Revisiting the Common Canister Protocol

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Abstract

Introduction: The COVID-19 pandemic spotlighted many healthcare shortcomings, one of which was drug availability (Bookwalter, 2021). A common canister protocol (CCP) for metered dose inhalers (MDI) has been reported as a method to manage hospital costs and drug limitations (Larson et al., 2015). The major concern in a CCP has been infection control. Our facility performed a quality improvement (QI) project in our pulmonary services department to establish our current infection control risk of our CCP by utilizing the 3M™ Clean-Trace™ Luminometer LX25 Adenosine Triphosphate (ATP) Monitoring System to determine the level of biomatter post disinfection with hospital-approved agents (Oxivir and Sani Wipes) against a control. Biomatter on these canisters measured < 250 Relative Light Units (RLU) was considered sanitized and negligible.

Methods: IRB approval received for an investigational study on a quality improvement process. Nine Respiratory Care Practitioners (RCP) were trained and identified as competent in the study protocol and procedure. Two groups of canisters were identified to determine the effectiveness of our CCP: Group 1 (control) a new, unused MDI, and Group 2 (intervention) a used post-sanitized MDI. Biomatter levels were measured in both groups using the 3M™ Clean-Trace™ Luminometer LX25 Adenosine Triphosphate (ATP) Monitoring System by swabbing both the actuator and canister. This work took place between February 23, 2024 and May 31, 2024. The failure rate was established as $\geq$ 250 RLU (3M™ Healthcare, n.d.).

Results: Nine Respiratory Care Practitioners following training and established competencies performed 115 tests on 8 in-use MDI actuators and canisters and 186 on 9 control canisters. The mean intervention RLU post-sanitizing was 51.2 (range 487) and the control RLU mean was 23.1 (range 123). There were 2 failures in the intervention group with a mean of 453 and a failure rate of 1.7%. The mean days tested post-sanitizing was 4.6 (range of 20). A two-tailed t-test was performed between the cannisters sanitized with Oxivir and Sani Wipes and found no significant difference where $p = 0.32$ (t Critical two-tail = 1.99).

Conclusions: CCPs have been demonstrated to decrease the associated cost of facility medication administration yet infection control concerns have limited incorporation of CCPs. The implementation of the 3M™ Clean-Trace™ system in our facility CCP provided real-time monitoring of our infection control process. The use of this system in a CCP may prove beneficial to assist facilities in realizing the cost benefits of a CCP. Further research incorporating this monitoring system for a CCP is recommended.

Keywords: Common canister protocol, drug scarcity during COVID-19, reusing metered dose inhalers, healthcare drug savings

Revisiting the Common Canister Protocol

The COVID-19 pandemic brought public attention and scrutiny to many healthcare shortcomings. One of these shortcomings was ongoing and pandemic-caused drug scarcity issues with an unprecedented increase in medication needs and demand (Bookwalter, 2021; Hendeles & Prabhakaran, 2020; Tsai et al., 2024). One reported method to manage and alleviate healthcare drug limitations and costs is a common canister protocol (CCP) for metered dose inhalers (MDIs) (Larson et al., 2015). A primary concern of the common canister protocol, especially during the COVID-19 pandemic, is the potential for cross contamination from residual biomatter.

The common canister protocol is not without controversy. According to Larson et al. (2015), some researchers need to be more convinced that the benefits of the common canister protocol outweigh even a minimal risk of cross-contamination. It is argued that protocol adherence for staff hand washing and MDI disinfection cannot be guaranteed (Larson et al., 2015). Neel and Tauman (2012) feel that the debate on cross-contamination surrounding the common canister protocol is perplexing because the volume of published data shows no clinically applicable cross-contamination when protocols are followed precisely and accurately. Their work reviewed biomatter detection methods across ten studies (Neel & Tauman, 2012). One study reviewed detected cross-contamination with bacteria commonly found in the respiratory tract, and four had a small quantity of *Staphylococcus Enterococcus* and *Enterobacteriaceae* due to the spray method for decontamination. This group universally felt that these CCP programs reviewed were safe, had minimal cross-contamination risk (all with spacer usage), and had a 50% decrease in associated costs (Neel & Tauman, 2012). Most discovered research utilized isopropyl alcohol as the primary disinfecting agent. As demonstrated in this QI project, to address and improve upon the associated risks mentioned above, adding a post-sanitizing biomatter level testing mechanism to the CCP may further help alleviate risk potential.

