RESPONSE TO REVIEW REGARDING COST ANALYSIS OF SALBUTAMOL ADMINISTRATION

To the editor: We would like to thank Dr. Michael Ballantine[1] for his interest in and feedback on our publication.[2]

As health care systems compare alternatives in drugs and technologies to improve care delivery, economic evaluations are increasingly being used to inform these decisions. To make comparisons, these evaluations rely on specific model parameters, which may differ across health care systems, clinical settings, and patient-care provider encounters. We noted in our publication that we did not prospectively collect data on specific aspects of the resource utilization of the IWK pediatric emergency department (PED), including nursing time. We rather relied on literature estimates for some inputs, multidisciplinary clinical expertise, and experience, as well as documentation of the clinical care pathway from our single PED. The aim in using clinical estimates from many institutions as input variables was to produce an analysis that was more readily transferable to other institutions.

However, our model is flexible and can accommodate changes in input costs were they to differ across settings. For example, we originally used the time motion study from Mason et al.,[3] which noted that the total time (i.e., the time from the beginning to the end of treatment) was 1,194 seconds for the delivery of the beta agonist by nebulization (NEB) and 123 seconds for the delivery of metered-dose inhalers and spacer (MDI-s). Mason et al.[3] also compared nursing time and found that nursing time for the delivery of NEB was not significantly different from that of MDI-s (134.5 seconds v. 155 seconds, respectively) but noted that the difference in set-up time for NEB was significantly higher (98.5 seconds for NEB v. 23 seconds for MDI-s). The flexibility of our model allowed us to assess whether using nursing time or total treatment time changed our cost comparisons for both PED and total costs.

Time inputs and PED costs

If we modified our PED cost regressions to include Ballentine's recommended use of the alternate time inputs of Mason et al.,[3] we found that MDI-s is associated with an additional cost of \$4.55 (95% confidence interval [CI] \$3.54 to \$5.56) per PED visit, as compared with nebulized therapy. This differs from the cost savings of \$23.55 (Table 5, Row B), reported in our original study using baseline time inputs (Table 2).

Doan et al.[4] chose another approach and multiplied the average length of stay by the hourly cost of nursing time in British Columbia. They determined that the average length of stay for the MDI-s was 0.83 hours (SD 0.42 hours) and the average NEB length of stay was 1.41 hours (SD 0.73 hours). In our study, the PED length of stay in the NEB group was not significantly different from that of MDI-s, after controlling for patient demographics, acuity, and time and date of the PED visit (Table 5, Row A). Therefore, the time inputs of Doan et al. and Ballentine are equivalent if adapted to our sample and methodology.

Time inputs and total costs

Regardless of which approach is used, while nursing time is crucial for emergency department (ED) costs and depends on numerous patient and parent variables, it is less important for total costs. This is because inpatient care accounted for 80% of the total costs in our study, and these inpatient costs would not be affected by nursing time inputs in the ED. If we modified our *total* cost (i.e., PED plus inpatient cost) estimates to include Ballentine's recommended time inputs, we found that MDI-s is associated with a cost savings of \$165 (95% CI \$33 to \$297) per PED visit. This is \$15 less than the amount that we reported in our original study using baseline model inputs (Table 5, Row B).

Alternative scenarios

While our original article included a sensitivity analysis in which input parameters were drawn from a wide distribution of values, Ballentine's recommendation allows us to demonstrate an analysis specific to nursing time. This highlights a central advantage of our model, which is to provide readers the flexibility to adapt inputs to their own clinical practices or experiences. Below, we discuss other

inputs that may also vary by institutional setting.

Patients arrive with inhalers and spacers

In some settings, patients/family may bring in both the inhaler and spacer device with them to the ED, thus making MDI-s costs very small. Our clinicians examine the spacers and inhalers that patients bring into the PED to determine if they can still be used or need to be replaced. Patients/family were encouraged, via public service announcements in late 2008/early 2009, to bring in their own MDI-s to the PED when seeking treatment. Should future work determine this public campaign was effective, further cost savings may be possible.[5]

Combination therapy

We did not examine the cost of combination therapy. As ipratropium needs to be administered along with salbutamol for some patients, the costs of the MDI delivery approach would be increased because of the need for two separate inhalers.

Differences in who administers therapy

We assumed that nurses delivered the salbutamol therapy. This may be different in other settings in which respiratory therapists administer these drugs or patients and family self-administer the medication with guidance. Turner et al.[6] determined labor costs for MDI administration for hospitalized patients not in the intensive care unit (ICU) and grouped patients into full supervision (100% of patients require the attendance of a respiratory therapist or nurse), half supervision (50% of patients require the attendance of a respiratory therapist or nurse), and self-administration.

Adverse events

We were not able to look at all relevant outcomes such as readmission rates, adverse events from drugs or their delivery system, and health-related quality of life for patients and patient/family/caregiver satisfaction between the two delivery methods.[7] For example, in our model, we did not include the potential financial impact of reduced risk of infection associated with MDI-s, as compared with NEB.

Conclusions

The transferability of economic models developed in one institution to other institutions and health care systems can pose challenges because of differences in their structures, programs, policies, and clinical care pathways; the type, capability, and capacity of their human and technical resources; their financial capacity; and other factors.[8,9]

While one goal of our publication was to examine the economic impact of a particular change in practice to promote the uptake of MDI-s and to communicate the results to our program managers, the model and results are now available for comparison as evidence changes in clinical practice and costs of inputs change over time. Another goal was to make our model available to other organizations that could adapt it to their settings and enhance the comprehensiveness, robustness, and applicability of the model. We look forward to employing any future innovations adapted to these models.

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