher conducted the process. The patients used the prescribed inhalers by their physicians (Pulmonary Fellows at the OPD or private consultants depending on who saw the patient) and according to their preference.

Inhaler adherence questionnaires were provided which is composed of six validated questions that were answered by the participants. The score is 1 if there is nonadherence and the higher the score the more non adherent the patient. It is a valid tool to identify adult patients with asthma who are likely to be non-adherent with their daily prescribed inhaler. The in-person inhaler education participants had a total of 4 visits (once per week) for the whole duration of the study. For the virtual group, follow up for these participants was conducted thru video call follow up. After 4 weeks, the patients were assessed again by the correct technique retention by administering the teach-to-goal checklist, medication adherence, asthma control through the consensus-based GINA symptom control tool. Comparative analysis was done statistically to analyze the data and determine the significant difference between the two groups. Participants were followed up weekly, fostering increased rapport with researchers and enhancing their comfort level over time. This approach facilitated the observation of naturalistic behavior, as participants demonstrated their typical inhaler use in everyday situations.

Sample Size Determination

Assuming a level of significance of 0.05, a power of 80% and an effect size of 1.00 (Ramos et al., 2021), the required sample size to determine if there is a significant difference in the correct technique retention, medication adherence and symptom control through GINA symptom control tool among asthma patients of LCP OPD who received in-person inhaler education and virtual inhaler education is 34. Adjusting for 20% of the sampled patients that would refuse to join the study, the final sample size is 42.

Research Instruments

This study utilized a range of research instruments to evaluate the efficacy of in-person versus virtual inhaler education in asthma patients. These include a demographic and clinical characteristics form, the Inhaler Adherence Questionnaire (IAQ) to assess medication adherence, the Teach-to-Goal Return Demonstration Checklist to evaluate inhaler technique, and the GINA Symptom Control Tool to measure asthma symptom control. By employing these instruments, the study aimed to provide a comprehensive understanding of the impact of different educational approaches on asthma management outcomes.

Statistical Analysis

Comparative analysis of the correct technique retention, medication adherence and the level of asthma symptom control using the consensus-based GINA symptom control tool before and after the administration (4-week recall) of the inhaler education was done using the Mann-Whitney U (Wilcoxon rank-sum) test and Friedman test for repeated measure to analyze the data using SPSS Statistics version 26.

Ethical Considerations

This study was conducted in accordance with the National Ethical Guidelines for Research Involving Human Participants 2022. The study protocol was approved by the LCP-IERB Study Protocol Code LCP-PF-027-2023 prior to implementation. The safety of the participants was of utmost importance in the study. As such, voluntary consent was exercised by the participants without the intervention of force, fraud, deceit, duress, or other forms of

coercion. The informed consent contained the information regarding the study and was completely understood by the participants. In line with this, the participants were assured that the confidentiality of the results will be as important as having them agree with their involvement in the study.

RESULTS

Table 1 presents the demographic characteristics of asthma patients at an outpatient department (OPD), comparing those who attended in-person education versus virtual education. The average age of all patients was 60.64 years. There was no significant difference in age between in-person (60.10 years) and virtual (61.21 years) attendees (p = 0.696). The majority were female (35 out of 39 patients), with no significant difference in gender distribution between in-person and virtual attendees (p = 1.000). The average height of all patients was 154.51 cm. There was no significant difference in height between in-person and virtual attendees (p = 0.287). The average weight of all patients was 60.89 kg. There was no significant difference in weight between in-person and virtual attendees (p = 0.091). The average BMI of all patients was 25.36 kg/m^2. There was no significant difference in BMI between in-person and virtual attendees (p = 0.124). The majority had a high school education (20 out of 39 patients), followed by college education (14 out of 39 patients). There were no significant differences in educational attainment between in-person and virtual attendees (p = 0.744). The most used inhaler type was Symbicort Turbuhaler (21 out of 39 patients). There were no significant differences in inhaler type usage between in-person and virtual attendees (p = 0.483). About 69.23% of all patients had a family history of asthma. While there was a higher percentage of in-person attendees with a family history of asthma (80.00%), it was not statistically significant (p = 0.176). Around 48.72% of all patients had a family history of allergies or atopy.