Our healthcare facility utilizes a common canister protocol for the Pulmonary Services Lab and outpatient pulmonary clinics. This policy dictates that common-use MDIs are to be administered with a spacer (one-way valve holding chamber). Staff are to clean hands, don

gloves, pre- and post-clean the MDI with non-bleach hospital-approved disinfectants (currently Oxivir and Sani Wipes), administer the medication as indicated, and not allow the patient to touch or exhale into the device. Sanitized metered-dose inhalers are stored in a controlled unit in clean individual plastic bags and labelled. Metered dose inhalers expire on day 28.

We performed a quality improvement (QI) project to identify our CCP cross-contamination risk using the 3M™ Clean-Trace™ Luminometer LX25 Adenosine Triphosphate (ATP) Monitoring System. This system identifies biomatter measurement levels in Relative Light Units (RLU). We performed sanitizing with hospital-approved disinfecting wipes (Sani Wipes and Oxivir) and measured RLU levels against a control (unused canister). The manufacturer (3M™, 2013) recommends an environmental surface best practice fail threshold of greater than or equal to 250 RLUs. For this QI project, canister biomatter measured at less than 250 Relative Light Units (RLU) was considered sanitized and negligible (3M™ Health Care, 2013). A secondary outcome was explored related to educational factors of the project participant training process. Staff participated in pre- and post-teaching surveys that incorporated feedback via a 5-point Likert scale. Available responses ranged from strongly disagree to strongly agree. Participant responses remained anonymous via a Qualtrics™ survey application. An institutional review board (IRB) approval was obtained for an investigational research study.

Methods

Databases including MedLine, Google Scholar, and PubMed were searched for investigation-related terminology; MDI common canister protocol, common canister protocol, revisiting common canister protocols, common canister protocols and potential colonization, metered dose inhalers in hospitals, drug shortages during COVID-19, aerosol use in the pulmonary function lab, disinfecting metered dose inhalers, reusing MDIs, nebulizer treatments during COVID-19, albuterol inhaler cost during COVID-19, nebulizer vs. MDI, and inhaler dose waste. Minimal peer-reviewed literature was found. The primary search terms yielded 42 pieces meeting the criteria for review, 25 were accepted for applicability, and 17 were removed due to duplication and failure to address common canister protocols, infection or cross-contamination, drug cost and shortages, and manufacturer usage of biomatter surveillance.

Study Design

Nine pulmonary services department-specific respiratory care practitioners (RCP) participated in this project. Participating staff were instructed one-on-one in the UC Davis Health Common Canister Protocol and the project requirements. Training included the use of the 3M™ Clean-Trace™ Luminometer LX25 Adenosine Triphosphate (ATP) Monitoring System, supplies, documentation, labeling of the canisters, the disinfecting process, RLU biomatter levels and meaning, and if re-sanitizing was required based on results.

Two canister groups were established to determine the effectiveness of our common canister protocol. The control group, consisted of new, unused metered dose inhalers, and the intervention group consisted of post-sanitized, in-use metered dose inhalers. Both group biomatter levels were measured using the 3M™ Clean-Trace™ Luminometer LX25 Adenosine Triphosphate (ATP) Monitoring System and the 3M™ Clean-Trace™ surface ATP test swab. Both the control and intervention MDI actuators and canisters were measured and recorded between February 23 and May 31, 2024. Relative light unit measurement failure rates were established as $\geq$ 250 (3M Healthcare, 2019; 3M Health Care, n.d.).

Results

The values were obtained by calculating the mean relative light units (RLUs) for both the control and intervention metered dose inhalers. The mean RLUs of both groups were calculated, as well as the mean post-sanitizing day and failure rate. A two-tailed t-test was also performed to compare the canisters sanitized with Oxivir and Sani Wipes (Table 1). In addition to these quantitative measures, staff feedback was collected via an 8-question, 5-point Likert Scale survey to gauge teaching effectiveness. The survey included response options ranging from 'strongly disagree' to 'strongly agree'.

