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The Clinical Nurse Leader as Outcomes Manager: Optimizing Screening Mammography in an Outpatient Breast Center

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The American Cancer Society (2018) predicted that by 2018 in the U.S. there would be an estimated 266,120 new cases of breast cancer in women, and one out of 38 women will die from breast cancer. Routine X-ray mammography screening continues to be the most valuable method of early detection for breast cancer and secondary prevention (Coleman, 2017; Henry, Judith, Mary, & Gregory, 2015; Kolak et al., 2017). Consistent and standardized film images are crucial for radiologist interpretation and quality assurance (Adcock, 2004). This clinical nurse leader (CNL) project was conducted in a 4,500 square foot outpatient breast center that is part of a community safety-net hospital. The center provides breast cancer services for culturally diverse populations in the San Francisco Bay Area. Patients consist of a large proportion of disadvantaged, low income, low English literacy, and high-risk women over the age of 45. The services provided at the main facility include screening, diagnostic x-ray exams, breast ultrasound, MRI, interventional imaged guided biopsies, referral for genetic testing, treatment planning, rehabilitation, psychosocial support, and patient education.

Recent observations in the mobile mammography van and central breast center (CBC) reflected that additional images were taken during a routine mammogram in a subset of screening patients. Further investigation indicated there was a lack of consistency in positioning techniques and an opportunity for improvement in technologist education and training. The National Mammography Quality Standards Act (MQSA, 2002) has enacted a series of criteria to regulate clinical image quality in mammography. The Enhancing Quality Using the Inspection Program (EQUIP, 2016) further emphasizes the requirement for ongoing facility reviews of clinical image quality. In compliance with the MQSA and the EQUIP, the author of this paper designed an evidence-based project to improve image quality and optimize screening mammography by technologists. An innovative educational campaign will be proposed to all technologists, focusing on the development of competence with positioning skills. The goal of this project is to help technologists identify their individual learning needs, address challenges related to knowledge and skills, reduce unnecessary film images, and promote optimal screening mammography.

Clinical Leadership Theme

The global aim statement for this project is to develop an evidence-based quality improvement (QI) plan and utilize educational interventions to improve image quality and optimize screening mammography. The CNL student will work in collaboration with the multidisciplinary team including radiologists, technologists, patient navigators, and unit support staff. The relevant CNL competency is “to facilitate collaborative, interprofessional approaches and strategies in the design, coordination, and evaluation of patient-centered care” (AACN, 2013, p. 17). This CNL competency encompasses the roles of educator, team manager, and outcome manager.

Statement of the Problem

Breast cancer is a global public health issue as well as at the local level in San Francisco. Screening mammography is used as the primary procedure for detection of breast cancer. In 1992, The MQSA was passed as a national quality standard for mammography which includes standards relevant to image quality and qualifications of mammography technologists, radiologists, and facilities. These uniform standards assure that mammography performed in the U.S. is safe and reliable. In 2016, the U.S. Food and Drug Administration (FDA) further proposed the EQUIP initiative to enforce MQSA regulations on continuous review of clinical image quality which has significant implementations for all facilities that perform mammography (Lillé & Marshall, 2017). In a standard screening mammogram, four views are required which include the craniocaudal and mediolateral oblique views in each breast (MQSA, 2002). Recent observations from a community safety-net hospital outpatient breast center reflected that five to eight views were taken during a routine mammogram in a subset of screening patients which exceeds the standard set of four views. Additional mammographic views can waste resources, expose patients to unnecessary radiation, decrease patient satisfaction and inhibit efficient workflow (Mercieca, Portelli, & Jadva-Patel, 2017).

High-quality imaging is required to achieve acceptable views for radiologist interpretation and patient satisfaction with the exam (Adcock, 2004). Technologists are responsible to ensure compliance with the MQSA criteria and determine if additional views need to be repeated. Radiologists are the final arbiters who confirm the quality of mammography images and maintain facility accreditation. However, upon microsystem assessment, the CNL student realized there was a lack of procedures and policies in the current facility that agreed upon by all technologists and radiologists on image quality. Radiologists complained they have encountered an increasing number of additional screening film views during interpretation that were not necessary. Technologists asserted that they do their best to produce qualified images; additional views were due to unsatisfactory positioning and patient habitus. They would rather have additional views during procedure instead of recalling patients back as a consequence of substandard images.

In order to address these matters, this project will focus on technologist learning and skill development. The CNL student will justify the needs for technologist education in collaboration with technologists and radiologist leaders. A tech-teaching plan that addresses the knowledge, skill, and experience differences will be developed and implemented at the outpatient breast center. By developing this evidence-based QI plan and utilizing technologist educational interventions, this project has the potential to improve image quality and optimize screening mammography.

Project overview

This evidence-based project aims to provide a variety of educational resources to assist the diverse learning needs of the technologists in screening mammography. A consolidated interprofessional development mammography screening case review and feedback session is scheduled to happen on April 25, 2018. Each technologist will be required to bring a confident case and an unconfident case for group discussion. A breast imaging radiologist and the lead technologist will share a best practice sample from the American College of Radiologist (ACR) and explain what criteria make the best image. The CNL student will go over the meeting agenda (see Appendix A), present microsystem findings, and propose an integrated interprofessional training program plan to all attendees in the session. Meanwhile, a tech-training packet will be compiled and distributed to all technologists which includes:

1. A mammography positioning guidebook authored by national subject matter expert (Miller, 2014).

2. A list of online mammography technologist training resources (Miller, 2018) (see Appendix B).

3. A mammography image quality evaluation checklist (see Appendix C).

4. Two recent publications regarding high-risk populations and mammography positioning (Monticciolo et al., 2018; Pal et al., 2018).

