SUSQI PROJECT REPORT

Project Title: BYOBD - Bring your own Bronchodilator

Start date of Project: April 29, 2025
Date of Report: August 22. 2025

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Discarded Ventolins during Project

Background:

The goal of this project was to decrease the waste of discarding minimally used high carbon footprint inhalers in the pulmonary function testing (PFT) lab at the Peter Lougheed Centre (PLC) in Calgary, AB. If effective, we plan to develop a strategy for broader implementation in the Calgary Zone acute care pulmonary function labs.

PFT often requires bronchodilator responsiveness (BDR) testing to be performed to diagnose asthma, which is assessed by comparing spirometry results from before and after administration of a short and/or quick acting inhaled bronchodilator. Current guidelines support the use of any short-acting bronchodilator appropriate for the clinical question at hand. For asthma, the most used bronchodilator is the short acting beta agonist (SABA), salbutamol (Ventolin), through a metered dose inhaler (MDI).

The current process in all four hospital-based PFT labs in the Calgary Zone for BDR testing utilizes a single-use Ventolin MDI per patient tested. One lab-supplied Ventolin MDI contains 200 doses of

100mcg of salbutamol. A bronchodilator assessment is performed by providing 4 doses (puffs) of Ventolin MDI via a disposable holding chamber before performing postbronchodilator spirometry. The single-use MDI is then discarded with 196 remaining doses (approximately 98% of medication remaining) or provided to the patient, if desired and deemed appropriate by their treating physician. In the latter case, it is dispensed by the in-clinic physician in a clear, sealable plastic bag.

While MDIs are widely used as prescribed treatment and for PFT, their environmental impact is significant. MDIs emit hydrofluorocarbons (HFCs) as part of their propellent system, and this traps more heat in the atmosphere than carbon dioxide [1]. The salbutamol inhaler being used in the pulmonary function labs at the PLC is Teva-Salbutamol (200 actuations) with a carbon footprint of 9.720 kgCO2e, which is the equivalent of a 42-km car journey [2]. For context, this is roughly the equivalent of driving from Calgary, AB to Okotoks, AB. Furthermore, when inhalers with unused doses are disposed of improperly, any remaining HFCs in the MDI leak into the atmosphere [1].

Previous SusQI projects often had two-fold aims [3-5]. First, reducing the prescription of MDIs and providing dry power inhalers (DPI) alternatives as they have no propellants in the formulation. Second, improving asthma control to decrease the need for short-acting bronchodilator rescue inhalers. While impactful, these interventions attempt to change prescribing practice patterns and rely on patient outcome.

Among the PLC respiratory physician group, the asthma population is large (difficult airways clinic, asthma clinic) with a high number of PFT being performed per week with BDR testing requests (data obtained by observation). With many inhalers being disposed of, essentially unused, our group investigated methods for decreased MDI waste at the PLC PFT lab.

This project was identified as a priority for a 12-week intervention given the identified high waste, consensus of priority with the PLC pulmonary physician group and PLC PFT staff, clinic, and PFT Manager support. With the assistance of the Alberta Health Services (AHS), Quality Improvement (QI) consultants and Sustainability Analyst from the Centre for Sustainable Healthcare (CSH), UK, the carbon footprint impact of this intervention could be determined for this project. Department of Medicine Planetary Health Lead, Respiratory Division Lead, Pulmonary Function Medical Director, and Infectious Disease (ID) Division Lead were supportive of this intervention.

Specific Aims:

To reduce the number of discarded single-use Ventolin MDI inhalers in the PLC PFT by 20% in the 3 weeks after implementation of each of two interventions at the PLC PFT lab in Calgary.

Methods:

To reduce the number of discarded, single-use Ventolin MDI inhalers used in the PLC PFT labs, two interventions were developed.

The first intervention was to develop a protocol for patients to use their prescribed short acting bronchodilator in the PFT lab for bronchodilator testing. This required review of the respiratory

literature [6,7] to ensure appropriate dose of all available short-acting reliever medications were documented. A written document was created and provided to PFT lab staff with management involvement and approval. A script was provided for administrative assistants to remind patients to bring all inhalers (including short acting bronchodilators) to their PLC appointments. This step was completed in 8 weeks, with manager involvement, and included orientation of PFT respiratory therapists and administrative assistants in the new protocol.