Table 1

t Test assuming unequal variance

Oxivir vs. Sani Wipe Results		
Statistics	**Oxivir**	**Sani Wipe**
Mean RLU	57.6	44.7
n	58	56
p	0.32	
	Intervention	**Control**
Mean RLU	51.2	23.1
n	115	186

After training and establishing competencies, nine Respiratory Care Practitioner participants performed 115 tests on eight in-use (intervention) MDI actuators and canisters and 186 on 9 MDI actuators and canisters in the control group. The median RLU count post-sanitizing in the in-use group was 51.2 (range 487). The control RLU count median was 23.1 (range 123). In-use canisters passed set limits, and two failed with relative lumen counts of 415 and 491 (mean 453). The rate of failure was 1.7%. The two RLU failures were from the same participant using an Oxivir sanitizing wipe. The median day tested post-sanitizing was 4.6 (range 20 days). A two-tailed t-test between the canisters sanitized with Oxivir and Sani Wipes found no significant difference $p = 0.32$ (t Critical two-tail = 1.99).

The pre-testing staff survey revealed a total of 8 submissions. The post-testing staff survey revealed a total of 7 submissions. There was a loss of one staff participant in the post-test survey due to an extended leave of absence. There was a knowledge gain in 7 of the eight questions, with one question lost due to technical issues. Not taking into the loss consideration, 83% (pre-instruction N = 30 pre, post-N = 55) of the participants reasoned positively about the training, 0% (pre-instruction N = 16, post-N = 0) did not feel adequately prepared, and a 95% neutral decrease (pre-instruction N = 23, post-N = 1). See the Appendix 2 for details.

Discussion

Most available literature on common or shared canister protocols after 2010 have not had a comprehensive evaluation, are in non-intubated patients, decontamination is with isopropyl alcohol, and indicated the use of one-way valve chambers (spacer) (Gowan et al., 2016; Neel et al., 2012). Most presentations were either abstracts or poster presentations and were not published in peer-reviewed medical literature, presenting descriptive vs. experimental findings showing weak strength of evidence (Gowan et al., 2016). The level of disinfection for CCP has not yet been established. Current recommendations from the CDC include appropriate exposure contact time with the germicide and strict adherence to current disinfection guidelines (Rutala et al., 2024).

Neel et al. (2012) concluded that despite not having a thorough safety evaluation, the common canister protocol had minimal cross-contamination risk (all with spacer usage) with their review of ten microbiologic evaluations and with a 50% decrease in associated costs. In a prospective trial by Gowen et al. (2016), the authors determined that a shared MDI canister on mechanically ventilated patients with 353 randomized patients (201 participants in the shared canister group and 152 in the single-patient canister group) had similar rates of VAP, LOS, and mortality. This group also found an increased risk with what they classified as ventilator-associated events and concluded there may be associated cost savings for shared canister MDI therapies (Gowan et al., 2016). Liou et al. (2014) found no bacterial growth on recycled metered dose inhalers. All articles indicated that further research is needed.

In pulmonary diagnostic procedures, bronchodilators via metered dose inhalers are essential for testing airway reversibility, bronchodilator responsiveness testing, and evaluating, treating, and testing causative bronchospasm (McLaughlin et al., 2019). The early surges in the COVID-19 pandemic and other previously mentioned issues led to a severe and disastrous shortage of albuterol and other inhalers, significantly impacting patient care (Hendeles & Prabhakaran, 2020). The re-emergence and ongoing use of common canister protocols in such care facilities as the UC Davis Health pulmonary services lab allowed for continued treatment and testing capabilities.

Catastrophic closures of global pharmaceutical factories amplified ongoing pre-pandemic drug shortfalls, thus heightening drug scarcities and healthcare initiation of drug limits for highly in-demand medications such as albuterol metered dose inhalers (MDI) (Bookwalter, 2021; Hendeles & Prabhakaran, 2020). Ideally, patients would have patient-specific single-use MDIs, but because of increasing drug scarcity during the COVID-9 pandemic, healthcare facilities were required to make creative, innovative, and outside-the-box thought processes with their pharmaceutical strategies, distribution, and use while refocusing on prior acceptable drug protocols such as the MDI common canister protocol (CCP) (Cooper et al., 2020; Bookwalter, 2021). To compound and exacerbate the albuterol MDI scarcity, the American Thoracic Society (ATS) urged against the aerosolization of liquid medications for inhalation due to the heightened and associated risks, exacerbating the increasing demand for metered dose inhalers (MDI) (Pasnick et al., 2020). Pre-pandemic, to manage costs and drug limitations, the pulmonary services lab (PSL) at UC Davis Health routinely used an MDI common canister protocol but had no way to determine or measure the safety of such practices. Due to exacerbated pharmaceutical issues from COVID-19 and ongoing drug supply chain issues, previous system-wide and departmental policies and procedures regarding the common canister protocol were updated in 2023. See the Appendix 1 for additional sample items.

