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Evidence-Based Practice - Oral Mucositis Prevention in Chemotherapy Patients: A Benchmark Project

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Contents

Acknowledgments

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Executive Summary

The purpose of this implementation project is to help decrease the rates of mucosal barrier injuries (MBI's) and oral mucositis (OM) in patients receiving chemotherapy on the oncology unit. In 2022, it was reported that seven MBI's occurred on an oncology unit in a large county hospital in an urban area. This secondary infection has the potential to increase morbidity, increase treatment costs, lengthen hospital stays, and can have devastating impact on quality of life (Correa et al., 2019). There is currently no protocol in place at the proposed location for this intervention that will help reduce this potential side effect of chemotherapy. If a secondary infection occurs during admission, the hospital is responsible for the cost. The lack of a preventative protocol created interest for multiple stakeholders. Research shows that an evidence-based oral care protocol should be implemented to help prevent this secondary infection. The intervention chosen not only had to be effective, easily available, low cost, but also needed to be easily performed.

According to research, the best way to prevent MBI's and OM is to create an oral care protocol that simply includes brushing teeth and using a mild oral rinse twice a day. Prior to the trial period, education will need to be completed for all staff on proper oral assessments, proper documentation for tracking purposes, and patient education. This proposed project will take an interdisciplinary team to accomplish with all hospital stakeholders involved.

Evidence-Based Practice – Oral Mucositis Prevention in Chemotherapy Patients: A Benchmark Project

Infection prevention is one of the most important priorities in nursing care. OM is one of the most painful side effects of chemotherapy treatment. This secondary infection is a serious complication that causes pain, issues with eating, swallowing, and causes unnecessary distress. Prevention of OM using proper interventions to create an evidence-based oral care protocol will help ensure a more positive patient outcome.

Rationale for the Project

This proposed evidence-based oral care protocol is to help decrease the MBI/OM rates on an oncology unit in a large county hospital in patients receiving chemotherapy. Over twelve months, in 2022, there were seven MBI's documented. This secondary infection has potential to increase morbidity, increase treatment cost, lengthen hospital stays, and can have a devastating impact on quality of life (Correa et al., 2019), and occurs in approximately 14%-81% of patients undergoing chemotherapy (Edwards et al., 2020). After researching this issue, it was found there was no protocol in place for prevention at the proposed project location. MBI's and OM have been reported as the worst, and most painful side effect of cancer therapy (Zanolin et al., 2014).

As healthcare workers, it is of utmost importance to provide high-quality patient-centered care. This proposed change will create an oral care protocol to help prevent this secondary infection and improve the quality of life for our patients. The research question guiding this proposed intervention is: In adult patients receiving systemic chemotherapy, how does an oral hygiene regime (brushing teeth and using a mild oral rinse twice daily) compare to current practice (brushing teeth once daily) affect mucosal barrier injury-related bloodstream infection rates/mucositis within twelve weeks of implementation?

Literature Synthesis

We must first understand the patient's experience to grasp the importance of preventing this secondary infection. Several studies focused on the level of distress, patient experience, and nursing knowledge of proper patient assessment for OM (Mondonca et al., 2019; Raymond & Agyeman-Yeboah, 2022; Zanolin et al., 2014). Distress comes from diagnosis, waiting for treatment, undergoing treatment, side effects, not knowing their future, and patients who have never received chemotherapy before (Mendonca et al.). OM is considered a side effect that does not affect all patients receiving chemotherapy. Patients with OM endure extra treatment for the infection, have an increased hospital stay, and have severe pain that affects their nutritional status. OM is also associated with complex physical, psychological, and social effects that lead to significant restrictions in daily life (Zanolin et al.). The first step in prevention is identification with proper assessment. This will allow early detection so proper interventions can be applied. Nursing staff need to be properly educated on OM and how to perform a proper assessment. With OM being a possible side effect, discussion needs to be added when educating about nausea, hair loss, and other complications. Evidence-based practice oral care protocols need to be initiated along with ongoing assessments, continual education for nurses, and patient education (Raymond & Agyeman-Yeboah).