Below is the dosing for alternative inhaled beta agonists for BDR testing to support patients using their own inhalers:

- Terbutaline (Bricanyl Turbuhaler, single-entity): 1000-1500mcg
    - Achieved with Bricanyl 500mcg x3 puffs
- Formoterol (Oxeze Turbuhaler, Symbicort Turbuhaler, Zenhale MDI): 9mcg
    - Achieved with:
        - Oxeze 6mcg x1 puff, or Oxeze 12mcg x1 puff
        - Symbicort (100mcg/6mcg or 200mcg/6mcg) x2 puffs
        - Zenhale (100mcg/5mcg or 200mcg/5mcg) x2 puffs

The second intervention was to discuss opportunities for multi-patient use of MDIs specifically for BDR testing in the PFT lab environment with Infection Prevention and Control (IP&C)] [8,9]. This involved meetings with ID Physician Lead and IP&C practitioners. Protocol development was prioritized by the IP&C teams. With this protocol change, Ventolin inhalers could be used by multiple patients (50 patients) with personal patient holding chambers and respiratory therapists dispensing. This procedure protocol was provided to all acute care PFT labs in the Calgary Zone as an internal document. Training was provided to the PFT lab respiratory therapists prior to implementation. This required 10 weeks of work to engage stakeholders, develop recommendations and protocols, provide training, and implement. This intervention was developed alongside the first, but due to a longer development period, was implemented two weeks after the first.

Multiple stakeholders were required to achieve change. All groups involved were committed to collaborating on protocol development within the 12-week Green Team initiative timeline. The PLC pulmonary Physician Group were first approached to participate in the Green Team initiative and to provide input on the top priorities at our site.

Calgary Zone representation for the PFT lab, Respiratory Division, ID Division, Internal Medicine Division, and IP&C were approached for participation. PLC site respiratory therapists, clinic managers, and asthma educators were approached for their participation. Once participation agreement was obtained by email, meetings with stakeholders were arranged to develop processes and interventions. All members kindly agreed to the tight timelines required for this project.

Patient and staff engagement was assessed by survey, with research staff provided in kind by the Department of Medicine. A Lunch and Learn session was provided by the physician group and PFT management for information dissemination and to discuss potential intervention challenges.

Measurement:

Patient outcomes:

It is important to monitor medication utilization and assess inhaler technique in patients with airway disease, including asthma and chronic obstructive pulmonary disease (COPD) [10]. Improper inhalation technique leads to insufficient medication dosing, leading to worsening of symptoms and increased healthcare costs for higher healthcare utilization [10].

By using patient's own inhalers for bronchodilator assessment in the PFT lab, respiratory therapist staff in the PFT lab can identify patients who do not have rescue short acting B2 agonist inhalers, who are not using their rescue inhalers correctly, and can improve efficiency at the patient's clinic appointment by prioritizing patients who need to be assessed by the asthma and COPD educators in pulmonary clinic, thus improving patient-centred care.

While these were identified as potential measurable positive patient outcomes, we did not formally measure number of patients assessed without a prescribed rescue inhaler, those who did not bring their rescue inhaler for bronchodilator assessment in the pulmonary function lab, and those whose inhaler techniques required improvement. However, some of this data was captured through a voluntary patient questionnaire approved by AHS Engagement & Patient Experience consultants in additional meetings. This was administered primarily through research assistant staff on AHS REDCap, which is a secure online survey platform [11, 12].

Environmental sustainability:

Environmental impact of our intervention was evaluated through:

- Counting the number of single-use Ventolin MDI discarded per week at the PLC PFT lab, these were collected in a bucket and counted weekly (see Appendix 1)
- Counting the number of plastic bags disposed per week of PFT testing (plastic bags were used when providing single-use Ventolin MDIs for patients to take home)
- Counting the number of single-use holding chambers disposed per week of PFT testing (MDIs require the use of a holding chamber for adequate medication dispensing in airways)

To establish a baseline, single-use MDIs disposed per week was counted at the PLC PFT lab and at the PLC pulmonary clinic prior to any intervention between May 12 and June 27. Counting continued into the implementation of the first intervention (June 30) and the second intervention (July 21).

Although we did not count holding chambers directly, we assumed that the number of disposable holding chambers equalled the number of MDIs discarded. These disposable holding chambers are made from paper and were put into recycling bins.

