Original Article :

Understanding Knowledge, Practices, and Barriers in Metered Dose Inhaler Use Among Sri Lankan Patients with Bronchial Asthma and Chronic Obstructive Pulmonary Disease.

VMIP Siriwardhana[1], WMDP Walisundara[1], APMD Ushani[1], HMRB Dissanayaka[1], KA Sriyani[1], and FMMT Marikar[2]

1. Department of Nursing, Faculty of Health Science, The Open University of Sri Lanka

2. Staff Development Centre, General Sir John Kotelawala Defence University, Sri Lanka

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Corresponding author:
FMMT Marikar
Staff Development Centre, General Sir John Kotelawala Defence University, Sri Lanka
Tel: +94-11-2622502 - Fax: +94-11-2638460 - faiz@kdu.ac.lk

Abstract

Background and Aims:
Despite declining mortality rates, asthma and chronic obstructive pulmonary disease (COPD) continue to pose significant public health challenges with persistently high morbidity rates. One prominent contributing factor is the inadequate use of prescription metered dose inhalers (MDIs) by patients, leading to insufficient dosing and suboptimal disease control. Thus, it is crucial to assess patients' knowledge, practices, and barriers concerning MDI usage.

Methods:
This descriptive convenience sampling, conducted at Polonnaruwa District General Hospital in Sri Lanka, enrolled 250 participants to investigate MDI-related behaviors. Questionnaire was used as data collection tool and sampling technique is conveniet sampling. Microsoft Excel spreadsheet and SPSS version 20 (IBM Corporation, New York, USA) software were used for statistical analysis.

Results:
The majority of participants were aged over 40, with a higher proportion of females (59%) than males (39%). Over half of them had been managing bronchial asthma and COPD for more than five years. Notably, all participants were MDI users, but 59% reported disease exacerbations occurring more than four weeks ago, with dust being the primary trigger (45%). Healthcare professionals, especially nurses and doctors, were common sources of MDI education. However, none of the participants demonstrated correct inhalation technique both before and after receiving education, raising significant concerns.

Conclusions:
This study highlights the inadequacies in MDI utilization among participants, emphasizing the urgent need for improved patient education by healthcare professionals. Addressing these knowledge and skills gaps related to MDI usage is essential for enhancing asthma and COPD management, ultimately leading to improved patient outcomes and a reduced disease burden.

Keywords:
chronic obstructive pulmonary disease, metered-dose inhalers, cross-sectional study, bronchial asthma.

Introduction

Bronchial Asthma (BA) and Chronic Obstructive Pulmonary Disease (COPD) are estimated to affect about 300 million people[1]. Metered Dose Inhaler (MDI) is most used device in daily management in BA and COPD[2]. Using the right inhaler technique helps to deliver medicines straight into the lung where it's needed. Patient's knowledge, barriers, and practices can be affected effectiveness of inhalation therapy[3].

BA and COPD are common diseases of the air ways and lungs that have a major impact on the health of the population[3]. BA is characterized by variable and recurring symptoms, reversible air flow obstruction and bronchospasm[4]. COPD is a lung disease characterized by chronic obstruction of lung air flow that interferes with normal breathing and is not fully reversible[4]. MDI is a device design to deliver a measured dose of and inhale drug. It usually consists of a canister aerosol spray, mist, or find powder that releases specific dose each time it is pushed against dispensing valve[5]. Two- thirds of United Status adults with COPD and BA are making multiple errors in their MDIs, according to new research[6]. When patients don't get enough training on how to use inhaler devices, they have less control of COPD. That leads to more health care consumption and cost[7].

According to the 2017 National Asthma Education and Prevention Program of United States of America, there was between fourteen to fifteen million asthmatic patients in the United States alone[8]. While in South Africa asthma is the eighth leading contributor to the burden of disease[9].

In addition to advancement in devices for delivery of therapeutic aerosols, other advancements in the first half of the 20th century helped set the stage for the onset of the modern era of pharmaceutical aerosol delivery. The breakthrough came in the 1956 when George Madison, the president of Ricker laboratory invented the MDI using glass vial and valves designed for perfume bottles. This launched the developed of MDI now the most common device used for treating for asthma. In 1972 MDI continued to grow popularity with the introduction of several important MDI products in Europe. Later 1982 MDIs were marked in the United[10].