5. A bilingual patient tips sheet on mammography screening (internal resources)(See Appendix D).

6. Proposed seven-part plan for continuous technologist training and education.

7. Post-meeting evaluation questionnaire (See Appendix E).

Specifically, the proposed seven-part educational plan (see Appendix F) includes:

1. A five-part webinar series sponsored by the Society of Breast Imaging.

2. Mammography positioning subject matter expert consultation.

3. Ongoing individual technologist feedback and film review with physicians.

4. Monthly feedback from the breast imaging led by technologist regarding image quality.

5. Quarterly mammography screening case review and feedback session.

6. Self-study.

7. Mammography screening patient tips.

A post-training evaluation questionnaire will be distributed right after the case review and feedback session to collect technologist feedback on this activity. Three expected objectives from this session will be (a) decreased additional views in screening mammography, (b) increased confidence/competency in technologists, and (c) enhanced a supportive environment that fosters effective communication between technologists and radiologists.

To improve image quality and optimize screening mammography, the project aims to decrease additional screening mammography views by 50%, through one consolidated interprofessional development mammography screening case review and feedback session by May 7, 2018. The specific aim statement summarizes the measurable goals, particular intervention, target population and time frame, which provide readers a better understanding of the global aim statement.

Methodology

Rationale

The outpatient breast center has a mobile "MammoVan" program to reach underserved women in at least seven community health centers. In the past six months, the CNL student calculated the number of screening views and found that a majority of patients received more than four screening views over an eight-day period. At the CBC, observations for one day also reinforced that excessive screening images were taken on screening patients. Technologists were consulted and multiple factors were identified that contributed to inadequate screening exams including the patient, technologist, equipment, and physician-related activities and interventions. A cause and effective diagram (see Appendix G) was conducted to analyze the root causes of additional views during mammography.

A SWOT analysis (see Appendix H) also was conducted to explore potential areas of strengths, weaknesses, opportunities, and threats prior to project implementation. The main strength of this project is that it satisfies immediate technologist learning needs as well as a strong buy-in from the radiologists. Through outreaching collaboration with mammography positioning subject matter expert, the technologists can further improve their competence and confidence in screening mammography. Time constraint is the biggest weakness of project implementation. There would be limited time for case review and group discussion between the lead physician and the technologists. Procedural difficulties and latency in the organization could further weaken the project's integrity.

Baseline data were then collected over a two-day period at the CBC (see Appendix I). The CNL student calculated the number of regular patients and the number of two-dimensional full-field digital mammography (2D FFDM) screening studies in January 2018. Irregular patients were excluded because their special body habitus or physical limitations prevented them from completing the mammography in four views. These irregular patients included, but were not limited to, patients with breast implants, big/dense breasts, kyphosis, undergone a mastectomy, or had been in a wheelchair. Three dimensional (3D) digital breast tomosynthesis (DBT) studies were also excluded since they provided views of the breast in "slices". This would create pictures from different angles. The results yielded that, in January of 2018, the CBC produced a total of 988 screening mammographic views for 182 regular patients (see Appendix I). Theoretically, if all patients received the standard set of four views, the total views would be 728. The additional 260 views (36%) have wasted resources, exposed patients to unnecessary radiation, decreased patient satisfaction, and inhibited efficient workflow.

A learning needs assessment survey was further designed and distributed to seven technologists at CBC to explore the reasons for additional views and their learning needs pertaining to the screening mammography (see Appendix J). The results yielded that (a) patient motion, artifacts, and positioning were three main reasons for additional imaging in screening mammography; and (b) body habitus of patients, poor visualization of posterior breast tissue, physically limited patient, and inabilities to adequately communicate with the patient were the top four reasons for sub-optimal image quality related to positioning. These findings further supported the fish-bone diagram, clarifying factors that may contribute to additional views in screening mammography. Moreover, the learning needs assessment also reflected (a) six of seven technologists were interested in receiving some teaching and education on how to promote effective communication and improve their positioning skills in difficult patients, (b) seven of seven technologists claimed they would like to receive one-to-one feedback on image quality either from a mammography positioning subject matter expert or a breast radiologist, and (c) the most preferred methods for self-study were video and books. Overall, these excellent data not only gave the CNL student a better understanding of the learners but also helped in designing the training plans.

Cost Analysis

Cost. Resources required for this project include a dedicated number of hours for the team identifying and developing the content of this project, time for staff meetings and communication, time for the creation of multi-format educational materials, and time for hosting and training the educational event. The total proposed budget is $4,258, as outlined in the Appendix J. The CNL student is responsible for leading and managing the project in all phases, which requires 220 hours of volunteering time. The mammography screening case review and feedback session is scheduled for 1.5 hours, which includes completion of a post-training evaluation questionnaire about this activity. At least eight copies of positioning books by Louise Miller (radiological technologist expert) are budgeted for self-study and group discussion. There is also a proposed budget for future Louise Miller's in-person consultation at the outpatient breast center. Capital resources include some copying and laminating to create the teaching aids for April case review and feedback session, as well as refreshments/lunch during that meeting.

Benefits. By decreasing additional views and optimizing screening mammography, this project has the potential to save cost and increase workflow. Currently, the center provides approximately 3,000 on-site 2D screening breast-imaging studies annually. Most of the patients are low-income women over the age 45 who are covered by Medicare program. According to GE Healthcare (2017), the reimbursement for a 2D screening mammogram is $100.49 (reflects national rates, unadjusted for locality). The loss of revenue from 260 additional views (equals 65 standard screening mammography) amounts to approximately $6,531 per month (65×$100.49) or

78,382 annually (65×$100.49×12). On the other hand, the average time for a technologist to perform a screening mammogram has been estimated to 15 minutes. The time wasted by the technologists in producing the 260 views could be estimated to 16 hours ([65×15]/60). According to the San Francisco Department of Human Resources (2018), the average hourly wage for a diagnostic imaging technologist is $43.81 per hour. There is a fiscal waste of $701 per month (16×$43.81) or $8,412 (16×12×$43.81) annually. Over the course of a year, there will be a total $86,796 ($78,382+$8,412) loss at the CBC.