The carbon footprint of each item counted in our intervention is below

- **Carbon footprint of Teva Ventolin inhaler (200 actuations): 9.720 kgC02e [13]**
- **Carbon footprint of plastic bag: 0.0161 kgCO2e [14,15,16]**

- Material-related emissions were calculated by weighing the bag and applying the LDPE film emission factor from The Inventory of Carbon and Energy (ICE) Database (Version 4.0). Due to limited information on the bag's manufacturing origin—only that it was produced in the United States—the transport distance was estimated as the shortest route from Calgary to the U.S. border (approximately 200 miles). This likely underestimates the actual transport distance. The 2025 U.S. EPA emission factor for a "medium heavy-duty truck" was applied to convert this distance into carbon emissions.

- **Carbon footprint of disposal Thayer Lite Aire medication holding chamber: 0.0384 kgCO2e [14,15,16]**
  - The team weighed the spacer itself along with its information leaflet and packaging. Emissions were calculated using emission factors from both the ICE and the Department for Energy Security and Net Zero (DESNZ) 2025 databases. The spacer is manufactured in Tucson, Arizona, and it was assumed to be transported to the lab by medium heavy-duty truck.

Greenhouse gas emissions associated with both the plastic bag and the spacer were estimated using a cradle-to-grave, process-based carbon footprint analysis. This assessment included emissions from raw material production, transportation, end-of-life disposal, and packaging for the spacer. Packaging emissions for the plastic bag, however, were excluded.

End of life disposal for both the plastic bag and the spacer was assumed to be landfill. Emissions from this stage were calculated using the AHS landfill emission factor. Additionally, emissions from transporting the bag to landfill were estimated separately using the same EPA truck emission factor and 11.5 km.

Economic sustainability:
Actual prices for items ordered through the PFT lab were not available for this report to avoid inadvertently disclosing any AHS contract pricing. Therefore, for this analysis, costs are based on prices publicly available as listed by comparable suppliers as cited.

- Ventolin MDI (200 inhalations)
  - 0.0438 per inhalation x 200 inhalations = $8.76 per MDI [17]
- Thayer Lite Aire Medication Holding Chamber
  - $425 per 100 units = $4.25 each [18]
- Plastic bag
  - $45 per 1000 units = $0.045 each [19]

For patients, the cost incurred for self-supplied doses required for BDR testing vary mostly depending on whether it is single entity SABA or a formoterol containing formulation. (AB Blue Cross Drug Benefit List). Range of cost for self-supply of bronchodilator ranged from 0.13 to 2.28 for one bronchodilator assessment. Patient-related costs were not included in this analysis.

Investment costs for the project included:

- One Lunch and Learn session for PFT staff: approximately $40

- One orange bucket for collection of discarded MDI: $20.

As a special note, the enthusiasm, support, and expertise of the assembled team was invaluable!

Social sustainability:

Patient and pulmonary staff survey was collected to assess social sustainability of intervention (Appendices 2 & 3).

Results:

Patient outcomes:

No specific measurement of patient specific outcomes or health outcomes was included for this project. Reported benefits from respiratory therapy staff, respiratory physicians, asthma/COPD educations include:

i. Reinforcement of patient's need to travel with rescue inhalers. Assessment of barriers to travelling with short acting rescue inhaler (e.g. carrying the holding required for MDI inhalers)
ii. Review of short-acting rescue bronchodilator usage and prescriptions per patient (e.g. some patients unsure what rescue inhalers they have been prescribed or are using when attending the PFT lab, this is highlighted for respiratory physician action at appointment)
iii. Early identification of poor inhaler technique at PFT appointment (this is highlighted for respiratory physician/asthma educator to address at the appointment)

Population outcomes:

With the information obtained in this PLC PFT specific intervention, implementation will be expanded to all PFT labs in acute care facilities in the Calgary Zone, further expanding the environmental and cost saving intervention.

Environmental sustainability:

In our baseline count over 7 weeks of study prior to implementation of any initiative, 23 MDIs were being discarded at the PLC PFT lab per week, including 23 holding chambers per week. The number of plastic bags dispensed was not specifically counted, and only those immediately contributing to waste could be counted based on our methods. Therefore, the weekly carbon footprint of medications and supplies per week is:

9.720 kgCO2e (per Teva Ventolin MD 200I actuations) + 0.0384 kgCO2e (per holding chamber)) + 0.0161 kgCO2e (per plastic bag) = 9.78 kgCO2e per PFT bronchodilator challenge test.