Table 1. *Demographic characteristics of asthma patients at LCP OPD, n=39*

Parameter	Value			*P*-Value
	Total n=39	In-Person Inhaler Education n=20	Virtual Inhaler Education n=19	
Age in years	60.64 (8.71)	60.10 (7.20)	61.21 (10.24)	0.696
Gender, mean (SD)				
Male	4 (10.26)	2 (10.00)	2 (10.53)	1.000
Female	35 (89.74)	18 (90.00)	17 (89.47)	
Height in cm	154.51 (7.80)	153.20 (9.01)	155.89 (6.23)	0.287
Weight in kg	60.89 (13.85)	57.24 (13.66)	64.74 (13.33)	0.091
BMI in kg/m2	25.36 (4.68)	24.23 (4.62)	26.55 (4.57)	0.124
Educational Attainment, mean (SD)				
Elementary	5 (12.82)	3 (15.00)	2 (10.53)	0.744
High School	20 (51.28)	11 (55.00)	9 (47.37)	
College	14 (35.90)	6 (30.00)	8 (42.11)	
Inhaler Type Used, mean (SD)				
Symbicort TurbuhalerR	21 (53.85)	10 (50.00)	11 (57.89)	0.483
Saltrol MDIR	1 (2.56)	1 (5.00)	0 (0.00)	
SeretideR Diskus	5 (12.82)	4 (20.00)	1 (5.26)	
SeretideR MDI	11 (28.21)	5 (25.00)	6 (31.58)	
Symbicort RapihalerR	1 (2.56)	0 (0.00)	1 (5.26)	
Family History of Asthma	27 (69.23)	16 (80.00)	11 (57.89)	0.176
Family History of Allergies/Atopy	19 (48.72)	14 (70.00)	5 (26.32)	0.010 *
Smoking Status				
Non-Smoker	38 (97.44)	20 (100.00)	18 (94.74)	0.487
Previous Smoker	1 (2.56)	0 (0.00)	1 (5.26)	
Smoker	0 (0.00)	0 (0.00)	0 (0.00)	

Note: Values are presented in frequency (percentage) unless otherwise stated.

Interestingly, there was a significant difference in the distribution between in-person and virtual attendees, with a higher percentage of in-person attendees reporting a family history of allergies or atopy (70.00% compared to 26.32% in virtual attendees; p = 0.010). Most patients were non-smokers (97.44%). There was no significant difference in smoking status between in-person and virtual attendees. Thus, the demographic characteristics between in-person and virtual attendees were largely similar, with no significant differences observed in age, gender, height, weight, BMI, educational attainment, or inhaler type usage except in family history of allergies or atopy.

Table 2 shows the comparative analysis of asthma symptom control utilizing the Consensus-based GINA Symptom Control Tool following a 4-week inhaler education program. It is revealed that there are no significant differences between patients who underwent in-person inhaler technique sessions and those who participated virtually (P=0.897).

Table 2. *The comparative analysis of asthma symptom control of asthma patients using the consensus-based GINA symptom control tool after 4-week inhaler education, n=39*

Asthma Symptom Control	In-Person Inhaler Technique n = 20	Virtual Inhaler Technique n = 19	P-Value [1]
Baseline	2.00 (0.25)	2.00 (0.00)	0.238
After 1 Week	2.00 (1.00)	2.00 (0.00)	0.747
After 2 Weeks	2.00 (1.00)	2.00 (1.00)	0.930
After 3 Weeks	2.00 (1.00)	2.00 (1.00)	0.621
After 4 Weeks	1.00 (1.00)	1.00 (1.00)	0.897
P-Value 2	0.373	0.203	

*Note: Values are presented in median (interquartile range); Code: 3 – Uncontrolled, 2 – Partly Controlled, and 1 – Controlled; * Significant at 0.05 using [1]Mann-Whitney U (Wilcoxon rank-sum) test and using [2]Friedman test for repeated-measures.*

Table 3. *The comparative analysis of medication adherence of asthma patients at LCP OPD in a 4-week inhaler education, n=39*

Medication Adherence	In-Person Inhaler Technique n = 20	Virtual Inhaler Technique n = 19	P-Value [1]
Baseline	1.00 (1.00)	2.00 (2.00)	0.063
After 1 Week	1.00 (1.00)	1.00 (1.50)	0.012 *
After 2 Weeks	0.00 (1.00)	1.00 (1.50)	0.013 *
After 3 Weeks	0.00 (0.00)	1.00 (1.00)	0.004 *
After 4 Weeks	0.00 (0.00)	0.00 (1.00)	0.032 *
P-Value 2	<0.001 *	<0.001 *	

*Note: Values are presented in median (interquartile range); 0 indicates adherence and >0 indicates non-adherence; * Significant at 0.05 using [1]Mann-Whitney U (Wilcoxon rank-sum) test and using [2]Friedman test for repeated-measure.*

Table 3 shows the comparative analysis of medication adherence among asthma patients undergoing a 4-week inhaler education program. The analysis unveiled significant differences between in-person and virtual inhaler techniques. In-person inhaler technique sessions consistently resulted in significantly lower scores in the adherence questionnaire indicating better adherence compared to virtual sessions throughout the duration of the program (P=0.032). This suggests that in-person inhaler education may be more effective in promoting medication adherence among asthma patients. However, it is essential to note that both groups showed improvements in adherence over time, albeit with differences favoring the in-person approach (P<0.001).