As discussed, this project aims to decrease additional screening mammography views by half (from current 36% to 18%). Fifty percent of loss saving is projected annually which amounts to $43,398 ($8,6796/2). Since the proposed budget is only $4,258, this project delivers a considerable return on investment benefits (see Appendix K). Moreover, by optimizing screening mammography and improving patient experience, this project has the potential to improve breast cancer screening rates in vulnerable populations throughout the San Francisco Bay Area. Taking advantage of the “MobileVan”, the breast center will further increase its revenue, patient volume, and capacity.

Theory

Leininger’s culture care theory and Lewin’s change management theory helped guide this evidence-based change of practice project. Originally developed in the 1970s (Leininger & McFarland, 2002), culture care theory is an established nursing theory that emphasizes culture and care as essential concepts in nursing. This theory is frequently used to discover diversities and universalities in human care as they relate to different components, and then provides culturally congruent care to human beings. Together with cultural care theory, Leininger developed the sunrise enabler (see Appendix L), which used as a cognitive guidance for cultural and healthcare assessment and research. During microsystem assessment, the sunrise enabler provided a framework for the CNL student to obtain new knowledge of the current healthcare expressions (patterns & practices), and the diverse group of technologists and multidisciplinary team members within various caring contexts. The outlined seven cultures and social structural dimensions that influence care also helped in discovering variables among each technologist and in identifying personalized learning needs.

Lewin's change management theory (1951) encompassed three distinct phases known as unfreezing, moving, and refreezing, which provide a high-level approach to change. The unfreezing stage involves examining status quo and increasing driving forces for change; the moving stage involves taking actions and making changes; and the refreezing stages involves making changes as permanent and establishing new way of things (Mitchell, 2013). In the unfreezing stage, through microsystem assessment, the leadership team identifies the needs to increase image quality and optimize screening mammography. The moving phase includes planning and implementation of the seven-part educational plan through one consolidated interprofessional development mammography screening case review and feedback session. In the refreezing stage, it is significant to establish a feedback system to stabilize the changes into the culture. By developing monthly feedback and quarterly group discussion regarding image quality, the technologists improve their knowledge, skills, and mammography services.

Literature Review

A review of the literature was utilized using several databases including Cochrane Database of Systematic Reviews, CINAHL, PubMed, and Science Direct. To obtain the most current review of the evidence, the search strategies focused on scholarly (peer-reviewed) journals published no earlier than 2013 and written in English. Search terms included the following: *screening mammography, image quality, positioning, technologist, quality improvement, and education.* The PICO strategy used to review literature was (a) P: Patients seeking screening mammography services, (b) I: Technologist education, (c) C: Current state of practice, and (d) O: Reduce additional screening mammographic images. Several articles highlighted the significance of the implementation of this QI project.

Breast cancer remains a critical public health challenge worldwide. Early detection and diagnosis are crucial to maintain a quality of life and to reduce complications in cancer patients. Originated from 1895, over the past hundred years, mammography has been significant advances to an effective, practical, and reliable method to increase early breast cancer detection rate and reduce disease mortality (Coleman, 2017). It offers benefits for both women and men in the worldwide. Even though there are some controversies surrounding breast cancer screening programs, serial screening with mammography continues to be supported by the ACR, which recommends women with average risk should start annual mammography screening at the age of 40 (Monticciolo et al., 2017). Women with higher risks should start mammographic screening even earlier and may benefit from supplemental screening modalities (Monticciolo et al., 2018).

Mammography is a specific type of imaging which requires adequate compression on each of the breasts in order to get qualified images for interpretation. Patients may also experience pain, uncomfortable, radiation, and even anxiety during that procedure. In 2015, Clark and Reeves conducted a literature review to explore women's experiences of mammography. Research articles published between 2002 and 2013 were identified in CINAHL, MEDLINE, and Science Direct. The results yielded that except for the influence from pain, fear, waiting, and physical environment, patient's experience was significantly depended on the behavior, attitude, professionalism, and interpersonal skills of the technologists (Clark & Reeves, 2015). Whelehan et al (2013) also reported that women who had a pain experience at a previous mammogram are more likely to fail to re-attend subsequent breasting screening. Pain and discomfort can affect women's satisfaction, health outcomes, as well as their adherence to breast cancer screening program. These studies highlight the necessity of reducing unnecessary views during the screening mammography since additional views will lead to extra compression force, radiation dosage, and pain in patients.

High image quality is even critical in cancer screening and earlier stage diagnosis for patients. Rauscher, Conant, Khan, and Berbaum (2013) conducted a research to exam the potential role of mammogram image quality and its contributor to disparities in breast cancer diagnosis. A total of 494 mammographic images were examined for 268 patients. Results showed higher image quality for technologist-associated indicators was associated with earlier stage at diagnosis. The considerable gains on image quality could be made through better positioning, compression, and sharpness, which would translate into an earlier stage at diagnosis for patients (Rauscher et al., 2013). Henderson et al (2015) also reported that technologists and their images had a significant effect on the radiologist's recall rate, sensitivity, specificity, and cancer detection rate of screening mammography. These studies further validate the significance of developing this QI project to improve image quality.

Inappropriate breasting positing is one of the key factors that affect the quality and quantity of mammography images. Popli, Teotia, Narang, and Krishna (2014) conducted a retrospective study to evaluate the mistakes of improperly positioned mammograms that need to be avoided to ensure a high-quality mammogram. Breast images were taken in a total of 1,369 female participate. Results showed positioning is the most important factor affecting the resultant mammography image. Improper positioning of the nipple was the commonest problem. Sabino et al. (2014) also conducted a retrospective research to evaluate the clinical quality of 5,000 mammograms, which were taken along with the Clinical Quality Control Program based on the European Guidelines. Among the 105,000 evaluated quality items, 89% of the failures were associated with positioning. These studies support the need for ongoing tech training and education, enhancing their competence in positioning techniques.