With 23 Ventolin inhalers and supplies discarded per week, 224.81 kgCO2e per week was generated.

During the three weeks of implementing the first intervention, an average of 14 MDIs per week were discarded along with 14 holding chambers, representing a decrease of 9 inhalers per week for the first intervention.

During the 4-week period, with both interventions implemented, 1.25 Ventolin inhalers (direct count), 0 plastic bags (direct count), and 10 holding chambers (estimated) were used per week; 12.53 kgCO2e per week was generated. This represented a further 12.75 inhalers decrease.

In total, this represents a total of 21.75 less Ventolin inhalers used per week, with a net carbon saving of 212.28 kgCO2e (224.81 - 12.53 kgCO2e).

Over one year, at the PLC PFT lab, 11,038.56 kgCO2e carbon savings will be realized (212.28 kgCO2e x 52 weeks in a year).

The PLC PFT lab was the pilot site for this intervention. The PFT lab in the 3 other acute care sites in the Calgary Zone, have also implemented this intervention. Assuming similar PFT test utilization numbers (as all acute care PFT labs are booking at full capacity), the projected savings over one year of implementation at all 4 sites would be estimated at 44,154.24 kgCO2e.

Economic sustainability:

Financial costs savings are being realized by AHS with this process change. These cost savings will be due to decreased waste disposal.
Ventolin inhaler cost per unit 8.76 as per Alberta Blue Cross, June 13, 2025
Disposal holding chamber 4.25 dollars as per Novus
Plastic bag 0.0425 dollars

Cost per bronchodilator assessment was thus determined to be 13.05 dollars.

Pre-implementation 23 bronchodilator assessments were performed, **23 x 13.05** dollars = **300.21** dollars per week.

Post-implementation costs per week: (1.25 Ventolin inhalers per week x 8.76 (inhaler cost) + 10 holding chambers (10 x 4.25 holding chamber cost) + 0 plastic bags = 53.45

Net weekly cost savings**:** 300.21 – 53.45 dollars= 246.76 dollars saved per week.

Investment costs for this project, one Lunch and Learn and one bucket purchased for capturing the number of disposed MDIs, which totaled approximately $60

With ongoing planned implementation over the next year, projected savings at the PLC are 12,771.52 dollars (12,831.52$ (246.76$ weekly savings x 52 weeks) – 60 dollars implementation costs).

With the expansion to all 4 adult acute care sites in the Calgary Zone, 51,086.08 dollars could potentially be saved per year.

Social sustainability:

Staff and patient surveys (Appendices 2 & 3) were collected during the implementation process to assess interest and support of this intervention. All (n=8) staff respondents agreed that environmental sustainability is important, with seven respondents feeling the new process had a positive impact on the environment that makes sense to them. Six out of eight respondents felt that the new process empowers them to do the right thing at work for the environment.

10 patients consented to and completed surveys. Most patients reported support for the project and intervention. However, one patient noted that environmental impact of inhaler treatment should not be a priority for the health care team.

> *"Relax. Stop worrying so much about the environment. You're in the health care field, let environmentalists worry about this stuff. Someone coming to a hospital is usually turned off by such things because your concern is not on them and their health issues but some lofty environmental goals, it means your focus is not on the patient but the administration and making you look good to the community. You're losing focus and that makes for poor patient care."*

Discussion:

Using a multi-intervention approach, we decreased the waste of single-use Ventolin MDIs at the PLC PFT lab by 95%. With engagement of multiple stakeholders, excellent support from our AHS Green Team leads and the Department of Medicine, we were able to make a significant change in greenhouse gas emissions in a short period of time (212.28 kg CO2e decrease per week) with significant cost savings, estimated 246.76 dollars per week. This initiative is being expanded to the other 3 PFT labs in the Calgary Zone and will be reviewed provincially by the IP&C team.

The primary challenge of this project was the tight turn-around time for intervention development, implementation, and meetings required to adapt IP&C policies. No concerns were raised during patient surveys about the use of their personal rescue inhaler at the PFT lab. Ongoing reminder phone calls will be required to ensure patients attend with their rescue bronchodilators.

During this intervention, patient level data on specific inhalers utilized in the PFT lab during the intervention was not routinely collected but will be assessed in future. It should also be noted that we did not capture the fiscal impact of the BYOBD intervention at a patient level as we did not capture who brought their bronchodilators and who did not. This impact is estimated to be small, between 12 cents and 2.82 dollars per patient bronchodilator assessment.