According to the latest WHO data published in 2017 asthma death in Sri Lanka reached 7160 of total death[11]. Medical statistic unit in DGH Polonnaruwa has estimated total attendance of respiratory disease clinic 8959 of patients of which 607 COPD and 679 BA in 2017. The proper technique of use of MDI is important to get maximum therapeutic effect. Hence

this study will explain the level of knowledge, practices of using MDI, and to identify the barriers for using MDI in patients of BA and COPD in District General Hospital Polonnaruwa, Sri Lanka. Examining the frequency and effects of co-occurring asthma BA and COPD in Sri Lankan populations, with particular attention to healthcare inequalities that impact diagnosis, treatment, and patient outcomes due to cultural, environmental, and other factors.

Method and Materials

The research approach, design, and process

This is a quantitative, descriptive pre-test/post-test research study. Similar intstrument was used to follow up and post test as well. This study was conducted in respiratory disease clinic (RDC) in District General Hospital (DGH), Polonnaruwa, Sri Lanka.

Patients suffering from BA and COPD under the age group of 18- 65 years who used MDIs were involved in this study. Participants were conveniently assessed, and 250 patients were involved in this study. Data were collected by giving self-administered questionnaire to answer sixteen questions regarding inhaler techniques and the disease condition of BA and COPD and the time allocated for the questionnaire was 45 minutes. Patient's practices of the MDIs were assessed by the check list of ten steps regarding inhalation techniques in the two ways such as pre-education and post-education. The researchers indicated a check mark (√) if the participants correctly demonstrated the steps, and the researchers indicated the (×) marks if the participants demonstrated the steps incorrectly. Consult experts in the field of respiratory health to assess the content validity of the questionnaire. Content validity was ensuring that the questionnaire covers all relevant aspects of inhaler techniques, BA, and COPD. The validity of the translation was independently assessed by two observers competent in both languages. Relevant demographic data, awareness and perceptions on the BA and COPD in the area prevention and treatment were assessed via the questionnaire. Reliability was measured by Test-retest reliability which assess the stability of the questionnaire over time by administering it to the same participants on two occasions and measuring the correlation between the results. Furthermore generalization was measured by statistical analysis which uses appropriate statistical analyses to determine the generalizability of the findings to the broader population. After collecting the data, the researchers thank for all the participants regarding their participation for the research study. Also, education ses-

sion was planned for all the participants according to the findings of our research study. Collected data was handled only by the researcher and supervisors of the study to maintain privacy. This study was done in the year of 2021. The population of this study was all adults BA and COPD patients (age 18-65 years) who attending to RDC at DGH Polonnaruwa, Sri Lanka during our study period. The database of adult BA and COPD patients were 300 at the time of the study. The sample was selected by using convenience sampling method. In this technique, each member of the population has an equal chance of being selected in the sample. The entire process of sampling done in a single step with each subject selected independently of each member of the population. Study was collected data from 250 BA and COPD patients according to this formula.

$N=z(1-\alpha/2)2p(1-p)/d2$

N= sample size, z= confidence level (95%), p=confidence interval (25%). d=precision (3.8%). $N=1.96\times0.25\times (1-0.25)/0.0382$, N=250 (calculated sample size)

Criteria and reasons for selection of the sample

All adults BA and COPD patients who were 18 years to 65 years of age attending to the RDC in DGH Polonnaruwa, Sri Lanka during the study period was included in the study. The exclusive criteria for the study were following, acute asthmatic patients who were very ill, patients who were mentally incompetent and patients who were not giving consent to take part in the study. Inclusion criteria was Age Range inclusion adults aged 18 to 65 due to adults are more likely to be affected by both COPD and BA. Diagnosis individuals diagnosed with both COPD and BA due to focus on the population of interest with dual diagnoses. Exclusion criteria was considered as Age Range: exclusion individuals below the age of 18 due to focus on the adult population where COPD and BA prevalence is higher. Pregnancy exclusion pregnant individuals due to pregnancy can impact respiratory conditions, introducing confounding variables.Severe Cognitive Impairment exclusion individuals with severe cognitive impairmen due to ensuring participants can provide reliable information and consent.