Multiple interventions have been researched to prove their effectiveness on prevention of OM. Two studies by (Correa et al., 2019; Edwards et al., 2020) compared oral cryotherapy (OC) with eight other interventions. The other interventions researched were elemental oral nutritional supplements, beta-hydroxy-beta-methyl butyrate, immune enhanced oral nutrition supplements, fat soluble vitamins, glutamine, zinc, miscellaneous nutritional supplements, and honey. The science behind OC shows it is the vasoconstriction created by the ice that restricts delivery of

cytotoxins in the chemotherapy that reduces the possibility of OM (Correa et al.). OC was proven to help prevent OM and gave indication for updating clinical guidelines for the Multinational Association of Supportive Care in Cancer/International Society of Oral Oncology (MASCC/ISOO) (Edwards et al.). OC is not only effective, but affordable, easily applied, had no serious side effects reported, and has become standard in OM prevention (Correa et al.)

Honey showed to potentially inhibit growth of bacteria that would lead to OM, but it was found that the actual benefit from the honey depends on the geographical location of where it came from (Edwards at al., 2020). This study resulted from a small sample size, gave poor descriptions of the interventions, and had insufficient evidence. The interventions reported low or very low certainty of evidence, so no change in protocol was suggested (Edwards et al.)

Glutamine was researched along with a multi agent method, MuGard, Caphosol, and a standard topical therapy in articles by (Hong et al., 2019; Murdock & Reeves, 2019; Tang et al., 2022). Glutamine is an antioxidant (one of the most abundant non-essential amino acids in the body) and is vital for immune regulation and helps maintain cell structure (Tang et al.). Glutamine supplement was not significant for preventing OM but did show strength in lessening severity (Tang et al.). This data was collected from a small sample size and requires more research to confirm. The multi-agent method tested used six interventions that included professional oral care, multi-agent combination oral care protocol, patient education, saline, sodium bicarb, and chlorhexidine (Hong et al.). Multi agent combination showed no promise for prevention but should be noted it was also tested on a small sample size. Patient education empowered patients to help manage their own oral health (Hong et al.). Patients were educated on self-assessments for OM. Patient education and self-assessment was found to show a significant reduction in severity but did not prevent OM (Hong et al.). Saline, sodium bicarb, and

chlorhexidine showed no benefit for preventing OM (Hong et al.). MuGard and Caphosol used as analgesics and neither helped to alleviate pain associated with OM (Murdock & Reeves). These studies found overall more research and data on prevention needs to be collected to change or create a protocol.

Another study by (McGuire et al., 2013) compared seven interventions to basic oral care. Data collected on dental care, normal saline, sodium bicarb, mixed medication mouthwash, chlorhexidine, calcium phosphate, and an oral care protocol. MASCC/ISOO considers basic oral care to be the most effective in treating OM and created a guideline in 2004 (McGuire et al.). This practice of basic oral care (brushing teeth and using a mild oral rinse) reduces the likelihood of oral infection, helps to minimize trauma-induced mucosal tissue injury, and promotes comfort (McGuire et al.). The other seven interventions showed no significance for change due to insufficient or conflicting evidence. Dental care by professionals does prove to have positive attributes for overall oral health and helps reduce infection (McGuire et al.). Systematic reviews provided research in basic oral care interventions to update evidence-based practice guidelines for preventing and treating OM in cancer patients receiving chemotherapy (McGuire et al.).

Other studies compared clove oil and a normal saline solution along with Granudacyn and Octenidol (Ressen & Mahmood, 2022; Zucker et al., 2023). Clove oil is known for being an antiviral, antifungal, antibacterial, and an analgesic (Ressen & Mahmood). Patients did report clove oil helping reduce the severity of OM and heal faster, but this intervention was not tested for prevention. Normal saline was shown to promote oral health and improve severity by drying out and disinfecting the wounds (Ressen & Mahmood). Despite the positive data from this study, the author felt more research needed to be collected to create a change in method for prevention.

Granudacyn and Octenidol were compared to each other to see which one was more effective in reducing the bacterial load of the buccal tissue. The hypochlorite component of Granudacyn provides an anti-bacterial defense and is considered non-cytotoxic whereas Octenidol is a more effective antibacterial but was not considered appropriate for use due to its cytotoxicity (Zucker et al., 2023). Both interventions were tested on healthy mouths, not cancer patients, therefore there is not enough data to prove prevention of OM.