In addition, changing physician PFT bronchodilator ordering practices could not be addressed during this 12-week period, but will be assessed post-implementation. Other places of future

intervention will be identifying those with excellent DPI techniques who can be safely transitioned to low carbon footprint rescue inhalers from high carbon footprint MDI inhalers, as well as identifying patients who safely do not require bronchodilator testing at the PFT lab routinely.

The risk of a patient suffering an adverse event with the use of their own prescribed rescue inhaler when they are given the option of using a lab-supplied inhaler seems at most similar to the risk of exclusively using a lab-supplied inhaler. IP&C policies for multi-use Ventolin inhalers in a controlled PFT lab are negligible and patients with respiratory virus symptoms do not have PFT testing completed as per protocol.

Conclusions:

The Green Team initiative was widely supported. It demonstrated what could be accomplished in an abbreviated time with minimal implementation costs (approximately $60 dollars). The moral distress of throwing away minimally used Ventolin MDIs was highly motivating for all members of the team. The suggestion of one team member to keep all Ventolin MDIs destined for disposal to demonstrate the efforts of our team, was highly impactful.

When barriers were identified, having the highly motivated team members/local champions assist with explaining the importance of this intervention supported protocol progress and buy-in from all stakeholders. Components of this intervention have already been disseminated to the three additional adult PFT labs in the acute care Calgary Zone.

Next steps for our group are to present this data at University of Calgary respiratory round for consideration of full adult divisional adoption, review of protocol at the next provincial IP&C meeting, identify opportunities to safely decrease bronchodilator ordering by physicians in the PFT lab, and work with our asthma/COPD educator teams to safely transition rescue inhaler prescriptions from high carbon footprint MDIs to low carbon footprint options such as DPIs when deemed safe to do so.

References and Resources

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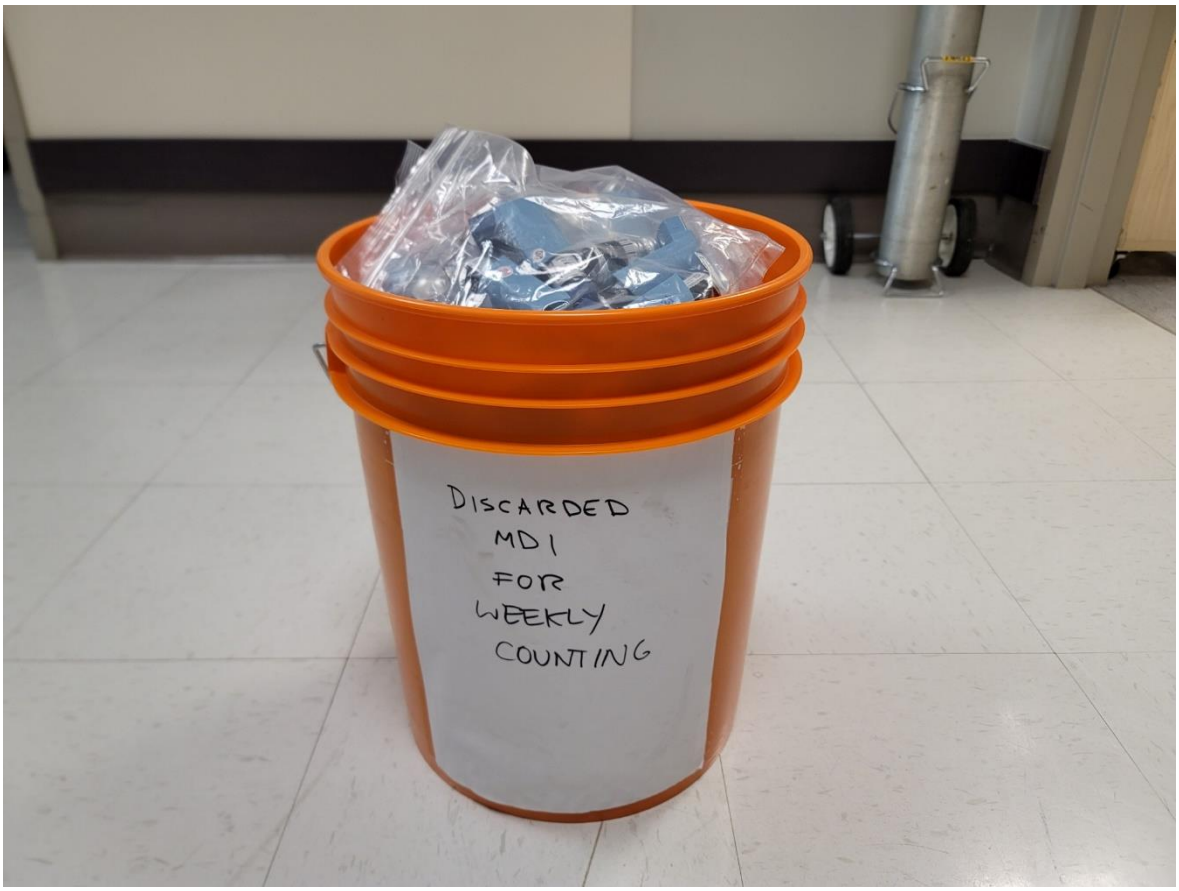
Appendices

