A Baby Step Toward Planetary Health: A Collaborative Quality Improvement Initiative to Reduce Single-Use Plastics in a Pharmacy and Neonatal Intensive Care Unit

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INTRODUCTION

The environmental harm associated with plastic waste from hospitals has had an alarming impact on our planet and its marine ecosystems. A decade ago, the World Health Organization (WHO) estimated that a general metropolitan hospital in a high-income country was generating approximately 10.7 kg of health care waste per occupied bed per day.[1] An estimated 85% of this waste would be considered nonhazardous, consisting mainly of paper, cardboard, and plastic.[1] This environmental concern was recently exacerbated through the increase in application of single-use plastics during the COVID-19 pandemic.[2] In fact, Peng and others[2] estimated that more than 8 million tons of pandemic-associated plastic waste was generated globally up to August 2021, of which 25 000 tons ended up in the ocean. A large proportion of this medical waste is pharmaceutical packaging material. In many pharmacy departments, single-use plastic bags are used for many purposes, including storing and separating medications both in the pharmacy and in automated dispensing cabinets; indicating storage requirements or other important information pertaining to the contents of the bag; labelling medications for patients; packaging medications for transport, including transport within the hospital and home with the patient; and storing paper documents.

The convenience of single-use plastic in hospitals is overshadowed by the devastating implications for the environment, and research has highlighted the harmful effects on marine life through entanglement, ingestion, and bioaccumulation.[3,4] There is harm from not only the fossil fuels required to produce plastics, which contribute to the carbon footprint of plastic manufacturing, but also the direct contribution to pollution in marine ecosystems.[4] These plastics can remain intact in the environment for centuries, eventually even making their way up the food chain.[4] Additionally, the most common types of polymer plastics, which make up approximately 30% of global production, are made of monomer chemicals and additives that can be directly hazardous to the environment.[4] When released into the oceans, these monomers act as reservoirs by absorbing and accumulating up to 1 million times the concentrations of toxic pollutants found in the surrounding waters.[5] The small size of micro and nano particles makes it easy for these concentrated toxins to spread ubiquitously in surrounding waters.[6]

Microplastics have been found in humans, with detection throughout the body, including in breast milk, blood, the lungs, the gastrointestinal system, and feces.[7] Garcia and others[8] identified microplastics in all of the human placentas that they tested and found that the most prevalent plastic polymer, representing 54% of the total, was polyethylene, which is used to make plastic bags. The effects of microplastics on reproductive and developmental toxicity are currently unknown, but are nonetheless concerning.[7] Additional health concerns related to microplastics in the human body include DNA damage, organ dysfunction, metabolic disorders, altered immune response, and neurotoxicity.[7]

In light of the current global climate crisis, an initiative to reduce plastic waste was implemented in our pharmacy for the neonatal intensive care unit (NICU). The pharmacy department collaborated with nurses and other staff members to develop a sustainable procedure for delivery of medications to the NICU that would reduce the amount of single-use plastic and paper waste. By replacing plastic and paper bags with reusable metal and plastic containers, the pharmacy significantly reduced the amount of waste generated. The purpose of this article is to describe the method

we used to reduce plastic waste within our pharmacy and to summarize the impacts of this approach.

DESCRIPTION OF THE INITIATIVE

Our initiative to reduce single-use plastic bags in the pharmacy and the NICU was a collaborative quality improvement project. The pharmacy provides the 32-bed NICU with a 24-hour supply of unit-dose medications for each patient, achieved with 2 deliveries per day, plus stat medication delivery as needed. Before this initiative was undertaken, every medication was placed in its own plastic bag, and all bags for one patient would be placed inside another plastic bag, to keep the patient's medications together.

The project grew out of a challenge from our nursing colleagues in January 2022 to reassess whether we needed to use so many plastic bags. We began by determining the role of the plastic bags. Upon discussion with nursing and pharmacy staff, we discovered that many staff members thought the plastic bags were intended to keep products sterile; however, the plastic bags in use were not sterile. The second most commonly cited reason for using plastic bags was to label each patient-specific medication and to keep each batch of patient-specific medications together both in the pharmacy and in the NICU.