This last study by (Steinman et al., 2021) focused on seven different interventions for treatment and prevention of OM by expert nurses, physicians, and psychologists. The seven interventions are propopils, sea buckthorn pulp oil, marshmallow root tea, OralLife gel and mouthwash, mare milk, hidalgo chamomile oil, and Saliva Natura oil spray. The study found negative attributes were in some of these interventions. A few interventions took time to create and require special preparations that are not applicable in a hospital setting. Cost and availability need to also be considered. Data collected along with opinions of these top seven interventions was mostly subjective and dependent on one or two participants (Steinman et al.). This study contained limited data capability as it was based on opinions and due to its small sample size. As a result, no conclusive treatments were found to change any standards or protocols.

Project Stakeholders

The oncology patients are the most important stakeholders, along with their family and nursing staff. Their interest provides a key component to drive this evidence-based change to improve their quality of life and create positive outcomes. Of course, the hospital has an interest in the measure as well. Implementing this project has the potential to decrease costs, hospital stays, and morbidity rates. Infections can be deadly to those who have a compromised or depleted immune system due to chemotherapy. Oral care protocols, including a proper

intervention, need to be in place as a preventative measure to help ensure positive patient outcomes.

Implementation Plan

Due to the considerable amount of time needed for implementation, a benchmark study is proposed. The location for this evidence-based proposal will be an inpatient oncology unit in a large sized county hospital in an urban area. This unit is also a med-surg unit, so only qualifying chemotherapy patients will be subject to this proposed trial. The data that must be collected will be a retrospective chart review of any patients being diagnosed or treated for OM. This will give us an idea, over a certain amount of time, of how many chemotherapy patients have been affected by OM. The major steps of the plan can be implemented by using a PDSA model.

P stands for the "planning" phase, which consisted of three different steps. The first step involves getting started, assembling the team, examining the current approach, identifying potential solutions, and developing an improvement theory. The proposed intervention is for patients to brush their teeth twice daily and use a gentle mouth wash (basic oral care). MASCC/ISOO created guidelines suggesting the use of a toothbrush, and the utilization of a non-medicated oral rinse for the prevention of OM (Raymond & Yeboah, 2022). An important part of this step will be to present a proposal to key people to gain permission to proceed. These key people include the head of the oncology department, the manager of the oncology unit, and the med-surg director. Special permission will also be needed from an Institutional Review Board (IRB) if the facility has one. In this step, barriers can also be assessed and a plan for data collecting can be created.

The second step continues with the planning phase. Additional education will have to be provided for all staff involved in direct patient care. Staff participation could be a potential

barrier as this change will require the nurse to complete and document their assessment properly. Education will need to be completed for all full-time staff as well as any "as needed" (PRN) staff members. This education will include proper oral assessments and interventions documented. Time will be needed to create educational materials and educate all the necessary staff.

The third step will be to get the electronic medical record (EMR) champion to generate the order set that will be added to all patients receiving chemotherapy. This will allow for quick data retrieval from the EMR. EMR reporting will be a vital resource that can be used to pull necessary data and help identify all people currently admitted who are receiving chemotherapy. Once completed, a "go live" date can be set. This date can be set after all education is completed, the oral care orders are available in the EMR, and the supplies for the intervention are ready.

The next phase of the PDSA model is D for "do". This is when the new protocol will be put to the test. Proper documentation can be tracked using the pareto chart at the end of every shift on any qualified patients during the trail. Pareto charts are a tool that can be used to identify an area of focus, especially in process improvement projects. Any missed documentation can be recorded using the chart, and staff can be re-educated on proper documentation of the interventions. See Appendix B for an example of a pareto chart that can be used.

After the data collection period, the next phase is S which means "study". In this phase the data collected from the EMR, pareto charts, and reports from the infection prevention team will be studied to determine if the change resulted in an improvement of patient outcomes. Here the results can be compared from the baseline and discussions can be had about the overall experience with the project.

The final phase is A for "act". In this step the team decides what to do with the lessons learned and the data collected through the PDSA cycle. The team can then decide to adopt the

change as a new standard of practice, it can be decided that more data needs to be collected under a different set of circumstances, or the whole change idea can be aborted, and a new solution be tried.

