



**Title: Re-using the Canister Portion of Metered Dose Inhalers in a Hospital Setting: Clinical Review of Safety, Cost-Effectiveness and Guidelines**

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**Context and policy issues:**

A metered dose inhaler (MDI) is used to deliver inhaled medications such as bronchodilators and corticosteroids. An MDI consists of a pressurized canister containing a drug, a metering valve and stem, and a mouthpiece actuator. Medications are delivered by pushing down on the canister to release a specific amount of aerosolized medication.<sup>1,2</sup>

At many hospitals, it is standard practice for respiratory care practitioners to deliver MDI therapy to the patients who need aerosol therapy, for example, those with asthma.<sup>1-3</sup> These MDIs are patient specific and thrown out upon patient's discharge, which might be after 1 to 2 days hospital stay. There is significant wastage when the canister portion that still filled with medication is discarded after short hospital stay. A "common canister protocol" (CCP) has been introduced in some hospitals, to provide patients an opportunity to share the same canister, in an attempt to reduce the costs for the patient and hospital, and to use MDIs more effectively. In this protocol, a single MDI canister was taken to a patient, the canister nozzle tip was wiped with an alcohol prep pad, and then inserted into a spacer for administering the prescription. The same canister was removed from the spacer thereafter and taken to the next patient; just prior to administration, the canister nozzle tip was wiped with an alcohol prep pad.<sup>3</sup>

There is a concern for the possibility of cross contamination while the canister is shared by different patients. Inhalation drug products contaminated with microorganisms are likely to cause lung infections because the contaminating organisms are introduced with the drug product directly into the lungs through the mouth. In addition, microbial contamination of these products may also cause degradation of the drug product.<sup>4</sup>

The purpose of this report is to examine the benefits and risks of re-using the canister portion of an MDI in a hospital setting.

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## Research questions:

1. Is there evidence for the safety or risk of infection with the re-use of the canister portion of metered dose inhalers in a hospital setting?
2. What is the cost-effectiveness of re-using the canister portion of metered dose inhalers in a hospital setting?
3. What are the guidelines for the safe and sterile re-use of the canister portion of metered dose inhalers in a hospital setting?

## Methods:

A limited literature search was conducted on key health technology assessment resources, including OVID MedLine, OVID Embase, The Cochrane Library (Issue 2, 2008), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, EuroScan, international HTA agencies, and a focused Internet search. Database results include articles published between 1996 and May 2008, and are limited to English language publications only. No filters were applied to limit the retrieval by study type.

HTIS reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews and meta-analyses are presented first. These are followed by randomized controlled trials and observational studies.

## Summary of findings:

There are no health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, cost-effectiveness studies or guidelines identified through the literature search.

Three abstracts of non-randomized studies investigated the potential cross contaminations related to the sharing of canisters.<sup>3,5,6</sup> One abstract of pharmacoeconomic analysis evaluated the costs saved that might be associated with the implementation of CCP.<sup>7</sup>

Dunlevy *et al.* performed an infection control surveillance on MDI canisters for cross contamination related to multiple patient reservoir devices, in an acute care university teaching institution with 600 beds.<sup>3</sup> The Aerosol Cloud Enhancer (ACE) was the reservoir device monitored in the study. The study population consisted of 101 non-intubated patients who were receiving MDI treatments. Three cultures were obtained for each subject. Culture A was obtained through swabbing MDI canister nozzle; culture B was obtained from disinfecting MDI canister nozzle with alcohol prep pad and repeat swab of canister nozzle; culture C was obtained from swabbing the ACE MDI adapter site. Binomial distributions for each culture set (A, B and C) at 24, 48, 72 and 96 hours incubation were <0.001, indicating significantly low probability of obtaining a positive culture. The authors concluded that the likelihood of contamination was low when common canisters were used with multiple reservoir devices. Because canisters may be shared without significant risk of contamination, this may be translated into savings for both the patient and respiratory care department.