Ethical considerations

Following ethical approval from research committee of Sri Jayewardenepura hospital (ERC FMS/SJP/2022/003), the approval letter with consent form introduce, the study purpose was distributed to ward sisters and sister in charge of all wards, to inform their nurses about the

study. One week after notification, we administered the questionnaires to all those who had consented to participate in the study. Furthermore, the research proposal was submitted to the Ethics Review Committee through the director of District General Hospital Polonnaruwa, Sri Lanka for ethical approval. The permission of data collection was taken after ethics approved and then by the director of District General Hospital, Polonnaruwa, Sri Lanka. Participants were invited to participate voluntary for the study. They were informed about the aims, methods, benefits, and possible discomforts verbally and through providing an information sheet. Written informed Consent was obtained from each participant before inclusion in the study. Confidentiality and anonymity were ensured by using an identification number for each participant. Data was handled only by the researcher and supervisors of the study to maintain privacy. Collected data was kept under lock and key for five years confidentiality. Voluntary participation encouraged by providing respect to human dignity.

Data analysis

Data analysis is a process of inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, informing conclusions, and supporting decision making. Data was analyzed using Microsoft excel spread sheet and statistical package for social sciences (SPSS IBM Corporation, New York, USA) version 20 software's and presented as frequency tables and figures. The data was stored under lock and key to protect the patient's privacy's demographic characteristics versus questions on knowledge and practice on the use of MDIs was analyzed. The steps of inhalation technique of use of MDIs were also analyzed. Data were compared at two time points, pre-education, and post-education.

Results

Demographic characteristics of the participants

Age of the participants

The sample size for this study was 250 participants and ninety-three-point six percent's (93.6%) of the participants were above the age of 40 years, which is 234/250. This was followed by the age group 30-39 years that made up 4.8%. The age group with the least number of participants was those between the ages of 21-29 years (1.6%). There were no participants under the age group of below 20 years (Table 1).

Table 1: Age of the participants (n= 250)

Age (Years)	Frequency	Percentage (%)
<20	None	0.0%
21-29	04	1.6%
30-39	12	4.8%
>40	234	93.6%
Total	250	100%

Highest educational level of the participants

Almost 155 participants (62%) completed primary school as the highest level of education, followed by secondary level of education completed 56 participants (22.4%). Only one participant (0.4%) completed tertiary education and thirty-eight participants (15.2%) indicated that they did not attend any form of schooling.

Asthma and COPD situation of participants

Most of the participants 134/250, 53.6% reported to have had their disease (BA and COPD) more than five years and 116 participants (46.4%) had the disease for less than five years. When the participants were asked about their last disease attacks, the responses were as follows: 149(59.6%) indicated that their last disease attacks were more than four (4) weeks prior to the interviews, followed by 101 (40.4%) with less than two weeks preceding the study. The remaining 6 (2.4%) had their last disease attacks between 2-4 weeks before the study (Table 2).

Table 2: Last disease attacks of participants

Last disease attacks	Frequency	Precentage(%)
<2 weeks	101	40.4
2-4 weeks	06	2.4
>4 weeks	149	59.6
Total	250	100

Knowledge about asthma and COPD - Triggering factors

The terms of triggering factors, the participants identified one or more factors as follows: Dust was the most common triggering factor at 45.6% (114/250), followed by exposer to cold air (98/250) 39.2%. Physical exercise induced asthma and COPD had 26/250(10.4%). Other triggering factors for asthma and COPD mentioned by the participants were different odor of paint, perfume, and stress which accounted for 12/250(4.8%) (Figure 1).