Cooper et al. (2020) rapidly developed and implemented an Albuterol MDI canister reassignment process during the COVID-19 pandemic. Data was obtained and reviewed from 162 hospitals affiliated with a single extensive healthcare system (Cooper et al., 2020). Before the pandemic, 98% of their patients received medication via a nebulizer vs. a metered dose inhaler during the pandemic (Cooper et al., 2020). After the implementation of the reassignment protocol, there was a 60% decrease in nebulizer usage that was sustained with greater than 50% reduction (Cooper et al., 2020). The group found that the canister reassignment was instrumental in allowing the delivery of bronchodilator therapy for COVID-19 patients while allowing an essential infection prevention strategy to protect our healthcare providers from the potential aerosolized microorganisms associated with nebulizer therapy (Cooper et al., 2020; Amirav & Newhouse, 2020).

Despite a lack of evidence during the COVID-19 pandemic, there was an increased concern for viral transmission risk concern with nebulized respiratory treatments causing a substantial MDI shortage, and transmission risk was considered inconclusive (Sethi et al., 2020; Goldstein et al., 2021). There was expert concern about the heightened infection transmission risk from nebulizer treatment aerosols and droplet nuclei because nebulizers can produce particle sizes of 1–5 µm (Amirav & Newhouse, 2020). The risk of infection transmission via droplet nuclei and aerosols with heightened propulsion may increase during nebulizer treatments, potentially carrying viruses and bacteria deep into the lung (Amirav & Newhouse, 2020; Tang et al., 2006). To further reduce risk, MDIs should be used with one-way valve spacers (valved-holding chambers) that permit airflow in but not out of the patient's mouth, thus improving efficacy compared to inhaled nebulized treatments (Cates et al., 2013; Mei-Zahav & Amirav, 2020).

Adenosine triphosphate (ATP), a vital coenzyme, is regarded as a significant biological molecule (Chu et al., 2022). ATP is viewed as an energy reservoir and a source and origin of life (Chu et al., 2022). Technology that measures ATP bioluminescence expresses levels of ATP as RLUs, which are found in all living cells and organic materials (Omidbakhsh et al., 2014). During the RLU measurement process, samples are exposed to a lysis buffer (ATP-releasing agent), luciferin and luciferase (both enzymes), and an ATP-activated light-producing substrate (Turner et al., 2010). ATP can then be quantified by the measuring device by the amount of light discharged during the exposure reaction and expressed as RLUs (Turner et al., 2010).

Proprietary pharmaceutical costs vary contractually among healthcare facilities, and specific cost savings vary according to the UC Davis Health Hospital and clinics. According to the National Drug Codes (NDC) List (2024), the current 2024 wholesale cost for an Albuterol MDI with 90 inhalations is $2.20, whereas a single dose vial of albuterol sulfate is $0.06. Larson et al. (2015) concluded that the common canister protocol had significant cost savings with a common canister approach ranging from $75,000 to $303,000 with their review (hospital size and period varied). Residual drug waste remaining in MDI canisters is also significant, with only approximately 11.3% of actual drugs used and 87 to 88.7% discarded (Larson et al., 2015; Sakaan et al., 2015). Treatment preparation time varies from nebulizers (mean 2.05 minutes;

95th % CI: 1.45-2.15 minutes) and MDIs (0.3 minutes; 95th% CI: 0.03-0.5 minutes) (Alhaider et al., 2014). Total treatment time also varies: A nebulizer takes 9.39 minutes (95th % CI: 9.06-10.12 minutes) to complete, and MDIs take 4.38 minutes (95th % CI: 4.2-4.56 minutes) (Alhaider et al., 2014). Evidence indicates that usage shortens prep time by 98% and delivery time by 48% ($p < 0.01$) (Alhaider et al., 2014).