Appendix 1: Bucket of MDIs that were discarded throughout the competition



Appendix 2: Staff survey of intervention implementation (Note: Some text was cutoff upon the export of the survey from Microsoft Forms)

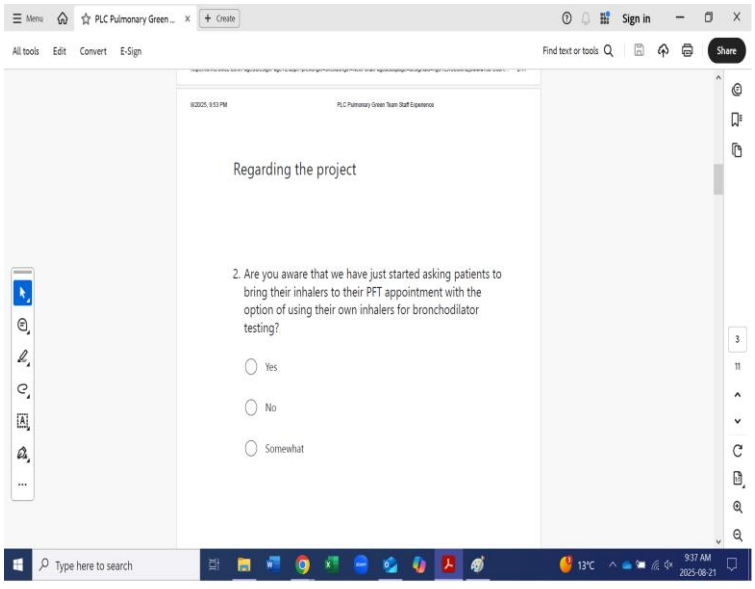
PLC Pulmonary Green Team Staff Experience

Introduction

Thank you for taking the time to complete this short survey regarding your experiences with the PLC Pulmonary Green Team project and its impact on the sustainability of care provided. We are interested in hearing what has worked well for you and where you have experienced challenges. We are also interested in getting your thoughts on where you think improvements can be made in the new process to improve service delivery, your job experience, and sustainability of the services. The survey will take about 5 minutes of your time to complete. It is anonymous with no means to identify you. Your responses will be kept confidential and will be summarized along with other staff responses for a report that will go to the project leads to guide their planning of quality improvement initiatives. We look forward to your responses and thank you again.

1. What is your role? (Choose most applicable)

- ◯ Physician
- ◯ Nurse
- ◯ Respiratory Therapist - PFT Lab
- ◯ Respiratory Therapist - Clinic CRE
- ◯ Admin/Clerical
- ◯ Other



3. As part of the roll out of the project, staff education/information was circulated in a variety of ways. Please rate how helpful you found the following education methods. (If you were not aware of a method, "N/A" but please indicate if you think you would have found it helpful)

	Extremely helpful	Somewhat helpful	Somewhat unhelpful	Not hel
Written resources	◯	◯	◯	(
Flow Diagrams	◯	◯	◯	(
Informal discussion with others	◯	◯	◯	(
In lab medication order favourites in CC	◯	◯	◯	(
Lunch and learn session	◯	◯	◯	(
Signs/posters	◯	◯	◯	(

4. Have you had a chance to participate in the new change in any way?

◯ Yes

◯ No

5. Please rate how much you agree with the following statements about the new process.

	Strongly agree	Agree	Neither agree no disagree
The new process is easier to follow.	◯	◯	◯
I am confortable using/participating in the new process	◯	◯	◯
The new process has been effectively communicated between disciplines within the clinic and lab	◯	◯	◯
The new process has decreased by workload	◯	◯	◯

	Strongly agree	Agree	Neither agree no disagree
The new process has improved the patient/care experience	◯	◯	◯

6. Please provide any suggestions to improve upon the rollout of the process to improve on the process itself.

Regarding sustainability

The goal of this project is about changing a process in BDR testing to improve environmental sustainability of the services we deliver.