A recent study from Stanford University highlights the importance of a team-based performance improvement initiative in improving mammographic positioning (Pal et al., 2018). In their facility, the technologists and radiologists established a series of quantitative measures of positioning performance including weekly audited mammograms for positioning quality, positioning training for technologists, performance tracking in dashboards, and a positioning coach to maintain performance. After three years' implementation, the technologist's positioning performance was increased from 67% to 91% and has been sustained for 23 months (Pal et al., 2018). This QI project can be valuable means for other institutions to replicate its methods. It also emphasizes that a team-based approach is required for performing and interpreting optimal images, ensuring radiation safety, promoting efficient workflow, encouraging patient engagement as well as evaluating financial and operational outcomes.

Timeline

The timeline for this change project extends from February – May 2018. However, it is anticipated that several activities will also be part of an ongoing program for technologists in-service, as well as, self-study to maintain knowledge, skills, and to monitor ongoing rates of film retakes and quality assurance in breast screening exams.

The detailed chronology for milestone completion is listed in Appendix M. In February, the new project idea was developed and discussed with main stakeholders at the outpatient breast center. Original data were collected and analyzed in regards to the additional imaging in screening mammography of January 2018. In March, informational interviews were conducted with technologists and a lead physician. An initial learning needs assessment survey was designed and distributed to seven technologists. Survey results were discussed with the outpatient breast center supervisor to finalize the educational plan and to seek budget for one on-site technologist positioning training seminar. A consolidated interprofessional development mammography screening case review and feedback session was finalized with the leadership team and scheduled to happen on April 25, 2018. In April, multi-format educational materials and PowerPoint were prepared for the technologist training session. Post-training evaluation questionnaire will be distributed to all technologists right after the training session. Comparative data on the number of routine screening mammographic views will be analyzed for at least one week of screening exams on May 7th. The final presentation of findings and recommendations to the breast center and the University of San Francisco will be completed before May 14th.

Expected Results

The anticipated short-term results include increased technologist and physician awareness of the practice pattern reflecting additional film imaging (more than the standard four) for screening exams by the technologists both on the mammography van and in the CBC. Through post-meeting survey, leadership team will identify whether the technologists enjoy this learning experience and feel supported by the organization. Another expected result is decreased film imaging in screening mammography. Comparative data will be collected on May 7th, which is one week after the interprofessional training session. The CNL student will calculate the number of regular patients and the number of 2D FFDM screening studies from April 26th through May 4th. The number of additional views will be analyzed and compared with baseline data in

January 2018. However, the targeted 50% decrease on additional views may not be achievable due to time constriction. One week's data after the training session are not sufficient enough to check the effectiveness of this project. The author suggests monitoring the number of additional views on a quarterly basis and giving sufficient time to implement the change well. Other results are expected to demonstrate an engaged technologist staff who will state that they are eager to improve communication, receive feedback, and optimize positioning techniques for screening mammography. Finally, a long-term teaching and learning plan for ongoing activities will be completed by May 9th and a schedule for implementation will be approved by the management team at the outpatient breast center.

Nursing Relevance

Breast cancer care requires an interprofessional approach with highly knowledgeable and skilled team members (Sorace, Harvey, Syed, & Yankeelov, 2017). Many breast centers in the United States are comprehensive and offer patient services under one roof; however, many are geographically disconnected and depend upon staff to assist in the coordination of care between fragmented service locations. This is especially true in facilities that serve disadvantaged populations where the financial and human resources may not be available to provide care in a centralized breast center with registered nurses, radiologic technologists in mammography, MRI, ultrasound, surgery and patient navigators for translation, communication and education. The role of the CNL can be instrumental in providing direct patient care, helping staff to plan care management, facilitate better communication and referrals and in assessing learning needs to develop targeted education programs various staff and/or patient subgroups in the microsystem. In the area of early detection, the role of the CNL also includes advocating for a relevant job description for a nurse to be hired as part of the breast center team because often, nurses are not perceived to be needed in the radiology and imaging departments of a hospital and they may be more likely to work in outpatient oncology or surgery rather than an outpatient breast center.

The patient population cohort at the outpatient breast center also includes many subsets of patients with cultural and ethnic diversity, such as Spanish and Chinese. The implementation of this CNL project is a valuable mean for staff members to obtain new knowledge about their patients who come from diverse cultures, integrate the best available evidence, including research findings, into practice decisions. Targeted outreach and individualized education will improve patient understanding of screening mammography and promote shared decision-making related to breast care. In the future, a patient education dimension of learning about the necessity of proper patient positioning and communicating tips to promote relaxation during the procedure could be planned. Nurses should always integrate the best available evidence, including research findings, into practice decisions. Organizations should always build their own competence, providing members of the community with the highest achievable level of care.

Summary Report

The global aim of this project is to create a long-term teaching and learning plan to help technologists to identify their individual learning needs related to knowledge, skills, and challenges to improve competence and confidence in performing screening mammography. Three expected objectives are (a) decreased additional views in screening mammography, (b) increased confidence/competency in technologists, and (c) enhanced supportive environment that fosters effective communication between technologists and radiologists.

The site for this QI project is an outpatient breast center that is part of a community safety-net hospital in the San Francisco Bay Area. The patient population consists of a large proportion of disadvantaged, low income, low English literacy, and high-risk women over the age of 40. Recent observations from the breast center and the “MammoVan” reflected that five to eight views were taken during a routine mammogram in a subset of screening patients which exceeds the standard set of four views. Further investigation reflected there was a lack of consistency in positioning techniques and an opportunity for improvement in radiologic technologist education and training.

Baseline data were then collected on March 2018. In January 2018, the CBC produced a total of 988 routine screening mammographic views for a number of 182 patients (5.4 views/per patient). If all patients received four views, the total views would be 728. The additional 260 views (36%) have wasted resources, exposed patients to unnecessary radiation, decreased patient satisfaction, and inhibited efficient workflow. A learning needs assessment on seven technologists further reflected they were willing to receive training and feedback from radiologists or from mammography positioning subject matter expert.