Timetable/Flowchart

Appendix C is a timetable/flowchart used to demonstrate the change process. The total time planned for this project is twelve weeks. The first step of planning would be to create the interdisciplinary committee, research, and decide on an evidence-based intervention. Once the intervention is decided (brushing teeth twice daily and using a gentle mouthwash), ample time is needed to educate all necessary staff on the new requirements of documentation. Educational materials need to be created, and staff perform a "check off" on proper oral care. It can also take time to get the order set in the EMR generated and a "go live" date to be set. The data can then be collected over a twelve-week period. After data collection, the interdisciplinary team can discuss the outcome of the intervention.

Data Collection Methods

Data can be collected from the pareto charts regarding proper documentation on the intervention and from retro chart reviews from the EMR. The infection prevention team will also be able to collect data from the EMR to see how many MBI's occurred over the twelve weeks. Data then be compared to the previous year when a total of seven MBI's suggested a need for an oral care protocol. The twelve-week trial will hopefully show an improvement in patient outcomes by revealing a decrease in documented MBI's.

Evaluation

The accuracy of data collected can be determined by chart audits using a pareto chart. The pareto chart allows tracking of the documentation done by nurses and ancillary staff to

ensure that the proper assessment and data can be accurately collected. Team leaders at the end of each shift can perform chart reviews of the required documentation (oral care order, oral care being performed, and oral assessment completed) of the qualifying patients and mark the pareto chart appropriately. This will allow for proper data collection in real time. The chart review will also show any missed documentation that needs to be addressed. The infection prevention team can monitor for any new MBI's that might have occurred during this time and monitor for a decrease in incidence once the intervention is in place.

Cost/Benefit Analysis

The best part about this proposed change is that it will have zero additional cost attached to it. This project saves money for all stakeholders involved. Basic oral care consisting of oral care protocols and initiating the dental care before and during chemotherapy along with the use of a bland oral rinse has long been considered the foundation of oral hygiene in patients receiving cancer treatment (McGuire et al., 2013). Toothbrushes, toothpaste, and mild oral rinse are supplies that the hospital already has on hand and are not a chargeable cost to the patient. When the infection occurs, it is considered a secondary infection during admission and the hospital will be responsible for any extra cost for the treatment. This project will save the hospital money for the required treatment, and the additional cost of the extended hospital stay for antibiotics and save the patients from having to endure a possibly deadly infection. OM significantly increases the financial burden, and it has an added estimated cost of $17,000 (Tang et al., 2022).

Discussion of Results

Dut to time constraints for this project, it was completed as a benchmark study. The expectations for this project, if implemented, would be to see a decrease in MBI/OM rates after

implementation. This project has potential to improve patient outcomes by decreasing the risk of this secondary infection and help decrease costs by avoiding an extended hospital stay and extra treatment for the infection. Challenges and barriers to implementation can be addressed by the interdisciplinary team as they are considered leaders of their specialty. This change project would be easy to sustain, if proven effective, as it would become an oral care protocol for all chemotherapy patients and become standard practice.

Conclusions/Recommendations

To implement an oral care protocol for the prevention of MBI's/OM is highly recommended according to research. It is stated in the literature to use standard oral care (brushing teeth and using a mild oral rinse) to help decrease the risk of infection and improve patient outcomes. It is our responsibility as healthcare workers to provide high quality patient centered care that is evidence based. Prevention of OM using proper interventions to create an evidence-based oral care protocol will help ensure a benefit to all stakeholders involved.