Organizational or departmental measures of variability can be assessed, calculated, and narrowed from the manufacturer's failure rate of 250 RLUs by calculating independent mean and standard deviations (SD) where 2-SDs would calculate a probability distribution goal of 95% (3M Health Care, 2019; El Omda & Sergent, 2023). In the presented QI project, the Median RLU count post-sanitizing in the in-use group was 50.8 (range 487), which would decrease the pass rate to 137 RLUs, thus practically ensuring fewer cross-contamination possibilities. The median day tested post-sanitizing was 4.6 (range 20 days). To reduce the cross-contamination risk and improve sanitizing, departments could improve workflows by sanitizing in-use MDIs daily, even for those in sporadic use. A two-tailed t-test between the canisters sanitized with Oxivir and Sani Wipes found no significant difference (p= 0.32). The two post-sanitizing failure results of 1.7% (RLUs of 415 and 491) were from the same participant and sanitizing wipe (Oxivir). Failure rates can be attributed to multi-participant handling of the MDI, actuator, and storage bag, multi-disciplinary access storage where labeling is viewed for required documentation, sanitizer failure, and inadvertent touching of unclean surfaces before obtaining results. Failure prevention includes further participant process education, workflow improvements, and narrowing of participants who swab for results. Our failure rate of 1.7% demonstrates the effectiveness of the monitoring process. Established biomatter levels have not yet been described relative to cross-contamination, resulting in adverse outcomes and warranting further investigation and is beyond the scope of this project. Application of acceptable biomatter limits should be identified in collaboration with institutional infection control and sterilization disciplines.

Before implementing the common canister protocol into their policies, healthcare organizations should factor in the risk vs. the benefit of such a program. The strengths of using the CCP with ATP measurement capabilities include significant cost savings from reusing MDI

medications, increased medication security during times of MDI shortages, and ease of use, functionality, and training of RLU measurement devices such as the 3M™ Clean-Trace™ Luminometer LX25 Adenosine Triphosphate (ATP) Monitoring System. The study sample, environmental constraints, methodology, and data analysis would be easy to replicate in other healthcare organizations. Limitations and weaknesses could include potentially contaminated patient exposures at larger healthcare institution departments where a larger population of staff handles MDIs, costs of the monitoring equipment, supplies, and maintenance, and who would be responsible for the monitoring and quality control. Other limitations included data collected from a single staff-controlled department in a healthcare institution where the swabbing process was observed and non-blinded using a device and supplies from a single manufacturer.

Conclusion

Common canister protocols have been demonstrated to decrease the associated cost of facility medication administration. Infection control concerns have limited the incorporation of CCPs. The implementation of the 3M™ Clean-Trace™ system to our facilities' CCP provided a real-time monitor of our infection control process. The use of this system in a CCP may prove beneficial in helping facilities realize the cost benefits of a CCP. Further research incorporating this monitoring system for a CCP is recommended.

Declaration of Financial/Other Relationships

There are no financial conflicts of interest to disclose.

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Appendix 1

UC Davis Health Policy: Common Canister Protocol for Pulmonary Services Lab and Outpatient Pulmonary Clinics

I. SETTING

Ambulatory clinics, Pulmonary Services Lab performed by: Respiratory therapists (RTs)

II. PURPOSE

To provide patients with metered dose inhaled (MDI) medication in an effective and efficient manner that minimizes the risk of MDI cross contamination and patient infection.

III. POLICY

A. Only in the Pulmonary Services Lab and outpatient pulmonary clinics, MDI medications may be re-used between patients if single use spacers are used by patients and the MDI canister and actuator is cleaned and disinfected with a hospital approved disinfectant between uses. Disc type inhalers and nasal sprays do not fall under the protocol described in this document. MDIs used on patients who are on any type of transmission-based isolation precautions (refer to policy 11025 Standard and Transmission Based Precautions for Infection Control) may not be re-used.i.e.