To satisfy their needs, the CNL student developed an integrated interprofessional training program plan including one case review and feedback session with a breast imaging radiologist on April 25th, 2018 and to monitor the number of additional views post-training on a quarterly basis. A training packet was also compiled and distributed to all attendees during the session which includes a mammography positioning guidebook, a list of online mammography resources, a checklist for image quality, two newly published articles on mammography, a bilingual patient tips sheet, and a proposed seven-part plan for continuous technologist training and education.

A post-intervention survey was distributed to six technologists who have participated in the case review and feedback session. The results yielded that six of six technologists felt this experience was significant and useful in their future work (see Appendix N), and they would like to spend more time with the lead physician (e.g. 2 hours) on a quarterly basis. Comparative data on the number of routine screening mammographic views were further collected one week after the session. During a seven-day period, the CBC produced a total of 393 routine screening mammographic views for 78 patients (5.0 views/per patient) [see Appendix O]. If all patients received 4 views, the total views would be 728. Compared with the baseline data in January 2018, after the training, the average views per patient received decreased from 5.4 to 5.0, as well as, additional views from 36% to 26%. However, the comparative data collection happened only one week after the training, the CNL student cannot determine whether the decline in additional views was induced by the intervention or was simply random. While these data look promising and conform to what was projected, the CNL student suggests monitoring the number of additional images on a quarterly basis in order to evaluate their credibility.

Learning is the continual acquisition of knowledge or skills through practice or study. It takes time to learn and it needs repetition to retain. According to Edgar Dale's Cone of Experience (Dale, 1969), after two weeks of learning, we can remember 10% of what we read (e.g., reading a book); 20% of what we hear; 50% of what we see and hear (e.g., watching a video); 70% of what we say (e.g., getting involved in discussion); and 90% of what we say and do (see Appendix P). The proposed seven-part plan for continuous technologist training and education has been well covered all phases of the learning pyramid, which guarantees the highest sustainability of this project.

Breast cancer care requires an interprofessional approach with highly knowledgeable and skilled team members. Patient education can be suggested as another essential part in decreasing unnecessary mammographic views and improving image quality. This is especially critical in this facility, which serves disadvantaged populations where culture and language can be barriers to early detection and prevention of breast cancer. In the future, a patient packet that includes handouts/videos about better positioning and patient relaxation techniques can be created and offered to the CBC, the “MammoVan”, and to community partners in the catchment area. By teaching enhanced patient positioning techniques, better images can be achieved by the technologists, as well as increasing the positive predictive value of mammography.

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Appendix A

Mammography Screening Case Review and Feedback Agenda

Mammography Screening Case-Review & Feedback Agenda

Location:	Outpatient Breast Center	**Date:**	April 25, 2018
Time:	7:30 am —9:00 am	**Facilitator:**	Luo, Yao
Participants:	1. Technologists 2. Physician 3. CNL Student 4. Affiliated Staff		

Meeting Objective:	Technologists will gain more skills and confidence in positioning and patient relations.

Agenda items:

Time	Agenda	Speaker
7:30 — 7:50	Breakfast and Welcome PowerPoint Distribution of Positioning Books	Yao
7:50 — 8:55	Mammography Screening Case Review and Feedback • What criteria make the best image • ACR best practice sample • Self-critique on cases • Group discussion and feedback	All Attendees
8:55 — 9:00	Post-Meeting Survey	All Attendees

Appendix B

Mammography Technologist Training Resources List

MAMMOGRAPHY EDUCATORS

MAMMOGRAPHY EDUCATORS

RESOURCES

Below are resources to support mammography technologists, find information on mammography accreditation, breast imaging regulatory requirements, and breast cancer support.

"Tips For EQUIP: A Practical Guide for Technologists and Radiologists"
by Louise C. Miller, RTRM, FSBI and Christine Puciato, RTRM, BS

"Mammography Positioning Standards in the Digital Era: Is the Status Quo Acceptable?"
by Ashley I. Huppe, Kelly L. Overman, Jason B. Gatewood, Jacqueline D. Hill, Louise C. Miller, and Marc F. Inciardi

"How to Help Your Technologist – Part 3 Common Problems with the Craniocaudal View"- SBI Newsletter
Series by Louise Miller, RTRM, FSBI: Part 3 of 3

"Common Problems with the Mediolateral Oblique: How to Help Your Technologist Part 2 – Not Enough Pectoralis and the Sagging Breast" – SBI Newsletter
Series by Louise Miller, RTRM, FSBI: Part 2 of 3

"Common Problems with the Mediolateral Oblique: How to Help Your Technologist Part 1 – The Inframammary Fold: How to Improve Visualization and Reduce Skin/Fat Folds in the Inframammary Fold" – SBI Newsletter
Series by Louise Miller, RTRM, FSBI: Part 1 of 3

"Screening Mammography: Clinical Image Quality and the Risk of Interval Breast Cancer"
An important article on the importance of positioning techniques for the detection of invasive breast cancer.

"Early Detection and Screening for Breast Cancer" by Cathy Coleman, DNP, MSN, PHN, OCN®, CPHQ, CNL: Assistant Professor, University of San Francisco School of Nursing and Health Professions, San Francisco, CA.

Mammography Quality Standards Act (MQSA) – Important Information about the Enhancing Quality Using the Inspection Program (EQUIP) Initiative

Appendix C

Mammography Image Quality Evaluation Checklist

Mammography Evaluation Sheet (Include date range here)

Accession #: ____________________ Date of Exam:______________ Tech Initials: __________

	Current Year				Previous Mammo			
CC projection	**Right**		**Left**		**Right**		**Left**	
Image Criteria	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Pectoral muscle visualized?								
Skin folds seen laterally?								
Skin folds seen medially?								
Skin folds, other? Location:								
Missing lat glandular tissue?								
Adequate separation of glandular tissue?								
Motion?								
Cleavage visualized?								
MLO projection	**Right**		**Left**		**Right**		**Left**	
Image Criteria	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Pectoral muscle visualized down to the PNL?								
Skin folds in axilla?								
Skin folds in IMF?								
Skin folds, other? Location:								
Muscle convex?								
Muscle straight?								
Visualization of Latissimus Dorsi?								
Muscle concave?								
Adequate separation of glandular tissue?								
Motion?								
Breast tissue in the "up and out" position?								
IMF visualized?								
Overall considerations	**Right**		**Left**		**Right**		**Left**	
PNL measurement for the CC within 1cm of MLO measurement?								
Nipple in Profile on at least 1 of 2 projections?								
Breast tissue adequately compressed?								