7. Please rate how much you agree with the following statements.

	Strongly agree	Agree	Neutral
Reducing the impact of healthcare on the environment is important to me.	◯	◯	◯
The new process has a positive impact on the environment that makes sense to me.	◯	◯	◯
The new process makes me better able to do the right thing for the environment in my workplace.	◯	◯	◯

8. Please provide any suggestions of additional environmentally focused changes you would like to see in our workplace.

Appendix 3: Patient survey of intervention implementation

Pulmonary Team Patient Survey

Purpose of this Survey

The Pulmonary Team is committed to providing care that is safe, respectful, and centered around your preferences and needs, while also being environmentally responsible.

The purpose of this short survey is to gather your feedback on:

How well we communicated for your Pulmonary Function Testing (PFT) appointment,Your awareness and willingness to help reduce environmental waste by bringing and using your own inhaler when appropriate.Your responses will help us improve the way we involve and inform patients, enhance the overall care experience, and design environmentally sustainable practices in our clinic.

This survey is anonymous and confidential. Your participation is voluntary and will not affect the care you receive now or in the future. Thank you for taking the time to share your thoughts.

Communication & Clinical Experience	
Were you able to bring your own inhaler to the testing appointment?	◯ Yes, and it was used for the test ◯ Yes, and it was not used for the test ◯ No, as I have not been prescribed inhalers ◯ No, for other reason(s) (Please select one answer.)
How was this addressed by the clinic team?	◯ I was provided with an inhaler at the clinic ◯ I was offered another solution
Please share the solution that you were offered:	_____
How did you feel about the way the clinic team handled the situation above?	◯ I felt fully supported and comfortable ◯ I felt mostly supported but slightly uncomfortable ◯ I felt neutral ◯ I felt somewhat uncomfortable or judged ◯ I felt very uncomfortable or judged (Please select the response that best reflects your experience.)
Before your testing appointment, did anyone tell you to bring your inhaler (e.g., Ventolin) to your Pulmonary Function Testing appointment?	◯ Yes ◯ No ◯ I don't remember

Before your testing appointment, did anyone tell you to bring your inhaler (e.g., Ventolin) to your Pulmonary Function Testing appointment?	◯ Yes ◯ No ◯ I don't remember
How were you informed?	☐ Phone call ☐ Appointment letter/email ☐ In-person during a previous visit ☐ I was informed in another way (Select all that apply.)
Please share other ways you were informed to bring your inhaler to the appointment:	_____
Were you informed why you might need to use your inhaler during the test?	◯ Yes, and I understood well ◯ It was explained, but I didn't understand ◯ No, it wasn't explained (Please select one answer.)

What reasons made it so you were not able to use your own inhaler for the testing appointment?	☐ I forgot ☐ I do not have one at home ☐ I was not told to bring it ☐ They are too expensive ☐ Other (please specify): ☐ Prefer not to answer (Select all that apply.)
Please share other reasons why you were unable to bring your inhaler to the appointment:	_____

Environmental Impact

	Very unlikely	Unlikely	Neutral	Likely	Very likely
Inhalers (such as Ventolin) have a high carbon footprint and can impact the environment. Knowing this environmental impact, how likely are you to bring and use your own inhaler for future tests to reduce waste and harm to the environment?	○	○	○	○	○

How clear and helpful was the information you received about bringing and using your own inhaler to reduce waste and support environmentally friendly care?

○ Very helpful and clear
○ Somewhat clear
○ Not clear
○ I did not receive any information
(Please select one.)

How well did the clinic staff support you in making informed and comfortable choices about bringing and using your own inhaler to reduce waste and harm to the environment?

○ I felt very supported and respected
○ I felt somewhat supported
○ I felt neutral
○ I felt unsupported or pressured
○ Not applicable
(Please select one.)

What would encourage you to remember and bring your inhaler to your appointment?