Table 4. *The comparative analysis of correct technique retention of asthma patients at LCP OPD in a 4-week inhaler education, n=39*

Correct Technique Retention	In-Person Inhaler Technique n = 20	Virtual Inhaler Technique n = 19	P-Value [1]
Baseline	2.00 (1.00)	2.00 (1.00)	0.696
After 1 Week	1.00 (1.00)	1.00 (1.00)	0.919
After 2 Weeks	1.00 (0.00)	1.00 (0.00)	0.979
After 3 Weeks	1.00 (0.00)	1.00 (0.00)	0.992
After 4 Weeks	1.00 (0.00)	1.00 (0.00)	0.992
P-Value 2	0.003 *	0.001 *	

*Note: Values are presented in median (interquartile range); lower scores are better. * Significant at 0.05 using [1]Mann-Whitney U (Wilcoxon rank-sum) test and using [2]Friedman test for repeated-measures.*

Table 4 shows comparative analysis of correct technique retention among asthma patients participating in a 4-week inhaler education program. The analysis revealed consistent and comparable outcomes between in-person and virtual inhaler techniques. Throughout the study period, both groups demonstrated significant improvement in median scores for correct technique retention, with no significant differences observed between the in-person and virtual sessions at any time point. This suggests that both modes of delivery were equally effective in maintaining correct inhaler technique among the participants. These findings underscore the feasibility and efficacy of virtual inhaler education programs, providing a viable alternative to traditional in-person sessions for ensuring proper technique retention in asthma management.

DISCUSSION

Education on inhaler technique is critical for effective asthma treatment. However, traditionally used face-to-face education is time consuming and relatively costly. Virtual inhaler technique education is non-inferior to in-person education in terms of cognitive learning and knowledge of asthmatic patients, improvement in inhaler techniques, and asthma control.[11]

In-person and virtual educational interventions yielded comparable results in enhancing asthma symptom control (Table 2). Initially, patients were categorized as partly controlled. After 4 week-period of inhaler education, asthma symptom control scores improved. However, it was not statistically significant for both groups with a P value-0.373 for in-person inhaler group and P value-0.203 for virtual inhaler group after 4 weeks (Table 2).

Over the course of the study, from baseline to the end of 4 weeks, median symptom control scores remained consistent within each group, indicating stable asthma management outcomes. These findings suggest that in-person and virtual educational interventions yielded comparable results in enhancing asthma symptom control. This highlights the potential effectiveness and feasibility of virtual healthcare delivery in providing education and support for asthma management, particularly in contexts where in-person interactions may be limited. Virtual inhaler education can be an alternative to in-person inhaler education in providing proper learning to acquire skills and knowledge in correct technique retention and in promoting inhaler adherence among asthma patients.

It was reported that medication adherence is a major problem in asthma control with reported nonadherence rates of 30-70% hence improvement in patient adherence to medication may result to good or excellent asthma control lowering exacerbation risks thereby improving the quality of life of asthma patients.[12] In this study, it was found out that patients who attended the in-person inhaler education are more adherent in using their inhalers than those who had the virtual inhaler education in a 4-week observational period (p=0.032) (Table 3). In general, major reasons of non-adherence is the cost of the inhaler devices. Patients reported that they tend to minimize using the inhaler to make it last longer. They also tend to use the inhaler less than the doctor prescribes when they have no symptoms. Some also verbalized that due to their work schedules, they tend to forget to use their inhalers. However, non-adherence on the virtual group may be due to misunderstanding of the instructions and complacency that they already know the technique because they already had the video material. Also, during the virtual inhaler education, there is a limited personal interaction between the clinician and the patient hence the patient may have fair supervision and limited time to ask questions to clarify steps. Another reason is the access to the internet, some patients had faulty internet connections that may contribute to lesser acquisition of knowledge regarding inhaler education. Indeed, medication adherence can significantly lower the risk of exacerbation which is reflective in this study because there was a stability in the asthma severity status exemplified by the GINA symptom control assessment tool (Table 2) and good adherence is associated with lower risk of severe asthma exacerbations but they recommended standardized methodology to assess the adherence and exacerbations and consider inhaler competence.[13]