PNL Measurements (cm)	**Current Year**	**Previous Mammo**
RT CC		
LT CC		
LT MLO		
RT MLO		

Please indicate changes needed to improve Image Quality (ex. Pull more lateral glandular tissue on CC)	
Right CC	
Left CC	
Left MLO	
Right MLO	

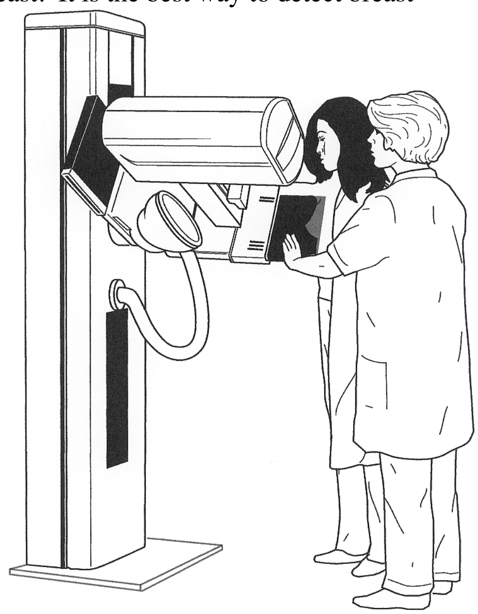
AC/FP 9/13

Appendix D

Bilingual Patient Tips Sheet on Mammography Screening — Page 1

Mammogram

A mammogram is an x-ray of your breast. It is the best way to detect breast cancer. You should have a yearly mammogram after age 40 or sooner if you have higher risks for breast cancer. Talk to your doctor about your risk factors.



Arrive on time for your test.

To Prepare

- **Tell the staff before the test if there is a chance you may be pregnant.**
- Do not use deodorant, lotion or powder under your arms or on your breasts the day of your test.

During the Test

- You need to undress from the waist up. You are given a paper gown to wear.
- You are asked to stand next to the machine.
- There are at least 2 x-rays taken of each breast.
- The person doing the test needs to touch and move your breast to get it in the right spot for each x-ray.
- Small sticky dots may be put on your nipples to help show them on your x-rays.
- Your breast is squeezed between 2 flat surfaces. This may hurt, but it does not harm your breasts.
- You are told to take a deep breath and hold it while the x-ray is taken.
- Each x-ray takes less than 30 seconds.
- If you have breast implants, more x-rays will need to be taken and the test will take more time.

Test results are sent to your doctor. Your doctor will share the results with you.

Talk to your doctor or nurse if you have any questions or concerns.

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Appendix D (continued)

Bilingual Patient Tips Sheet on Mammography Screening — Page 2

乳房 X 线摄影

乳房 X 线摄影是发现乳腺癌的最佳方法。40 岁之后应该每年拍一次乳房 X 线摄影，如果患乳腺癌的风险更高，则应该更早拍乳房 X 线摄影。告诉医生你有哪些风险因素。

做检查要准 时。

准备工作

- **如果你可能有孕在身的话，要在检查开始之前告诉工作人员。**
- 检查当天不要在腋下涂除臭剂或在乳房上用润肤液或爽身粉。

检查过程中

- 必须脱掉腰部以上的衣物。工作人员会让你穿上一件纸质长袍。
- 工作人员会让你站在机器旁。
- 每一侧乳房至少要拍两张 X 线摄影。
- 检查人员需要触摸你的乳房并将乳房移到拍 X 线摄影的适当位置。
- 可能会在你的乳头上涂一点黏质物，以便乳头在 X 线摄影上显示出来。
- 你的乳房会被两个平面挤压。可能会疼，但是不会对乳房造成伤害。
- 拍 X 线摄影时，工作人员会叫你深呼吸，并且屏住呼吸。
- 拍每一张 X 线摄影最多需 30 秒时间。
- 如果你隆过胸，则需要拍更多 X 线摄影，而且检查时间会更长。

检测结果会送给你的医生。医生会把检测结果告诉你。

如果有任何问题或忧虑，你可以告诉医生或护士。

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Mammogram. Simplified Chinese

Appendix E

Post-Meeting Evaluation Questionnaire

Post-Meeting Evaluation Questionnaire

(For participants in mammography screening case-review& feedback meeting at AVON, SFGH)

Please indicate your level of agreement with the statements listed below:

1. The objectives of the training were clearly defined.

   Strong agree______Agree______Neutral______Disagree______Strong disagree______

2. The topics covered were relevant to me.

   Strong Agree______Agree______Neutral______Disagree______Strong Disagree______

3. The materials distributed were helpful.

   Strong Agree______Agree______Neutral______Disagree______Strong Disagree______

4. The experience will be useful in my work.

   Strong Agree______Agree______Neutral______Disagree______Strong Disagree______

5. What did you like most about this meeting?

   ____

   ____

6. What aspects of the meeting could be improved?

   ____

   ____

7. Do you want to attend this kind of team-meeting in the future?

   Yes: Monthly_________ 2. Quarterly________3. Half-year________4. Yearly________

   No ____

8. Please share other comments or expand on previous response here:

   ____

   ____

Thank you for your feedback!