After identifying the perceived reasons for using plastic bags, we organized a brainstorming session to consider what could replace the plastic bags. These discussions led to putting labels directly on the tablet packages and syringes instead of on a plastic bag containing the medication, to be put inside another labelled bag. Direct labelling of products would also improve safety, as there had been instances of different medications being added to a labelled bag, with uncertainty as to the point at which these additions had been made. To keep multiple patient-specific products together for bedside delivery, paper bags, elastic bands, and small paper labels were tested. Initially, the infection control department advised that we could reuse paper bags, so we started replacing the plastic bags with paper bags; however, we were later told that paper bags could not be reused, so we stopped using them, as we did not want to waste paper either.

The next steps involved searching for reusable containers for the medications. We first explored options already available in the hospital, but these were ruled out. A search of the PharmaSystems catalogue did not reveal any suitable alternatives, so we conducted an online search using the Google search engine. A variety of small boxes were obtained and tested. Small, lidded metal boxes, 15 × 11 × 4 cm (Figure 1), that could fit oral medications and small doses of IV medications were found to be suitable from both the nursing and pharmacy perspectives. We began using 30 of these small metal boxes for delivery of all patient-specific medications to patient rooms within the NICU.

Once we had established this process for oral and IV medications, we looked for a similar but larger container for delivery of total parenteral nutrition doses. We could not find similar metal containers large enough for this purpose, so we again used the Google search engine to look for a plastic alternative. We found plastic boxes measuring 18 × 26 × 8 cm (Figure 1), with 18 × 26 × 15 cm boxes available for even larger products; these boxes are made of polyethylene terephthalate (PET). This type of plastic is stiff and tough, yet flexible enough to withstand some pressure, and has the added advantage of being free of volatile impurities.[9] Lastly, PET is known to be recyclable through a well-established primary recycling process that allows discarded plastic to be reintegrated with new materials for production of new products.[3] These properties are all ideal to support frequent reuse of these containers and appropriate recycling, if required, in the future. Both the metal and plastic boxes are opaque and have lids, thus affording protection from light and confidentiality. In addition, it is possible to write on the lids; such exterior labelling is removed by cleaning between uses. These climate-friendly containers have eliminated the need for single-use plastic bags for medication delivery in our department and conform with suggestions for sustainable practice for Canadian hospital pharmacists as outlined by CASCADES Canada,[10] as well as the *RPS Greener Pharmacy Guide for Hospital Pharmacies* published by the Royal Pharmaceutical Society.[11]

Education was completed to ensure that staff in the pharmacy and in the NICU were aware of the changes being made and the rationale for doing so. In addition, at the request of nursing staff, collection bins were set up in each unit to collect medication bins ready to be returned

FIGURE 1. Lidded reusable boxes for organizing and transporting medications from the pharmacy to patient wards. A small metal box for oral medications and small doses of IV medications is shown balanced on top of a larger plastic box suitable for larger products. The plastic box is made of polyethylene terephthalate (PET) plastic.

to the pharmacy. Working collectively, the pharmacy and nursing departments assisted in ensuring that this initiative was successful for long-term use.

EVALUATION OF THE INITIATIVE

To determine if the change made a difference in the use of plastic bags, pharmacy staff calculated the number of bags that would have been used over a 3-month period. In that time, the introduction of reusable containers for medication delivery from the pharmacy department to the NICU replaced an average of 789 plastic bags per week, which translates to approximately 41 000 plastic bags per year. As such, for nonhazardous medications, the use of plastic bags for medication transport and storage in the NICU decreased from approximately 41 000 per year to zero. The impact on the organization's carbon footprint was also significant, as the carbon footprint from the 75 reusable containers that we procured was approximately 40 kg of carbon for the foreseeable future, compared with approximately 720 kg of carbon for a 1-year supply of plastic bags.[12] The bins have been in use for more than 2 years without a single bin needing replacement.