One study reported a pilot surveillance program to assess the presence of pathogens on MDI canisters being used with spacer devices from multiple patients.<sup>5</sup> In phase one of the study, 21 canisters were collectively used in delivering more than 300 MDI treatments to at least 25

different patients over a one week period following a CCP. At the end of the week, the 21 canisters were collected, each canister nozzle tip was wiped with an alcohol prep pad to simulate preparation for patient delivery and then swabbed and environmentally cultured. In phase two, 18 canisters were examined; however the canister nozzle tips were not wiped with an alcohol prep pad just prior to the culture in an effort to assess the potential results of failure to sanitize the canister nozzle tip prior to patient use. In phase three, the method in phase I was repeated utilizing 16 canisters whose nozzle tips were cleaned with an alcohol prep pad just prior to the environmental culture. The results showed that in phase one 21/21 cultures resulted in no bacteria growth. In phase two, 17/18 cultures resulted in no growth while 1/18 culture resulted in growth of *Streptococci* Group D *Enterococcus*. In phase three, 16/16 cultures resulted in no growth. The authors concluded that cross contamination of MDI canisters to spacer devices is unlikely when following the CCP.

Another study investigated the safety of administering MDI medications among patients under CCP in a teaching hospital.<sup>6</sup> The OptiChamber® was used in this study. Three specimens (A, B and C) were taken for each patient: specimen A was obtained from the MDI mouthpiece following swabbing with an alcohol pad before it was attached to the OptiChamber; specimen B was obtained from the same location after the MDI mouthpiece was removed from the OptiChamber, following the administration of the medication; specimen C was obtained from the MDI mouthpiece after swabbing it with an alcohol pad following the removal of the MDI mouthpiece from the OptiChamber. Fifty patients were enrolled. The 150 cultured samples demonstrated no growth at 24, 48 and 72 hours of incubation. The authors concluded that CCP was a safe method for administering medications via MDIs, and it also implied that a significant reduction in purchase costs of MDIs was possible when implementing CCP.

Ehlers *et al.* conducted a pharmacoeconomic analysis to empirically measure the actual cost savings, if any, attributable to the implementation of CCP for administering MDI therapy at a medical center with 537 beds.<sup>7</sup> In their study, 34 months of MDI units and cost data, representing equal periods pre-CCP (canisters were supplied individually) and post-CCP, was collected. A significant reduction in the number of canisters used pre and post conversion (4506 vs. 1880, a reduction of 58.3%) was revealed. The overall annual cost savings from conversion to CCP was estimated as US\$69,000. The authors concluded that substantial cost savings resulted from the conversion to CCP at their medical center, and no adverse effects have been reported.

### Limitations

- Evidence that addressed the research questions was very limited, even though we expanded the search timeframe to 10 years; few studies were published from 1997 to date.
- No health technology assessments, systematic reviews, randomized controlled trials or cost-effectiveness analyses were identified. Only abstracts of three non-randomized trials and one pharmacoeconomic study were identified, which may be subject to selection bias and are not able to provide sufficient data.
- No guidelines were identified for the safe and sterile re-use of the canister portion of MDIs in a hospital setting.
- Results of the included studies should be interpreted with caution, due to the unavailability of high quality studies/reports.

### **Conclusions and implications for decision or policy making:**

In summary, published evidence of re-using the canister portion of MDIs is very limited. All the included clinical studies indicated that cross contamination related to shared canisters was unlikely when following the “common canister protocol”. In addition, sharing a MDI canister among different patients resulted in significant cost savings in a hospital setting, when compared with the situation that each patient had his/her own MDI canister. All these studies used alcohol prep pads to sanitize the canister portion of MDI, and demonstrated that this was effective in minimizing the incidence of cross contamination.

In the future, more well-designed clinical trials that evaluate the benefits and harms and more studies that examine the economic outcomes within the Canadian health care system are warranted.

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