Appendix F

Proposed Seven-Part Educational Plan — Page 1

Proposed Seven-Part Educational Plan

No.	Topic description	Notes
1	**Title:** A Five-part Webinar Series Sponsored by the Society of Breast Imaging (SBI) **Timeframe:** One hour each for five parts **Learning Outcome:** ◆ Self-study ◆ Group discussion ◆ Increased knowledge on positioning **Logistics for support:** ◆ SBI Official Website: https://www.sbi-online.org/ABOUTSBI/ContactUs.aspx	Coming Soon
2	**Title:** Mammography Positioning Subject Matter Consultation (SMC) **Timeframe:** May 2018-2019, within one year as designed by the outpatient breast center **Learning Outcome:** ◆ 1:1 Feedback ◆ Hands-on workshop ◆ Increased knowledge and skills **Logistics for support:** ◆ Louise C. Miller's Official Website: https://www.mammographyeducation.com ◆ Approval by department ◆ Assessment of technologist learning needs and recurrent SMC ◆ Input from charge tech on MQSA and EQUIP initiative	Yearly
3	**Title:** Ongoing Individual Technologist Feedback and Film Review with Physician **Timeframe:** Daily or as required by physician or tech **Learning Outcome:** ◆ Decreased unnecessary films taken during screening mammography ◆ Increased inter-professional communication and collaboration **Logistics for support:** ◆ Pre-scheduled open time frame allotted for MD/ tech case review and feedback	Ongoing

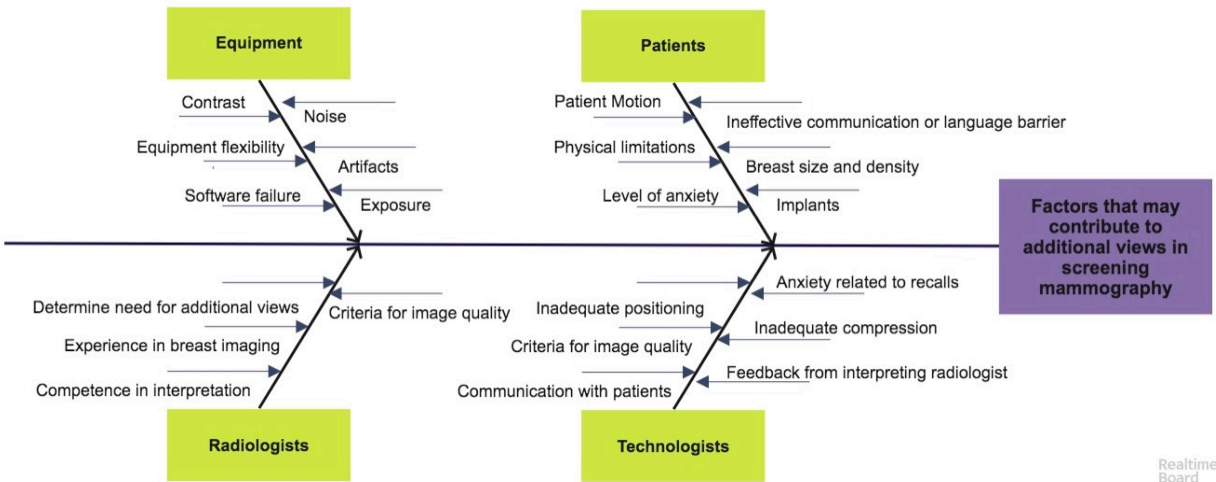
Appendix F (continued)

Proposed Seven-Part Educational Plan — Page 2

4	**Title:** Monthly Feedback from the Breast Imaging Charge Technologist Regarding Image Quality **Timeframe:** Monthly **Learning Outcome:** ◆ 1:1 Feedback or group feedback ◆ Decreased total number of repeated screening images due to unsatisfied positioning or patient motion ◆ Increased engagement and technologist satisfaction **Logistics for support:** ◆ Prepared checklist for film review ◆ Scheduled 1:1 or group meeting for feedback	Monthly
5	**Title:** Quarterly Mammography Screening Case-Review and Feedback **Timeframe:** Kickoff on April 25, 2018 then quarterly (July, October, January, April) **Learning Outcome:** ◆ Learn how to give and receive effective feedback ◆ Improved technical positioning skills on screening mammography **Logistics for support:** ◆ Support from charge technologist and QI leader ◆ Agenda, training materials, and supporting documents ◆ Prepared refreshments, room, and equipment	Quarterly
6	**Title:** Self-Study **Timeframe:** On-going **Learning Outcome:** ◆ Increased knowledge and self-confidence **Logistics for support:** ◆ Book & Video, Literature research, Web search ◆ Shadowing at Stanford/UCSF	Self-promoted
7	**Title:** Mammography Screening Patient Tips **Timeframe:** Will be finalized in May, 2019 **Learning Outcome:** ◆ Improved patient readiness and patient-technologist cooperation for Mammography **Logistics for support:** ◆ Literature review ◆ Informational interview on patient experience ◆ Brochure with graphics	Patient-focused

Appendix G

Root Cause Analysis Diagram



Appendix H

SWOT Analysis

Internal	
Strengths	**Weaknesses**
1. Satisfy technologist learning needs 2. Strong buy-in from technologists, radiologists and the outpatient breast center 3. Overall improvement in confidence and competence among technologists 4. Supporting and providing qualified mammographic images in a consistent manner	1. Technologist disengagement 2. Lack of cultural competency and cultural sensitivity 3. High risks to a reversion back to ingrained practices and workflows 4. Lack of trust in the CNL student 5. Time restriction and work burden 6. Procedural difficulties and latency
External	
Opportunities	**Threats**
1. Improving communication within interprofessional team members 2. Outreaching collaboration with mammography positioning subject matter expert 3. Quality control and improvement 4. Increase patient experience 5. Extended benefits for entire organization	1. Funding 2. Technical barriers