In this study, there were 4 different types of inhalers used Salmeterol/Fluticasone metered-dose-inhaler and Budesonide/Formoterol rapihaler, Budesonide/Formoterol turbuhaler and Salmeterol/Fluticasone diskus according to patient's medication and preference. Most of the critical

errors identified were failure to do the tight sealing of the lips, failure to breath out gently to empty the lungs, and failure to hold breath for 5–10 seconds. However, the patients had improvement in the correct technique retention as evidenced by the lesser trials doing the teach-to-goal checklist. It was noted that during the 4-week inhaler education period, both groups exemplified improvement in the correct technique retention with a P value–0.003 for the in-person inhaler group and P value–0.001 for the virtual inhaler group. However, the two groups had no significant difference in the correct technique retention after 4 weeks (P=0.992) (Table 4). Hence, virtual inhaler education is non-inferior to in-person inhaler education in terms of delivering correct technique retention among asthma patients. The identified errors in the teach to goal checklist were also the critical errors identified in a study done by Price et al. (2013) wherein they identified common errors and barriers in inhaler competence among asthma patients.[14] They suggested technological innovation and educational interventions including improving healthcare professional and patient inhaler knowledge and skills through web-based tutorial, multimedia presentations and physical demonstrations–all involving virtual and in-person inhaler education.

CONCLUSION

Virtual inhaler education is non-inferior to in-person inhaler education in terms of asthma control and correct technique retention. However, in-person inhaler education is still more effective in promoting medication adherence among asthma patients. Indeed, virtual inhaler education can be an alternative avenue in promoting asthma care in the most convenient way possible especially for patients who have limited access to healthcare to reduce exacerbations leading to lower cost and improvement of quality of life. Increasing the study population and extending the experimental period to more than 4 weeks are recommended to further analyze the asthma symptom control, continued consistent correct technique retention and maintained adherence.

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APPENDIX

A. TEACH-TO-GOAL RETURN DEMONSTRATION CHECKLIST

a. Teach to Goal Script: Turbuhaler

Instructions:

1. Demonstrate first each step correctly (use script to guide you)
2. Then have them return demo the steps themselves, using checklist below, check for errors. (Trial 1)
3. Work on the steps with error until the patient gets it correctly
4. Return demo, using check list below, check for errors (Trial 2)
5. Fine tune the steps with errors
6. Return demo, using check list below, check for errors (Trial 3)
7. Congratulate the participant/patient

	Trial 1	Trial 2	Trial 3
1. **Unscrew and remove cover**			
2. **Check dose counter**. Your patient may be inhaling an empty device. So have them check each time.			
3. **Hold inhaler upright while twisting grip**.			
4. **Twist the grip around** (counterclockwise) and twist back until you hear a click.			
5. **Breathe out gently away from the device.** It's important not to breathe into the device as you may blow the medicine out of the device.			
6. **Put mouthpiece between teeth without biting and close lips to make a good seal.** Make sure the tongue is not blocking the mouthpiece. Hold the inhaler horizontally and tilt head a little backwards to straighten up the upper airway.			
7. **Breathe in strongly and deeply.** Remember, the dry powder will not fly on its own, your breath will have to suck it up from the device and breathe it into your lungs.			
8. **Hold breath for about 5 seconds** or as long as comfortable. This to allow the particles time to settle and deposit.			
9. **While holding breath, remove inhaler from mouth**.			
10. **Breathe out gently away from the inhaler**. Replace cover			

b. Teach to Goal Script: Diskus

Instructions:

1. Demonstrate first each step correctly (use script to guide you)
2. Then have them return demo the steps themselves, using checklist below, check for errors. (Trial 1)
3. Work on the steps with error until the patient gets it correctly
4. Return demo, using check list below, check for errors (Trial 2)
5. Fine tune the steps with errors
6. Return demo, using check list below, check for errors (Trial 3)
7. Congratulate the participant/patient

	Trial 1	Trial 2	Trial 3
1. **Check dose counter**. Your patient may be inhaling an empty device. So have them check each time			
2. **Open cover using thumb grip**			
3. **Hold inhaler horizontally, load dose by sliding lever until it clicks.**			
4. **Breathe out gently away from the device.** It's important not to breathe into the device as you may blow the medicine out of the device.			
5. **Put mouthpiece between teeth without biting and close lips to make a good seal.** Make sure the tongue is not blocking the mouthpiece. Hold the inhaler horizontally and tilt head a little backwards to straighten up the upper airway.			
6. **Breathe in strongly and deeply.** Remember, the dry powder will not fly on its own, your breath will have to suck it up from the device and breathe it into your lungs.			
7. **Hold breath for about 5 seconds** or as long as comfortable. This to allow the particles time to settle and deposit.			
8. **While holding breath, remove inhaler from mouth**			
9. **Breathe out gently away from the inhaler**.			
10. Close cover to click shut.			