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Appendix A

Evidence Table

Author, Year, Title	Theoretical basis for study Qualitative Tradition		Number, Characteristics, Attrition rate & why?	Independent variables (e.g., IV1 = IV2 =) Dependent variables (e.g., DV =) Do not need to put IV & DV in Legend	What scales were used to measure the outcome variables (e.g., name of scale, author, reliability info [e.g., Cronbach alphas])	What stats were used to answer the clinical question (i.e., all stats do not need to be put into the table)	Statistical findings or qualitative findings (i.e., for every statistical test you have in the data analysis column, you should have a finding)	• Strengths and limitations of the study • Risk or harm if study intervention or findings implemented • Feasibility of use in your practice • Remember: level of evidence (See PICOT handout) + quality of evidence = strength of evidence & confidence to act • Use the USPSTF grading schema http://www.ahrq.gov/clinic/3rduspstf/ratings.htm
1. Correa et al., (2019). Systematic review of oral cryotherapy for the management of oral mucositis in cancer patients and clinical practive guidelines	N/A	SR	Papers reviewed Initial (n=114) Excluded (n=78) Reviewed (n=36)	IV – OC DV - OM	Cochrane meta-analysis, LoE assigned to each modality, findings added to MASCC/ISOO database	LOE for prevention of OM using OC	LOE – II and III All proved prevention of OM with OC	Strengths and limitations: Level I study, small sample size Risk or harm: may exacerbate pain d/t OC Feasible: Yes, evidence proved guideline change.
2. Edwards et al., (2020). Nutritional interventions for oral mucositis: a systematic literature review	N/A	SLR	Articles reviewed Initial (n=908) Excluded (n=885) Reviewed (n=23)	DV – OM IV1 – OC IV2 – EONS IV3 – BHBM IV4 – IEONS IV5 – FSV IV6- Glutamine IV7 – Zinc IV8 – MNS IV9 - Honey	Certainty of evidence GRADE Protocol	Low, very low, moderate LOE assigned to each IV	Using GRADE, all proved low, very low or moderate certainty of evidence, no change in protocol suggested	Strengths and limitations: Level I study, small sample size, poor description of interventions applied, insufficient evidence Risk or harm: none Feasible: No, not enough evidence.

3. Hong et al., (2019). Systematic review of basic oral care for the management of oral mucositis in cancer patients and clinical practice guidelines	N/A	SR	Papers reviewed Initial (n=2441) Excluded (n=2414) Reviewed (n=17)	DV – BOC IV - MAM	Severity of OM Pain associated	LOE assigned to each modality, effective yes or no	No change in guidelines, BOC most effective	Strengths and limitations: Level I study, small sample sise, insufficient evidence Risk or harm: none Feasible: No, no evidence for change, continue with BOC.
4. McGuire et al., (2013) Systematic review of basic oral care for the management of oral mucositis in cancer patients	N/A	SR	Studies reviewed Initial (n=129) Excluded (n=23) Reviewed (n=52)	DV – BOC IV1 - DC IV2 - NS IV3 - SB IV4 – MMM IV5 - chlorhexadine IV6 - CP IV7 - OCP	Hadorn criteria to determine LoE, Summerfield's schema	LOE for each intervention, treatment or prevention modality	No change in guidelines, suggests OCP, no interventions proved outcomes for change	Strengths and limitations: Level I study, IV LoE varied, Risk or harm: none Feasible: Yes, no evidence for change using IV's, but recommends OCP be created.
5. Mendonca et al., (2019) Distress in the context of cancer and chemotherapy: A mixed-method study		MM	Qualitative (n=18) Quantative (n=100)	DV – LOD IV – chemo patients	Qualitative - Interviews analyzed using Amedoe Giorgi's comprehensive-emperical model Quantitative – SPSS software version 20.0, Shapiro-Wilk test, Turkey's test	Likert scale - LOD 220- max 44 - minimum Empirical-comprehensive model Phenomenological interview	Higher distress – pt w/ advanced cancer/receiving palliative chemo, pts not started chemo yet, and nearness of death	Strengths and limitations: Brings to light symptoms (other than physical) that need to be addressed and validated with proper nursing care, limited by most pts surveued were advanced stages and palliative. Risk or harm: none Feasible: Finding are useful knowledge, but does not address PICOT
6. Murdock & Reeves (2019). Chemotherapy induced	N/A	Case study – chart review	Charts reviewed (n=147)	DV – patients with OM IV1 – MuGard	Pain scale 0-10	Chi-square Fisher's exact	Baseline compared with no differenced detected from day 3-7 in patients receiving IV1, IV2 and IV3	Strengths and limitations: Level IV, small sample size, imbalance of participants in each group, Risk or harm: standard pain associated with OM