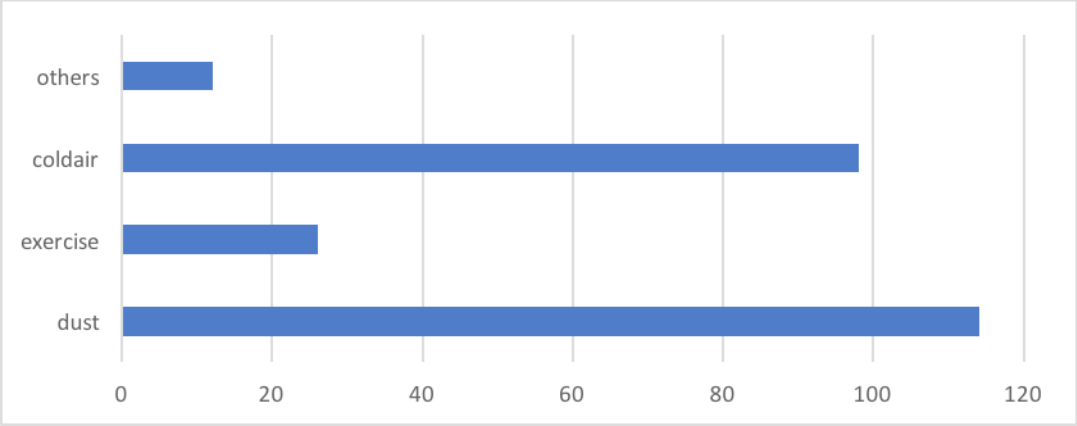

Figure 1: Triggering factors for asthma and COPD

Knowledge on MDI - Education on use of it

An overwhelming number of the participants 233/250 (93.2%) indicated that they were taught on how to use the MDI, while only 6.8%(17/250) reported that they did not get any form of education on how to use the MDI. When asked who taught them how to use the MDI, the participants indicated more than one source of information. The nurses and doctors were the frequent educators on the use of MDIs. Nurses most frequently provided information, that is, 163/250 (65.2%), followed by Doctors at 54/250 (21.6%). Twenty three participants (9.2%) were taught by pharmacists on the use of MDI. Eight participants were taught by a friend and only two participants were taught by a family member (Figure 2).

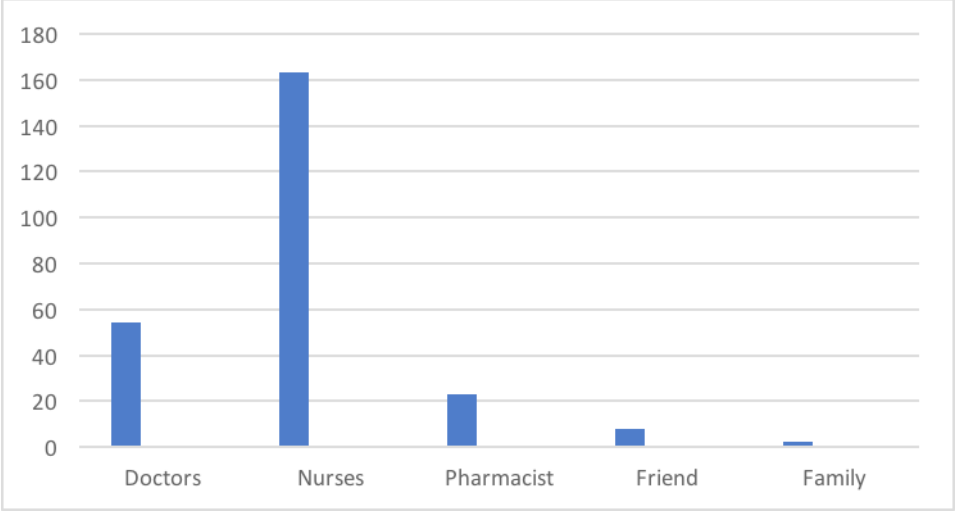

Figure 2 : Source of information on use of MDI

Brands of MDI used by participants and reason

Majority of participants did not indicated the name or type of MDI used due to poor knowledge of MDI. Also only twenty two participants (8.8%) were knew the names of the MDIs and they identified the inhalers by the colour of the container of

the inhalers. The majority of the participants 117(46.8%) indicated that metered dose inhalers used to prevention of BA and COPD, while 34% participants indicated that MDIs as relivers. Thirty five participants (14%) had unknown purpose and thirteen participants indicated other reason for use of MDIs (Table 3).