c. Teach to Goal Script: pMDI

Instructions:

1. Demonstrate first each step correctly (use script to guide you)
2. Then have them return demo the steps themselves, using checklist below, check for errors. (Trial 1)
3. Work on the steps with error until the patient gets it correctly
4. Return demo, using check list below, check for errors (Trial 2)
5. Fine tune the steps with errors
6. Return demo, using check list below, check for errors (Trial 3)
7. Congratulate the participant/patient

	Trial 1	Trial 2	Trial 3
1. **Remove cover** – That is a no brainer. But it can happen.			
2. **Check dose counter** (if applicable) You may be inhaling an empty pMDI. So, make sure you check the dose counter each time.			
3. **Hold inhaler upright and shake well**. The inhaler contents are a mixture of the medicine and a propellent. You have to shake it to make sure you get the right amount of each. Otherwise, you may get too much or too little of the medicine. So, shake it vigorously about 10 times.			
4. **Breathe out gently away from the device.** It's important not to breathe out too forcefully or empty the lungs completely as it may cause airway collapse when the patient breathes in			
5. **Put mouthpiece between teeth without biting and close lips to make a good seal.** Make sure the tongue is not blocking the mouthpiece. Make sure that the medicine will not escape from your lips. Tilt head a little backwards to straighten up the upper airway.			
6. **Start breathing in slowly through the mouth and at the same time press down firmly on the canister.** Getting the timing right is important. If you press too late, your breath will not contain any medicine. If you press too early, before you start breathing, then you will just lose the medicine in the air.			
7. **Keep breathing on slowly and deeply**. Remember, the particles of the pMDI spray have its own speed. You only need to guide them into your breath so that the particles can penetrate deeply into the lungs. Otherwise, if you breathe too fast, then the particles will just impact in your throat.			
8. **Hold breath for about 5 seconds** or as long as comfortable. This to allow the particles time settle and deposit.			
9. **While holding breath, remove inhaler from mouth**.			
10. **Breathe out gently away from the inhaler**. **Replace cover.**			

d. Teach to Goal Script: Rapihaler

Instructions:

1. Demonstrate first each step correctly (use script to guide you)
2. Then have them return demo the steps themselves, using checklist below, check for errors. (Trial 1)
3. Work on the steps with error until the patient gets it correctly
4. Return demo, using check list below, check for errors (Trial 2)
5. Fine tune the steps with errors
6. Return demo, using check list below, check for errors (Trial 3)
7. Congratulate the participant/patient

	Trial 1	Trial 2	Trial 3
1. **Check dose counter**. Your patient may be inhaling an empty device. So have them check each time. **Remove cover.**			
2. **Shake the device.**			
3. **Breathe out gently away from the device.** It's important not to breathe into the device as you may blow the medicine out of the device.			
4. **Seal your lips around the mouthpiece.** Make sure the tongue is not blocking the mouthpiece. Hold the inhaler horizontally and tilt head a little backwards to straighten up the upper airway.			
5. **Inhale slowly and deeply.**			
6. **Hold breath for 5-10 seconds.**			
7. **Exhale gently away from the device.**			
8. **Close the device.**			
9. **Gargle after use.**			

B. Inhaler Adherence Questionnaire:

- Have you at times been careless about using your inhaler?
- Have you ever forgotten to use your inhaler?
- Have you ever stopped using your inhaler because you felt better?
- Have you ever stopped using your inhaler because you felt worse?
- Have you ever used your inhaler less than the doctor prescribed because you felt better?
- Have you ever used your inhaler more than the doctor prescribed because you felt you were having an attack?

C. GINA symptom control tool

Box 2-2. GINA assessment of asthma control in adults, adolescents and children 6–11 years

A. Asthma symptom control		Level of asthma symptom control		
In the past 4 weeks, has the patient had:		**Well controlled**	**Partly controlled**	**Uncontrolled**
• Daytime asthma symptoms more than twice/week?	Yes☐ No☐	None of these	1–2 of these	3–4 of these
• Any night waking due to asthma?	Yes☐ No☐			
• SABA reliever for symptoms more than twice/week?*	Yes☐ No☐			
• Any activity limitation due to asthma?	Yes☐ No☐			

Legend: SABA, short-acting beta agonist

D. INFORMED CONSENT

Patient Information and Informed Consent Form
(ENGLISH VERSION)

You are being invited to participate voluntarily in the study entitled Comparison of the Efficacy of In-person vs. Virtual Inhaler Education in Terms of Adherence and Inhaler Technique Among Asthma OPD Patients: Randomized Controlled Trial under the supervision of Dr. Diego A. Estigoy and Dr. Domina Flor L. Gamboa.

