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Practical guidelines and innovation in respiratory health: production of plastic bottle spacers in Olinda, Pernambuco

Orientações práticas e inovação na saúde respiratória: confecção de espaçadores de garrafa pet em Olinda, Pernambuco

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Abstract

Inhalation therapy allows the administration of drugs directly into the airways. Thus, the devices used in this therapy are important for managing obstructive lung diseases (e.g., asthma and chronic obstructive pulmonary disease). Nowadays, different types of inhalers are used, such as nebulizers, dry powder inhalers, pressurized metered-dose inhalers, and soft-mist inhalers. Despite their particularities, they all require adequate use to ensure treatment effectiveness. From this perspective, a group of students identified the need to undertake initiatives in the city of Olinda, Pernambuco (Brazil) aimed at health education regarding the correct use of the pressurized metered-dose inhaler (commonly known as a pump), combined with the production of low-cost manual spacers.

Keywords: Chronic obstructive pulmonary disease; Health education; Spirometry; Inhalers; Inhalation therapy.

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Resumo

A terapia inalatória permite a administração de medicamentos diretamente nas vias aéreas. Dessa forma, os dispositivos utilizados nessa terapia são importantes para o manejo de doenças pulmonares obstrutivas, a exemplo da asma e da doença pulmonar obstrutiva crônica. Atualmente, são utilizados diferentes tipos de inaladores, como nebulizadores, inaladores de pó seco, inaladores pressurizados dosimetrados e inaladores de névoa suave. Apesar de suas particularidades, todos eles requerem uso adequado para garantir a eficácia do tratamento. Nessa perspectiva, um grupo de estudantes identificou a necessidade de empreender iniciativas na cidade de Olinda, Pernambuco, Brasil, voltadas à educação em saúde quanto ao uso correto do inalador pressurizado dosimetrado, popularmente conhecido como bombinha, aliado à produção de espaçadores manuais de baixo custo.

Palavras-Chave: DPOC; Educação em saúde; Espirometria; Inaladores; Terapia inalatória

INTRODUCTION

Obstructive lung diseases, such as chronic obstructive pulmonary disease (COPD) and asthma, are challenging for public health because their effective treatment relies on the adequate use of inhalers.[1] In 2023, the state of Pernambuco recorded 4,263 hospitalizations for COPD and 5,408 for asthma, highlighting the impact of these conditions on public health.[2] The inappropriate use of inhalers is strongly linked to a higher number of hospitalizations, frequent visits to emergency services, and routine use of antibiotics and oral steroids, increasing costs in the health system.[3]

The inhaler must release a high proportion of fine particles, be easy to use, and provide consistent and accurate doses to ensure effective deposition of the drug in the bronchi.[1] In addition, the most widely used inhalers include nebulizers, dry powder inhalers, pressurized metered-dose inhalers (MDI), and soft mist inhalers.[1]

Over time, inhalers underwent continuous advancements to meet the demand for more effective and easy-to-use devices. The treatment effectiveness depends on the technique of using inhalers, as the optimal distribution of the drug in the lungs improves the control of symptoms.[4] In this context, adherence and technique are influenced by the educational level and beliefs of the patient, as well as the access to drugs and the health system.[3]

During clinical practice, several factors challenge the treatment effectiveness, such as frequent errors in inhalation techniques. Therefore, guidance on correct device use and periodic reviews are essential, as errors may persist even after initial educational interventions, hindering treatment. Common errors include lack of synchronization between inhalation and device activation, difficulty maintaining the apnea time, and patients placing their tongue in front of the mouthpiece. These mistakes may reduce the amount of drug reaching the lungs.[3] In addition,

mouth hygiene after inhalation is important to avoid side effects, such as oral candidiasis.

MDIs are among the most commonly prescribed inhalers in hospitals and at home for treating lung diseases worldwide. These pressurized devices release a fixed dose of the drug in a spray form, providing better lung deposition of extra-fine particles. Although they are low-cost and easy to transport, the need for synchronization between the activation of the device and inhalation is a key disadvantage.[1]

In this sense, the attachment of a spacer to the device is crucial to improve synchronization, especially for children and older adults.[4,5] The spacer allows unidirectional flow, improving drug deposition in the lower airways and reducing side effects from heavier particles, which are retained in the spacer rather than the mouth or oropharynx.[6] Additionally, the spacer should be washed every two weeks with water and detergent, brushed with a clean brush, and thoroughly dried.[4]

The current context sets the search for affordable and efficient solutions to address public health challenges as a global priority. Therefore, the production of low-cost plastic bottle spacers offers an innovative intervention to improve respiratory treatment effectiveness and reduce exacerbations, hospitalizations, and costs to the health system. This experience report described an initiative in Olinda, Pernambuco, focused on guiding the correct use of inhalers and teaching how to create low-cost handmade spacers.