oral mucositis management: A retrospective analysis of MuGard, Caphosol, and standard supportive measures				IV 2 – Caphosol IV3 - STT		Mann-Whitney		Feasible: No findings for change, rules out these certain interventions.
7. Raymond & Agyeman-Yeboah (2022). Nurses' knowledge on assessment and management of cancer therapy-associated oral mucositis	N/A	SRQS - interviews	Participants interviewed (n=12)	DV – knowledge on assessing OM	Data colleted from interviews, response to questions to indicate certain knowledge	Theoretical thematic analysis	Nurses at front line, education for proper assessment for OM needed, suggest protocol for OM prevention	Strengths and limitations: Level V, data collected, limited by small sample size Risk or harm: none Feasible: Yes, ongoing assessments, continual education for nurses, initiate EB oral care protocols
8. Ressen & Mahmood (2022). Effect of Interventiona l Protocol Using Clove Oil Versus Normal Saline Solution Upon the Degree of Oral Mucositis Amon Patients Undergoing Chemotherap y: A Comparative Study	N/A	SRQS	30 patient with OM	DV – OM IV1 – clove oil IV2 – NSS Control (n=10) Clove oil (n=10) NSS (n=10) P value	Interviewing technique, analyzed by program SPSS Version 25 Mann-Whitney test Kendal-Taue test	Degree of oral toxicity, level of OM	Clove oil proven more effective (antibacterial, antifungal, antioxidant)	Strengths and limitations: Level V, limited sample size, found data supporting treatment of OM, but not preventing Risk or harm: none Feasible: No, more data needed for prevention, continue with BOC.

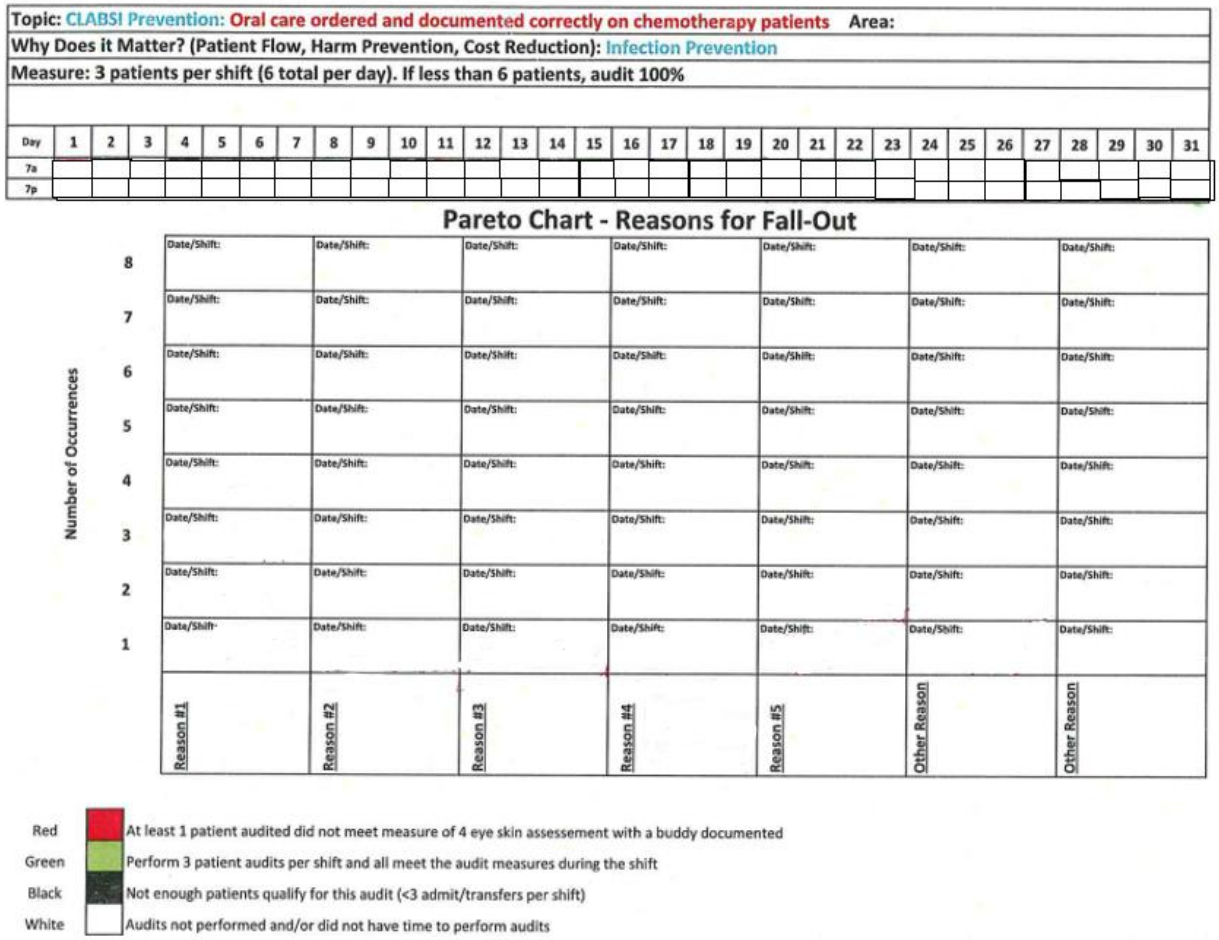
9. Steinmann et al., (2021) Nursing procedures for the prevention and treatment of mucositis induced by cancer therapies: clinical practice guidelines based on an interdisciplinary consensus process and stystematic literature search	N/A	SLR	19 nursing procedures	DV – OM IV – 19 interventions discussed	Safety Clinical experience/prevention/therapy Effort of training Practical feasibility	Rating system for each category	No significant data to create change, continue with BOC	Strengths and limitations: Level 1, discussion only Risk or harm: all deemed safe Feasible: Yes, low effort of training, No, based on time it takes to administer, No, d/t some having higher cost,
10. Tang et al., (2022) Role of glutamine in the management of oral mucositis in patients with cancer: A meta-analysis of randomized control trials	N/A	Meta analysis of RCT's	Initial (n=2168) Delupcates excluded (n=516) Ineligible (n=1591) Evaluated (n=64) Reviewed studies (n=15)	DV – OM IV – glutamine	Data collected from RCT's	Data analyzied using SMD's and 95% CI	Glutamine showed benefit in improving severity of OM, not preventing	Strengths and limitations: Level I data collected, limited by small sample size, Risk or harm: none Feasible: Yes to treat, no for prevention, more studies needed to make change
11. Zanolin et al., (2014) Patient experiences with oral mucositis caused by chemo-/ radiotherapy: a critical qualitative	N/A	LR	Initial (n=92) Excluded duplicate (n=4) Excluded inadequate focus (n=74) Excluded no reason (n=12)	IV – OM DV – symptoms	Questionnaire Interviews	N/A	Results no synthesized, limited amount of sample/studies	Strengths and limitations: Level 1, limited data, small sample Risk or harm: none Feasible: Yes, brings awareness of discomfort/patient distress/assessing patient symptoms