Before you agree to join in this study, you need to know the risks and benefits so you can make an informed decision. This process is known as "informed consent".

This consent form tells you about the study that you may wish to join. Please read the information carefully and discuss it with anyone you want. This may include a friend or a relative. If you have questions, please ask the Study Doctor or study staff to answer them.

The objective of the study is to compare the efficacy of in-person vs. virtual inhaler education in terms of medication adherence and inhaler technique retention among asthmatic patients seen in the LCP OPD.
The number of study participants is 42.

The duration of your participation in the study will be 4 weeks (28 days).

In this study you will either be in the virtual inhaler education group or in the in-person inhaler education group. You have an "equal" or 50 % chance (like flipping a coin or randomizing electronically) of being in the two groups.

Your responsibilities as a study subject includes:

1. Watch 1-2 minute-long videos showing the proper use of the inhalers if you will be assigned to the virtual group.

2. Attend and listen to the researcher who will teach the proper way of using the inhalers if you will be assigned to the in-person group.

3. Answer the adherence questionnaires that will be provided by the researchers. This is composed of six validated questions that will assess your adherence.

The study will be divided into two phases and the following phases will involve:

1. The pre-experimental phase or the baseline phase and will involve filling up of the information of the participants, history taking, recording the weight and height of study participants, and assessing the asthma control through the GINA (Global Initiative for Asthma) symptom control tool.

2. The experimental phase will cover a period of 4 weeks (28 days) wherein the study participants have already been randomly assigned into virtual and in-person groups. The virtual group will be given 1-2 minute-long videos showing the proper use of the inhalers. Whereas the in-person group will be taught by the same researcher in a one-on-one session. Then, a return demonstration will be done by the study participants for both groups.

The researchers may remove you from this study for any justified reason according to the protocol. Examples why you may have to stop some or all study-related activities are:

1. Staying in the study would be harmful.
2. You fail to follow up.
3. You fail to follow instructions.
4. You become pregnant.
5. The study is cancelled.

You may withdraw your consent from participation in this study at any time. It is important that you inform the researchers in writing. The researchers will continue to retain and use any research results that have already been collected for the study evaluation. No further study-related activities will take place. The choice to withdraw from research participation will not affect your medical care.

There are no risks in the study. The only possible inconvenience that the researchers foresee is possible transport inconvenience. You will be given any new information that may affect your willingness to start or continue in the study.

The benefits of participating in this study includes the possible improvement on the medication adherence and inhaler technique that may subsequently improve your asthma control.

There will be no monetary costs to you for participating in this study. You will not be charged for any amount for tests and procedures performed solely for research purposes. However, you will be given free snacks and inhalers during visits as compensation in participating in this study.

It is important that you follow carefully all the instructions given by the researchers regarding this study. If you become ill or are physically injured as a result of participation in this study, please contact the researchers right away to be taken care of.

Unless required by law, your name will not be disclosed outside the research clinic. Your name will be available only to the following people or agencies: the researchers and staff; and authorized representatives of the researchers and ethics committees. While participating in this study, the researchers will replace your name with a special code that identifies you.

Your participation in this study is voluntary and you may cancel this consent at any time and without any reason. If you do so, your participation in the study will end and the study staff will stop collecting information from you.

You have the right to review your Study Information and medical records and request changes to the Study Information if it is not correct. However, please note that during the study, access to Study Information may be limited if it weakens the integrity of the research. You may have access to the Study Information held by the researchers at the end of the study. Data and results of the study will be published and will be available for academic purposes.

You can call or ask questions anytime regarding this study. The contact person for further information or for inquiries are Dr. Diego Estigoy, 09286668973, and Dr. Domina Flor L. Gamboa, 09150175587.

This study has been approved for implementation by the Lung Center of the Philippines Institutional Ethics Review Board (LCPIERB). If you have questions related to your rights as a research subject, please contact LCPIERB.