B. PROCEDURE/RESOPNSIBILITY

1. Administration of MDIs.

a. All applicable MDI drugs will be administered using spacers. If the drug ordered is not compatible with a spacer, then the MDI cannot be reused between patients.

b. Patients should be capable of following instructions and be instructed to not exhale into the patient spacer during MDI administration.

c. Some dosage counters affixed to MDI actuators prevent effective cleaning and disinfection (due to difficulty wiping all surfaces of dosage counter). If a dosage counter is not able to be used because of this, manual methods of tracking doses remaining in a particular MDI may be employed. Alternatively, MDIs are to be disposed of after a set period of time of 28 days (last day of use is day 27). The MDI expiration date of 28 days will ensure re-used MDIs still have doses available for patient use. MDI's are to be labeled accordingly.

d. All MDI medications must be administered according to the steps and requirements outlined in hospital policy 4055 Medication Administration.

e. Staff should only retrieve MDIs for administration with clean hands and must never handle MDIs with used personal protective equipment (PPE). Clean PPE may be worn during drug administration per standard precautions (consult aforementioned policy 11025). Patients are not to handle or self-administer the MDI (canister or actuator).

2. Cleaning and disinfection

a. After drug administration, staff remove the MDI from the spacer. The spacer may be provided to the patient for re-use or discarded as needed.

b. Staff separate the MDI canister from the actuator and thoroughly wipe both canister and actuator with a hospital approved disinfectant (consult policy 2111 Disinfection in Patient Care Areas, attachment 1 , for a list of hospital approved disinfectants).

1) Bleach products should not be used for cleaning and disinfection of MDIs

2) Cleaning and disinfection may require two steps with separate wipes if either the canister or actuator are visibly soiled

3) Staff should follow the wet time for the hospital approved disinfectant used

c. After cleaning and disinfection of the MDI, staff perform hand hygiene with an appropriate hand hygiene product. Refer to policy 11023 Hand Hygiene for further details on expected hand hygiene practice.

d. Once hospital approved disinfectant wet time has been observed and canister and actuator are dry, staff re-assemble the canister and actuator and return the MDI to appropriate medication storage area in a clean plastic bag. Staff ensure appropriate medication labeling is re-applied, as necessary.

e. Prior to next dose administration, staff follow the above steps and disinfect the canister and actuator. Both canister and actuator must be completely dry prior to MDI administration.

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Appendix 2

8 question 5-point Likert Scale Survey

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total Responses
I understand how to swab the MDI using the 3M Clean Trace™ Surface ATP swabs.	Pre	1	1	2	2	2	8
	Post	0	0	0	0	7	7
	Change	-1	-1	-2	-2	5	-1
I understand how to use the Clean Trace™ Luminometer LX25 analyzer.	Pre	2	2	2	2	0	8
	Post	0	0	0	0	7	7
	Change	-2	-2	-2	-2	7	-1
I understand the levels of passing vs. non-passing for the Clean Trace™ Luminometer LX25.	Pre	2	1	2	3	0	8
	Post	0	0	0	0	7	7
	Change	-2	-1	-2	-3	7	-1
I feel that the Clean Trace™ Luminometer LX25 will help the PSL with MDI disinfecting strategies.	Pre	2	0	2	3	1	8
	Post	0	0	0	0	7	7
	Change	-2	0	-2	-3	7	-1
I feel that the Clean Trace™ Luminometer LX25 will improve how I feel about using MDIs between patients.	Pre	2	0	2	3	1	8
	Post	0	0	0	0	7	7
	Change	-2	0	-2	-3	7	-1
Would you recommend continuing the use of the Clean Trace™ Luminometer LX25?	Pre	2	0	3	2	1	8
	Post	0	0	1	0	6	7
	Change	-2	0	-2	-2	5	-1
I understand UC Davis Health's common canister protocol policy and procedure.	Pre	0	?	1	5	0	?
	Post	?	?	?	?	?	?
	Change	?	?	?	?	?	?
After the one-on-one instruction and PPP, I understand how to use the Clean Trace™ Luminometer LX25.	Pre	1	0	4	3	0	8
	Post	0	0	0	0	7	7
	Change	-1	0	-4	-3	7	-1
I understand the importance of documenting the results in the common canister protocol CQI research log.	Pre	0	0	5	2	1	8
	Post	0	0	0	0	7	7
	Change	0	0	-5	-2	6	-1
Participant Demographics							
Age Range (years)		**20-30**	**31-40**	**41-50**	**50+**		
	Pre	0	3	5	0		8
	Post	0	3	4	0		7
	Change	0	0	-1	0		-1
Years as a Respiratory Therapist (years)		**< 5**	**6 - 10**	**11-20**	**21+**		
	Pre	0	3	5	0		8
	Post	0	2	5	0		7
	Change	0	-1	0	0		-1