☐ A reminder call/text/email before my appointment
☐ Knowing it reduces harm to the environment
☐ Knowing it reduces waste
☐ Other
(Select all that apply.)

Please share other ways to encourage you to remember and bring your inhaler to your appointment: _____

Do you have any suggestions for reducing the environmental impact from Pulmonary Function Testing?

_____

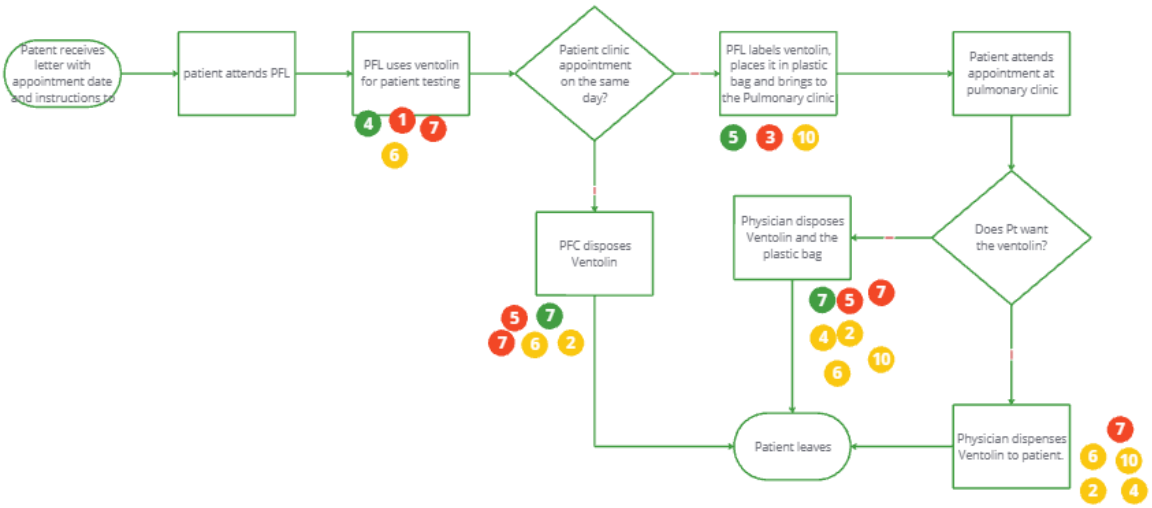
OPTIONAL - We occasionally invite patients to provide feedback or participate in future quality improvement initiatives to improve patient care. If you are interested in being contacted for such opportunities, please provide your name and preferred contact information below. This information will remain confidential and used only for this purpose.

Name (optional) _____

Phone Number (optional) _____

Email address (optional): _____

Appendix 4: Process map prior to implementation interventions



Process map of BDR testing at PLC PFT lab. Green circles identify environmental resources, red circles identify financial resources, and yellow circles identify social resources.

Critical success factors

Please select one or two of the below factors that you believe were most essential to ensure the success of your project changes.

People	Process	Resources	Context
☐ Patient involvement and/or appropriate information for patients - to raise awareness and understanding of intervention **☐x Staff engagement** ☐ MDT / Cross-department communication ☐ Skills and capability of staff ☐ Team/service agreement that there is a problem and changes are suitable to trial (Knowledge and understanding of the issue) **☐Support from senior organisational or system leaders**	☐ clear guidance / evidence / policy to support the intervention. ☐ Incentivisation of the strategy – e.g., QOF in general practice ☐ systematic and coordinated approach ☐ clear, measurable targets ☐ long-term strategy for sustaining and embedding change developed in planning phase **☐ integrating the intervention into the natural workflow, team functions, technology systems, and incentive structures of the team/service/organisation**	☐ Dedicated time **☐ QI training / information resources and organisation process / support** ☐ Infrastructure capable of providing teams with information, data and equipment needed ☐ Research / evidence of change successfully implemented elsewhere ☐ Financial investment	☐ aims aligned with wider service, organisational or system goals. ☐ Links to patient benefits / clinical outcomes ☐ Links to staff benefits **☐ 'Permission' given through the organisational context, capacity and positive change culture.**

This template is adapted from SQUIRE 2.0 reporting guidelines.

Template References

- SQUIRE | SQUIRE 2.0 Guidelines (squire-statement.org)
- Home | Sustainable Quality Improvement (susqi.org)