Email: ierb@lcp.gov.ph
Telephone No.: (02) 8924-6101 local 4047/4048

I have read this document/had its contents explained to me. I understand the purpose of this study and what will happen to me in this study. I do freely give my consent to join in this study, as described to me in this document. I understand that I will receive a copy of this document as signed below.

By signing this consent form, I authorize the use, access, and sharing of my personal medical information as described in the section "Confidentiality and Authorization to collect, use and disclose Personal Medical Information". This consent is valid unless and until I revoke it.

Patient	Signature	Date
Legally authorized representative	Signature	Date
Principal Investigator	Signature	Date
Name of presenter of the document	Signature	Date

Impormasyon Sa Pasyente At Dokumento Ng Pagsang-Ayon

(TAGALOG VERSION)

Ikaw ay inaanyayahan na kusang loob na lumahok sa pananaliksik na pinamagatang Comparison of the Efficacy of In-person vs. Virtual Inhaler Education in Terms of Adherence and Inhaler Technique Among Asthma OPD Patients: Randomized Controlled Trial under the supervision of Dr. Diego A. Estigoy and Dr. Domina Flor L. Gamboa.

Bago po kayo pumayag na sumali sa pag-aaral na ito, kailangan po ninyong malaman ang mga panganib at mga benepisyo para kayo ay makagawa ng isang may kaalamang desisyon. Ang prosesong ito ay kilala bilang "may kaalamang pahintulot".

Ang kasulatan ng pahintulot na ito ay magsasabi sa inyo tungkol sa pag-aaral na maaaring nais ninyong salihan. Pakibasa pong mabuti ang impormasyon at pag-usapan ninyo ng sinuman na gusto ninyo. Maaari pong kabilang dito ang isang kaibigan o isang kamag-anak. Kung mayroon po kayong mga katanungan mangyaring hilingin sa Doktor ng Pag-aaral o tauhan ng pag-aaral na sagutin ang mga ito.

Ang layunin ng pananaliksik ay Masuri and bisa ng Virtual Asthma Inhaler Education kung ito ay inihambing sa In-person Inhaler Education sa mga Asthmatic na pasyente sa OPD.

Ang Bilang ng kasali sa pagaaral na ito ay 42.

Ang iyong paglahok sa pagaaral na ito ay tatagal ng apat na lingo (28 na araw).

Sa pag-aaral na ito kayo po ay maaring makalahok sa virtual group o sa in-person group. Mayroon po kayong "pantay" o 50% tsansa (tulad ng pagpitik ng barya) na mapasali sa magkabilang grupo.

Sa pag-aral na ito. kayo po ay inaasahan na:

1. Manood ng mga videos na may habang isa hanggang dalawang minuto kung saan ay mapapanood ang tamang paggamit ng mga inhalers.
2. Makinig sa doktor na magtuturo ng tamang paraan kung paano gamitin ang inhalers.
3. Sumagot ng "adherence questionnaires" na ibibigay ng mga mananaliksik.

Ang Doktor ng Pag-aaral ay maaari po kayong tanggalin mula sa pag-aaral na ito sa anumang makatwirang dahilan ayon sa protokol.

Mga halimbawa kung bakit maaaring kailangan ninyong itigil ang ilan o lahat ng mga gawaing may-kaugnayan sa pag-aaral:

1. Ang pananatili sa pag-aaral ay maaaring makasama.

2. Hindi po kayo nakabalik sa follow up.

3. Nabigo po kayong sundin ang mga tagubilin.

4. Kayo po ay nabuntis.

5. Ang pag-aaral ay nakansela.

Maari ninyo pong bawiin anginyong pahintulot mula sa partisipasyon sa pag-aaral na ito. Mahalaga po na ipaalam ninyo ito sa inyong Doktor ng Pag-aaral sa pamamagitan ng sulat. Ang inyong doktor ay patuloy na itatago at gagamitin ang anumang mga resulta ng pananaliksik na nakolekta na para pagpasiyahan ang pag-aaral. Wala nang karagdagang mga gawain na may kaugnayan sa pag-aaral ang magaganap. Ang kagustuhang bumitiw mula sa partisipasyon sa pananaliksik ay hindi makaka-apekto sa inyong medikal na pangangalaga.

Walang mga panganib ang umuugnay sa partisipasyon sa pag-aaral na ito.

Ang iyong pakinabang sa pagsali sa pagaaral na ito ay ang posibleng mapabuti ang iyong paggamit ng inhaler na magdudulot ng mabisang pagkontrol sa iyong asthma.