Staff in the pharmacy and nursing departments were approached for feedback regarding feasibility and acceptability of the new products and procedures. Requests for feedback were distributed by email, and the pharmacy lead (B.N.) approached staff members for their opinions in small-group and one-on-one conversations. More than 50 people provided feedback. Some of the feedback involved products that were tested and deemed unsuitable because they were too small, too large, too difficult to open, or too rough in texture, which made them difficult to clean between uses. Feedback about the products incorporated into current use mentioned that they were a good size, were easy to clean and easy to stack, and kept the medications organized; users also appreciated the ability to write directly on the bins. Feedback discussions occurred continuously during the first 3 months after implementation, and feedback regarding opportunities to further improve the process is ongoing. So far, no negative feedback has been received about the bins selected for use.

We initially were using reusable rubber bands to hold multiple syringes of the same medication together; however, nursing staff reported that it was difficult for them to select the needed syringe from a batch when the syringes were small, so we stopped using rubber bands for small syringes. Nearly 2 years after implementation of the bins, the nursing staff indicated that they wanted to keep the medications in the bins until the time of administration, to reduce potential contamination of medications in the patient's environment. To fulfill this request, we needed additional bins, which led to the final total of 75 bins. Overall, staff in both the pharmacy and the NICU were appreciative of the impact of this "baby step" toward sustainable practice and were surprised by the overall reduction in plastic bag use.

To determine the impact of the initiative on patient safety, the pharmacy lead monitored the patient safety learning system for any relevant events. There was a reduction in reported medication events involving a mismatch between the product inside the plastic bag and the patient-specific label, because all medications were now labelled directly on the medication package. With this change in procedure, there was no longer an opportunity for incorrect medications to be inadvertently added to a patient-specific plastic bag. Before the change to reusable bins, it was unclear whether this type of medication error occurred in the pharmacy or on the unit. Since the change was made approximately 2 years ago, no medication errors related to medication labelling and delivery have been reported.

The main limitation associated with reusable plastic boxes is the requirement for alcohol wipes to disinfect the boxes before reuse. We are currently using 2 or 3 alcohol wipes per day to clean the bins, which represents approximately 100 kg carbon per year.[13] However, the moderate increase in carbon footprint from alcohol wipes would have a significantly lower environmental impact than the previous practice of using plastic bags. In addition, we are currently implementing reusable wipes to further reduce our impact.

IMPLICATIONS AND SIGNIFICANCE FOR PRACTICE

The initiative implemented in the pharmacy department for the NICU employed principles of both reduction and reuse that have been described as constituting a global strategy to create more sustainable health care.[14] In fact, reduction of environmentally harmful waste, like plastics, has been suggested as the most favourable option on the pyramid-of-waste hierachy.[15] The reduction in plastic waste generated by a small change to medication delivery practices for the NICU was substantial, with more than 41 000 plastic bags per year removed from production and waste streams. This diversion is significant, as the indirect and poorly reversible effects of plastic on the marine carbon pump could be more hazardous than the direct effects of greenhouse gas emissions.[16] The reusable containers that replaced the single-use plastic bags were also affordable. At approximately $10 per bin, the total cost for the first year (i.e., for 30 bins) was approximately the same cost as a year's worth of plastic bags. The bins also eliminated the need for ongoing purchase of single-use products in which to transport the medications. We estimate that the need to replace our reusable containers will be limited, due to the resilient nature of the materials used.

Given the successful implementation of this change for the NICU, we have been replacing plastic and paper bags for medication delivery to our pediatric units as well. We have

outlined a simple process to integrate reusable containers within a hospital pharmacy department for a patient care unit, which can be replicated in other facilities where integration of reusable items is feasible. Reducing plastic production and waste can improve the overall health of the environment, as well as the health of the patients under our care.

CONCLUSION

Opportunities exist in hospital pharmacy processes to adopt sustainable practices and solutions that will reduce our environmental impact. As described here, replacing single-use plastic and paper bags with reusable containers in a single health care unit led to a surprising reduction in the number of plastic bags used. Together, by implementing small changes, we can reduce and eventually eliminate the plastic pollution from the health care system that ends up in our ecosystems, thus preserving the health of our environment for generations to come.

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