METHODS

This experience report described a university extension project performed in the city of Olinda, which focused on guiding the correct use of inhalers and the production of low-cost spacers using plastic bottles. This project aimed to expand access to respiratory health care based on the evidence and challenges presented in the literature.

Asthma is the main cause of hospitalizations due to chronic respiratory diseases in the city of Olinda, Pernambuco. Thus, instructing the population about the proper use of inhalers promotes greater adherence to treatment, enhances therapeutic efficacy, and reduces hospitalizations due to exacerbations.

The project activities were performed in two stages. The first, entitled “International Asthma Day: Asthma has no cure, but it can be controlled," occurred in May 2023 in Olinda, Pernambuco, at a multi-sports complex commonly used for social activities that benefit the local population. The responsible students and teachers, supported by a specialized medical society, provided spirometry assessments for pre-selected patients from a teaching clinic and walk-in patients. Additionally, students gave oral and practical guidance on the correct use of MDIs, conducted a workshop on creating low-cost spacers using plastic bottles, and addressed the most common doubts about respiratory diseases.

The production of low-cost spacers was taught using audiovisual resources and banners

that illustrated the following steps:

1. Separate the needed materials: two 600 ml plastic bottles; a cup with water, scissors, adhesive tape, pen, ruler, and MDI (pump);
2. Remove the caps and labels from the bottles and wash them with running water;
3. Cut the first bottle 6 cm from the bottom edge and discard the bottom;
4. Cut the second bottle 10 cm from the bottom edge and discard the bottom;
5. Boil water on the stove or in the microwave;
5. Dip the mouth of the first bottle into the cup with boiled water for about 30 seconds to expand the mouth of the bottle;
6. Carefully remove the bottle from the water and fit the nozzle onto the inhaler;
7. Fit the two bottles together at the cut end and secure them with adhesive tape.

After the workshop, instructions were provided on the adequate use of the inhaler with the homemade spacer, as well as the hygiene precautions for its maintenance. Furthermore, a brief survey was conducted to assess the prior knowledge about asthma among patients awaiting lung function tests, aiming to clarify doubts and minimize misconceptions.

The second stage of the project activities occurred in October and November 2023 at a teaching clinic in Olinda. The pulmonology outpatient clinic of the teaching clinic offered four days of free spirometry exams for patients with appropriate referrals from the responsible pulmonologist. The team of students directed the action toward the patients in the waiting room, promoting an educational session on the correct use of inhalers based on audiovisual materials and practical demonstrations.

RESULTS

The good adherence to inhalation therapy relies on the adequate inhalation technique. During the activities, we observed that even patients who had been using inhalers for a long time still had doubts about the correct technique. Based on the reaction of the patients, students noticed that most were unsure of the proper use of and unaware of the possible complications caused by poor oral hygiene.

In addition, the idea of making spacers using plastic bottles (Figure 1) was a novel concept for many patients. Although this idea was not relevant for most patients, the knowledge could be shared with others who might benefit, such as children and frail older adults.

Figure 1. Spacer made from a plastic bottle.

The audience at both activities included around 100 patients; they were receptive to learning during the activities. Thus, this initiative may have encouraged greater autonomy in managing health and disease and improved therapeutic success, as many inappropriate behaviors were identified and corrected.

FINAL CONSIDERATIONS

Given the importance of promoting respiratory health and the proper use of inhalers, the guidance provided by students and the construction of spacers from plastic bottles represents an important contribution to the local community. In addition to being a viable and accessible option, these devices offer an economical solution to support the use of inhaled drugs. The simple manufacturing process taught by the students and the wide availability of materials contributed to the positive acceptance of the initiative.

The experiences gained in developing and implementing these guidelines highlight the importance of community education in health promotion and the potential for innovation in creating accessible and effective solutions. Continuous efforts are needed to review inhalation techniques and the use of metered-dose inhalers with homemade spacers, which are essential for improving treatment efficacy and adherence. These initiatives are expected to inspire future projects and

strengthen the commitment to improving the quality of life in Olinda, Pernambuco.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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AUTHOR CONTRIBUTIONS

LSB: Conceptualization, Data curation, Visualization, and Writing-original draft. **NGLT**: Investigation, Data curation, Visualization, and Writing-original draft. **JFMLT**: Investigation, Data curation, Visualization, and Writing-original draft. **ASS**: Investigation, Data curation, Visualization, and Writing-original draft. **GCF**: Investigation, Data curation, Visualization, and Writing-original draft. **AVG**: Conceptualization, Formal analysis, Project administration, Supervision, and Writing - review and editing. **AFFO**: Conceptualization, Formal analysis, Project administration, Supervision, and Writing - review and editing. All authors approved the final version.

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