literature review			Reviewed studies (n=2)					
12. Zwicker et al., (2023) Anticeptic efficacy of two mouth rinses in the oral cavity to identify a suitable rinsing solution in radiation or chemotherapy induced mucositis	N/A	RCT – blind crossover	N=20	DV – OM IV1 – granudacyn IV2 – Octenidol IV3 – placebo	Total bacterial count doen with swab, calculated using pre-values and post-values	Bacterial load before and after rinses was statistical using GraphPad Prism 4.00, used a one-way ANOVA w/ Dunn's multiple comparison test	IV1 and IV2 showed decrease in bacterial load, Octenidol most effective	Strengths and limitations: data showed decrease of OM, not tested on cancer patients, only tested on buccal and saliva, not including tongue Risk or harm: none Feasible: No, not implementable d/t study being on healthy mouths/healthy people, continue current BOC practice

Legend: BHBM=beta-hydroxy-beta-methyl butyrate, BOC=basic oral care, CP=calcium phosphate, CI=confident intervals, CO=clove oil, DC=dental care, d/t=due to, DV=dependent variable, EB=evidence-based, EBP=evidence-bases practice, EONS=elemental oral nutrition supplements, FSV=fat soluble vitamins, IEONS=immune-enhanced oral nutrition supplements, IV=independent variable, LOD=level of distress, LOE=level of evidence, LR=literature review, MAM=multi-agent methods, MASCC/ISOO=Multinational Association of Supportive Care in Cancer/Internal Society of Oral Oncology, MM=mixed method, MMM=mixed medication mouthwash, MNS=miscellaneous nutritional supplements, NS=normal saline, NSS=normal saline solution, OC=oral cryotherapy, OCP=oral care protocol, OM=oral mucositis, RCT=randomized control trail, r/t=related to, SB=sodium bicarb, SLR=systematic literature review, SMD's=standardized mean differences, SOCM=standard oral care methods, SPSS=statistical package of social sciences, SR=systematic review, SRQS=systematic review of qualitative studies, STT=standard topical therapy, w/=with

Appendix B

Pareto Chart



Appendix C

Timetable/Flowchart