Table 3: Reason for use of MDI

Reason for use of MDI	Frequency	Percentage(%)
Prevention of Asthma and COPD	117	46.8
Relievers	85	34
Unknown purpose	35	14
Others	13	5.2

Inhalation technique of MDI

No participants performed all the inhalation steps correctly in before and after education. The most incorrect demonstrated action of inhalation was failure to synchronize breathing with actuation. Sixty three (63%) precent of the participants had difficulty in breathing in slowly while actuating the inhaler to release one dose and continuing to breathe. This findings raises concerns as it is the single most important step of the whole inhalation technique.Other errors were; failure to breath out slowly to residual volume before actuation and not holding the breath for ten seconds after inhalation. This step was performed incorrectly by 56% of the participants. Failure to breath out slowly after holding the breath for ten seconds 64% was also one of the error of inhalation. If another puff is required, wait for at least one minute and repeate above 1-8 steps was aonther error in the inhalation technique. It was 55.6% (Figure 3 and 4)

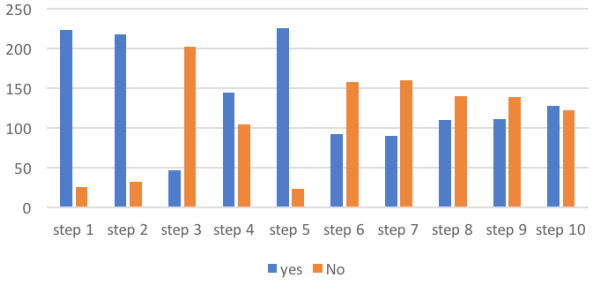

Figure 3: Inhalation technique pre- education

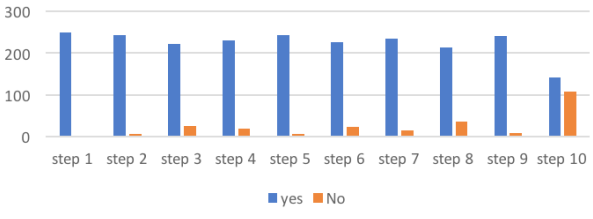

Figure 4: Inhalation technique post-education

Discussion

This chapter describes the main findings and links the literature to the findings as needed. The purpose of the discussion is to interpret and explain the meaning of the findings, considering what is already known about the problem under investigation, and to explain new insights or insights that may arise as a result of the investigation of the problem. am. The results

are discussed under the subtitle and there is a compression between the results of this study and what is currently known.

The sample size for this study was 250 participants. The survey shows that the maximum number of participants was in the group aged 40 and over (93.6%). This is because the prevalence of COPD and BA gradually increases with age. But Bhandari & Sharma. A study conducted by 2012 reported that the highest incidence of COPD was in the age group of 60-69 years[12]. The gender was 148 males and 102 females. The male / female ratio was 3: 2. Nearly 155 participants (62%) completed primary school as the highest level of education, followed by 56 participants who completed secondary school. Only one participant completed higher education. Thirty-eight participants stated that they had not participated in any form of education. The poor education level of the participants may have influenced their understanding of the basic concepts of asthma and COPD treatment, such as "leaver" and "preventive drugs".

Williams et al., 2021[13] found that reading level is the most powerful predictor of MDI technology. Their study measured patient reading comprehension and correlated patient literacy skills with asthma knowledge and MDI skills. Many patients with poor reading comprehension did not understand when to take "relief" asthma medications and did not recognize the importance of using the inhaler correctly. These patients were unable to understand the function of the various inhalers. "Preventor" and "lifter". Therefore, it is shown that literacy can be an obstacle to asthma self-management skills because these patients do not understand medical guidance[13].

The study reported that most participants (53.6%) had asthma and COPD for more than 5 years, and (46.4%) had asthma for less than 5 years. Participants (53.6%) had asthma and COPD for more than 5 years but lacked the knowledge and skills to use MDI. However, there was a strong association between the duration of asthma and COPD and the choice of MDI to use. That is, the choice of inhaler to use was influenced by the duration of asthma and COPD. Therefore, participants suffering from long-term asthma and COPD were even combination therapies and long-acting β2-agonists, but participants newly diagnosed with asthma and COPD, or suffering from COPD for some time. Most of the participants were short-lived. -Only active β2 agonist.

When I asked the participants about their last illness, the answers were: 149 (59.6%) showed that the last illness occurred more than 4 weeks before the inter-

view and 101 occurred less than 2 weeks before the study. The remaining 6 had a last seizure 2-4 weeks before the study. Therefore, participants were relatively controlled in terms of illness. This finding contradicts the fact that most of the participants were unable to correctly show every step of inhalation while using MDI.

