

## Are we handling used metered dose inhaler canisters safely? – A call for action to address an environmental hazard

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### Abstract

**Background:** Metered dose inhalers (MDI) are preferred treatment for asthma and chronic obstructive pulmonary disease. The used MDI canisters are to be disposed off in appropriate manner to prevent environmental pollution. In this study, the disposal methods followed by the patients were investigated.

**Methodology:** This study was conducted in out-patient setting in departments of pulmonary medicine of a tertiary care teaching hospital in south Kerala. The Any patient who was using MDI for at least past one year was enrolled into the study. Exhaustive sampling was done over a period of six months to obtain interviews of 883 patients. Age, gender and educational status of participants, disposal methods they followed for MDI canisters and the source of information for the disposal methods were enquired.

**Results:** Among the 883 patients who were interviewed, 46% were females and 54% were males and 57% were older persons (age above 60 years). All of them were using MDI for at least past one year. None of them were informed about the correct methods of disposal of used MDI canisters (recycle or incineration or plasma pyrolysis). Majority (79%) of the participants disposed them in the waste bins or into the general waste heaps, 13.7% of the participants burned them in their courtyard and 7 (0.8%) participants stored them and 3 (0.4%) used to flush down them in the toilet.

**Conclusions:** MDI canister disposal is an unaddressed environmental hazard. Take back programs need to be initiated to recycle them or at least to incinerate them safely according to Biomedical Waste Management and Handling Rules. 'Complete the Cycle' scheme in United Kingdom can be a model for a recycling project venture. Incineration is currently possible through IMAGE project (IMA Goes Eco-friendly) which is currently run in Kerala.

**Keywords:** Biomedical waste management; Metered dose inhaler; Inhalational therapy; Recycle, Take back program.

### Introduction

It was estimated that there were 37.9 million asthma patients and 55.3 million chronic obstructive pulmonary disease patients in India in 2016 [1]. The overall prevalence of COPD globally was estimated to be 10.1% [2]. Metered Dose Inhalers were developed in 1950s [3]. Currently, inhalational therapy is the preferred treatment choice for asthma and COPD [4]. Most of the patients get educated by the doctors on correct technique of using MDIs but, [5] disposal methods are seldom discussed.

In the United Kingdom (UK), about 73 million respiratory inhalers are prescribed every year [6]. Such an estimate is not available for India but, may be higher compared to UK. India is a signatory of Montreal Protocol on Substances that Deplete Ozone Layer and hence chlorofluorocarbon (CFC) containing MDI were phased out in 2008 [7]. Apart from the drug, MDIs contain dehydrated alcohol and surfactants as excipients, hydrofluoroalkanes (HFA) as propellant, related impurities and unrelated impurities such as CO, N<sub>2</sub> and O<sub>2</sub> [8]. Hence, inappropriate disposal of MDI canisters is an environmental concern. In this study, disposal methods of used MDI canisters practiced by the patients were analyzed.

### Material and Methods

This cross sectional study was conducted in out-patient setting of department of pulmonary medicine in Pushpagiri Institute of Medical Sciences and Research Centre which is tertiary care teaching hospital in Tiruvalla, Kerala. Adult

patients who were currently using metered dose inhalers for a minimum of past one year were enrolled for the study. Voluntary written informed consent was given by the study participants. Exhaustive sampling was done from April to September in 2018 and 883 patients were enrolled. A pilot tested semi structured questionnaire on disposal methods for MDI was administered by a research assistant. The correct methods for safe disposal were defined as recycling [6] or incineration/plasma pyrolysis at 1200°C [9]. The Voluntary written informed consent was taken and the confidentiality of the data is maintained. Frequency and proportions were calculated for the responses. An ethical committee approval was obtained.

### Results

Out of 883 patients, 481 (54.47%) were males and 402 (45.53%) were females; 504 (57%) were older persons (age ≥ 65 years) (Table 1). Majority (53%) of the participants had only school level education and the rest had higher education (Table 2). All were currently using MDI for at least past one year. The distribution of patients by duration of use is given in Table 3. There were 563 (63.76%) patients who were using MDI with dose counter.

None of the participants had received information from any source on methods to dispose the MDI canisters. Majority (79%) of the participants disposed them in the waste bins or into the general waste heaps, 13.7% of the participants burned them in their courtyard and 7 (0.8%) participants stored them and 3 (0.4%) used to flush down

them in the toilet (Fig. 1). The persons who burned the canisters got used to hear them explode.