Walang magiging gastos na pera sa inyo sa pakikilahok sa pag-aaral na ito. Hindi po kayo sisingilin para sa (mga) inaaral na gamot o anumang mga pagsubok at mga pamamaraang isinagawa para lamang sa mga layunin ng pananaliksik. Kayo po ay bibigyan ng libreng “snacks” at inhalers sa kada follow up ninyo sa buong tagal ng pag-aaral.

Mahalaga na maingat ninyong sundin lahat ng mga tagubiling ibinibigay ng Doktor ng Pag-aaral at ng kanyang tauhan tungkol sa pag-aaral na ito. Kung kayo ay magkasakit o pisikal na mapinsala bilang resulta ng partisipasyon sa pag-aaral na ito, paki-kontak kaagad ang Doktor ng Pag-aaral upang malapatan ng kaukulang atensiyon.

Maliban kung kinakailangan ng batas, ang inyong pangalan ay hindi ibubunyag sa labas ng klinika ng pananaliksik. Ang inyong pangalan ay makukuha lamang ng sumusunod na mga tao o mga ahensya: ng Doktor ng Pag-aaral at ng tauhan; at awtorisadong mga kinatawan ng Doktor ng Pag-aaral; ethics committees o ng mga inspektor ng awtoridad na pangkalusugan,Habang kasali sa pag-aaral na ito, papalitan ng Doktor ng Pag-aaral ang inyong pangalan ng isang espesyal na pantukoy na kikilala sa inyo.

Ang inyong partisipasyon sa pag-aaral na ito ay kusang loob at maaari ninyong kanselahin ang inyong pahintulot sa anumang oras at nang walang anumang dahilan. Kung gawin nyo ito, ang inyong partisipasyon sa pag-aaral ay magtatapos at ang tauhan ng pag-aaral ay titigil sa pagkolekta ng impormasyon mula sa inyo.

May karapatan kayong pagbalik-aralan ang inyong Impormasyon ng Pag-aaral at mga medikal na tala at humiling ng mga pagbabago sa Impormasyon ng Pag-aaral kung ito ay hindi tama. Gayunpaman, pakitandaan na sa panahon ng pag-aaral, ang pagtingin sa Impormasyon ng Pag-aaral ay maaaring limitado kung ito ay nagpapahina sa integridad ng pananaliksik. Maaari ninyong matingnan ang Impormasyon ng Pag-aaral na hawak ng Doktor ng Pag-aaral sa katapusan ng pag-aaral. Ang mga datos ng pag-aaral na ito ay gagamitin at mailalathala para sa mga layuning pang-akademiko.

Maaari kang magtanong ng kahit anong oras hinggil sa pag-aaral na ito. Ang tatawagan at kakausapin ay si are Dr. Diego Estigoy, 09286668973, at Dr. Domina Flor L. Gamboa, 09150175587.

Ang pag-aaral na ito ay inaprubahan ng Lung Center of the Philippines Institutional Ethics Review Board (LCPIERB). Kung mayroon kayong mga katanungan kaugnay sa inyong mga karapatan bilang isang kalahok sa pananaliksik, paki-kontak po ang LCPIERB:

Email: ierb@lcp.gov.ph
Telephone No.: (02) 8924-6101 local 4047/4048

Nabasa ko ang dokumentong ito/naipaliwanag sa akin ang mga nilalaman nito. Naiintindihan ko ang layunin nitong pag-aaral at kung ano ang mangyayari sa akin sa pag-aaral na ito. Malaya kong ibinibigay

ang aking pahintulot na sumalisa pag-aaral na ito, gaya ng inilarawan sa akin sa dokumentong ito. Naiintindihan ko na tatanggap ako ng kopya ng dokumentong ito na pinirmahan sa ibaba.

Sa pagpirma sa kasulatan ng pahintulot na ito, pinahihintulutan ko ang paggamit, pagtingin, at pagbabahagi ng aking personal na medical na impormasyon gaya ng inilarawan sa seksyong “Pagiging Lihim at Pahintulot na makolekta, magamit at maibunyagang Personal na Medikal na Impormasyon”. Ang pahintulot na ito ay may bisa maliban na lang at hanggang sa bawiin ko ito.

_____

Pangalan ng Pasyente/Petsa
(isatitik ang pangalan)

_____

Pangalan ng Kinatawang legal/Petsa
(legal na awtorisadong gumawa bilang personal nakinatawan sa pagpirma para kay [pangalan ng pasyente])

(isatitik ang pangalan)

_____

Pangalan ng Imbestigador/Petsa
(isatitik ang pangalan)

_____

Pangalan ng nagpahayag/Petsa
(nagpahayag/nagpaliwanag ng dokumento)
(isatitik ang pangalan)