With respect to triggers, participants identified one or more factors as follows: Dust was the most common trigger at 114 (45.6%), followed by 98 cold exposures (39.2%). Exercise-induced asthma and COPD were 26 (10.4%). Other triggers for asthma and COPD mentioned by participants were different odors of paints, perfumes and stress, accounting for 12 (4.8%). Reed, 200414 did not compare triggers, but, like other chronic diseases, emphasized the importance of identifying, avoiding, or controlling these factors[14].

An overwhelming number of 233 participants (93.2%) said they were taught how to use MDI, but only 17 (6.8%) reported that they were not trained on how to use MDI. Did. Nurses and doctors frequently educated on MDI and how to use nurses. The study was done by Nyachwo, 2002[15], demonstrated that nurses were frequent educators. In her study the researcher indicated that some medical practitioners assumed that pharmacists and nurses demonstrated and reviewed the use of MDI by their patients while others cited lack of time and absence of inhalers as reasons for not demonstrating how MDI should be used. Twenty-two participants (8.8%) were knowing the names of the MDIs and they identified the inhalers by the color of the container of the inhalers, except for 228(91.2%) participants did not indicate the name or type of MDI used[15].

Most of the participants 117(46.8%) indicated that MDIs used to prevention of BA and COPD, while (34%) participants indicated that MDIs as relivers. This finding raises a lot of concern as 46.8% of participants knew that inhaled corticosteroids prevented their disease. If the remaining 53.2% knew the role of inhaled corticosteroids and were to use them properly, their disease would have been controlled. Furthermore if 34% of the participants thought that inhaler was a reliver, one would assume that it was used only during an attack and not use again as prescribed.

No participant correctly performed all inhalation steps before and after the instructions. The most common mistake in this study was the lack of synchronization between breathing and performance. 63% of participants had difficulty breathing slowly because they operated the inhaler to supply the dose and continued to breathe. This discovery raises concerns as it is the most important step in the over-

all inhalation technology. This is because small doses of inhaled medicine reach the lungs, resulting in poor control of asthma and COPD.

The other mistake was not that he slowly exhaled residual air before playing and did not hold his breath for 10 seconds after inhalation. These steps were mistakenly performed by 56% of the participants. The slow lack of exhalation after holding the breath for 10 seconds at 64% was also one of the inspirational mistakes. These results are like the studies by Al-Wasil and Al-Mohaimeed 2003[16]. In their study, common mistakes were not breathing slowly to the pre-activation residual amount, not holding breath for 10 seconds after inhalation, and not synchronizing breathing. And breathing. Performance (66%). In their study, not tilting their head back was the most common mistake, but in this study, it was the fourth most common mistake (76%), even a minute if a second dose was needed. Don't wait (74%) [16].

Conclusion

This study focused primarily on knowledge, practice, and barriers to the use of MDI. Proper use of DM has proved difficult for most participants. Very few participants followed all the key steps in MDI inhalation technology. This can be enhanced by proper patient education through hands-on demonstrations, photo display, and video display of inhalation techniques. Repeated training on proper inhalation techniques can improve the effectiveness, compliance and quality of life of patients with asthma and COPD. Most of the participants lacked the knowledge and skills to use MDI effectively. Ineffective inhalation techniques appear to be a common problem, resulting in inadequate pulmonary drug release and increased morbidity from AB and COPD. All medical professionals should be obliged to teach all patients with obstructive airway disease. The nature of the disease, precautions, the need to use an inhaler, and the need to show how the inhaler is used. In addition, the patient's inhalation skills deteriorate over time, so all tests need to be evaluated by a medical professional to ensure that the correct skills are maintained. The patient information leaflet should be translated into the local language.

Limitation and Suggestions

Main limitation of this study is sample size, in this study we have selected a small sample size which doesn't reflect the total population. Hence this cannot be generalized the population which is a real drawback of the study. Shortage of time is another limitation of this study. As nurses we have limited time for data collection with

our duty shift in hospital. Lack of financial support is another limitation of this study. On some occasions, some patients did not bring their MDIs. In that time the researchers needed to purchase the MDIs for the study. The findings of the present study will help the health care providers (nurses) need to take measures to promote healthy behavior in patients with BA and COPD by improving the knowledge and thereby attitude which otherwise will increase the burden of exacerbation and complications and even death. Acute exacerbation of asthma is an emergency, and the researcher could identify from the present study that the patients are not aware many important measures to be taken during emergency.

Conflict of Interest

None

Funding

None

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