**Table 1: Distribution of participants by their age**

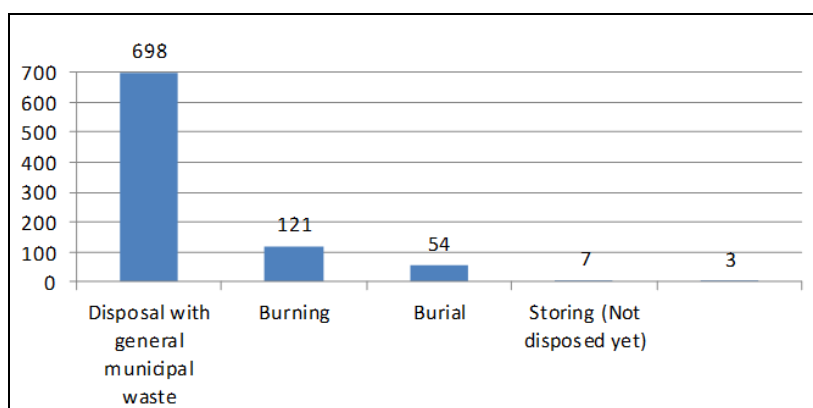
Age in years	Frequency	Percentage
35 to 50	25	2.83%
50 to 65	354	40.09%
65 to 80	454	51.42%
>80	50	5.66%

**Table 2: Educational status of participants**

Duration	Frequency	Percentage
Up to 10 <sup>th</sup> standard	468	53.00%
11 <sup>th</sup> and 12 <sup>th</sup> standard	150	16.99%
Graduation	221	25.03%
Post-graduation	44	4.98%

**Table 3: Duration of metered dose inhaler use**

Duration	Frequency	Percentage
1 to 2 years	389	44.05%
2 to 3 Years	406	45.98%
>3 Years	88	9.97%



**Fig. 1: Disposal methods followed for metered dose inhaler canisters (N=883)**

**Discussion**

Biomedical Waste Management and Handling Rules in India specifies that the pharmaceutical waste should be disposed by incineration or plasma pyrolysis at 1200°C or by encapsulation or shall be sent back to manufacturer [9]. The ideal method to handle MDI waste canister may be to recycle them [6]. There are industry experts offering recycling of complex pharmaceutical wastes like MDI canisters [10]. In the United Kingdom, one of the pharmaceutical companies runs a scheme named ‘Complete the Cycle’. They had completely recycled 1.2 million inhalers till March 2018 which is equivalent to take 5199 cars off the roads [6]. However, a recycling scheme for MDI is not currently present in India.

None of the participants of this study were informed about disposal method for MDI canister and all of them were disposing MDI in unsafe ways. Our report of 2018 from Kerala, mirrors a report from Sunderland from UK in 1992 [11]. Hassan WU et al, 1992 from Sunderland had reported that all the participants disposed MDI in unsafe ways – dumping in waste bin, burning or burying [11]. Two-third of the participants were using MDI with dose counters which also generate electronic waste. Electronic waste contain heavy metals, brominated flame retardants or polychlorinated biphenyls and burning will generate toxic fumes [12]. There are number of educational interventions on techniques of inhaler use [13]. Education on correct disposal methods of the MDI and the access to such methods shall be ensured to the patients by the healthcare

providers. The patient could be required to bring the empty canister to provide a new one. Empty canister take back program could be run by pharmaceutical companies, medical shops or the hospitals. IMA Goes Eco-friendly (Image) project run by Indian Medical Association of Kerala state provides access to safe biomedical waste management even to small healthcare facilities [14]. A motivation from the providers part, would make it possible to dispose the MDI canisters safely. Pharmaceutical companies could be urged to start a recycling scheme under Green Initiatives of Corporate Social Responsibility [15]. Pulmonologists shall set a role model themselves to initiate ‘MDI take back’ so that other providers may follow and also shall advocate for a recycling scheme.

**Conclusions**

MDI canister disposal is an unaddressed environmental hazard. In developed countries MDI recycling programs exist. Take back programs can be initiated with the existing resources in Kerala by the providers to incinerate them safely according to Biomedical Waste Management and Handling Rules. Advocacy for a recycling program may find success eventually.

**Conflicts of Interest:** None declared.

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