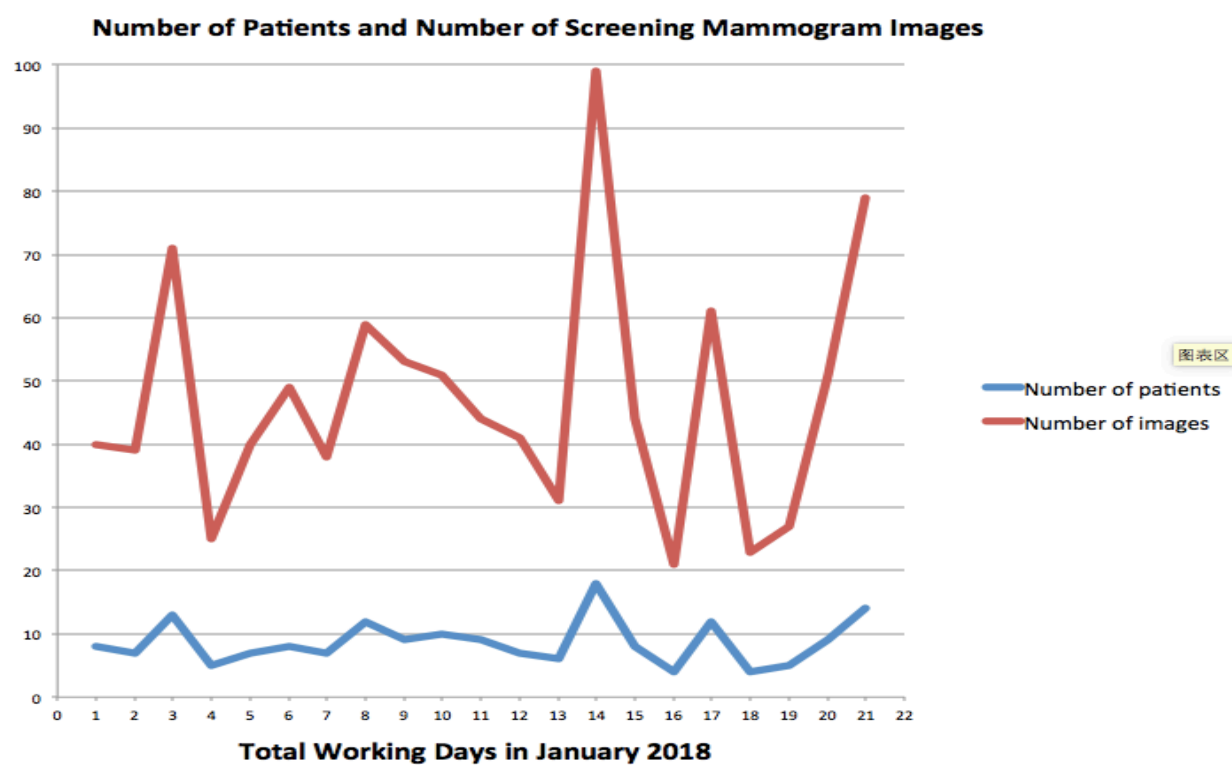
Appendix I

Baseline Data

Baseline Data

- In January 2018, the central breast center (CBC) produced ***988*** 2D screening mammographic views for ***182*** "regular" patients.
- If all patients received 4 images, the number would be ***728***.
- *(988 – 728) / 728 ≈ **36%***

Three Dimensional Digital Breast Tomosynthesis Studies —— Excluded	
Patients —— Excluded	**Number of Cases**
Patients with breast implants	6
Patients with big/dense breasts	12
Patients history of mastectomy	6
Patient with kyphosis	1
Patient in wheelchair/Limited mobility	1



Appendix J

Technologist Learning Needs Assessment Survey — Page 1

Technologist Learning Needs Assessment — Screening Mammography
(The purpose of this survey is to support technologist education in the breast center)

1. Are you interested in learning more about the technologist role in screening mammography?

   Yes (What are your priority learning needs?) ________________________________
   ____

   No _______.

2. How do you prefer to learn?
   (Please rank preferred method from 1-5, 1-most preferred, 5-least preferred)

   a. Self-study
      1. book 1________2_______3_______4_______5________

      2. video 1________2_______3_______4_______5________

      3.social media 1________2_______3_______4_______5________

      4.phone apps 1________2_______3_______4_______5________

      5.other ____

   b. One-to-one feedback from a mammography positioning subject matter expert technologist
      1________2_______3_______4_______5________

   c. One-to-one feedback from a breast radiologist
      1________2_______3_______4_______5________

   d. Attend class on mammography positioning
      1________2_______3_______4_______5________

   e. Other ______________________________________

3. Based on your past positioning experience, please circle 3 main reasons for repeated images in a screening mammogram:

   a. Patient motion b. Exposure c. Sharpness d. Contrast e. Artifacts

Appendix J (continued)

Technologist Learning Needs Assessment Survey — Page 2

f. Positioning g. Noise f. Incorrect labels g. Equipment failure
h. Other____

4. Regarding mammographic positioning for a routine 4 view screening mammogram, please rate the reasons for sub-optimal image quality related to positioning: **(Please rank the top 5 reasons with 1 being the most important reason in your opinion)**

    a. ______Poor visualization of posterior tissue
    b. ______Portion of breast not present on the film
    c. ______Sagging breast (cutoff bottom of breast on film for RT MLO)
    d. ______Inadequate amount of pectoralis major muscle on image
    e. ______Excessive exaggeration on the craniocaudal view
    f. ______Skin folds
    g. ______Nipple not in profile
    h. ______Height differences between the patients and the technologist
    i. ______Body habitus of patient
    j. ______Physical disability patient (special needs patient)
    k. ______Inability to adequately communicate with the patient (language barrier, mental status, etc)
    l. ______Large breasts
    m. ______Small breasts
    n. ______ Inadequate compression

    o. Other ____

5. Please share one request or personal learning need that you have related to screening mammography education for technologists.

____

____

Name: Optional ____

Thank you
Yao Luo
Nurse practitioner student, USF School of Nursing and Health Professions

Appendix K

Cost and Benefit Assessment

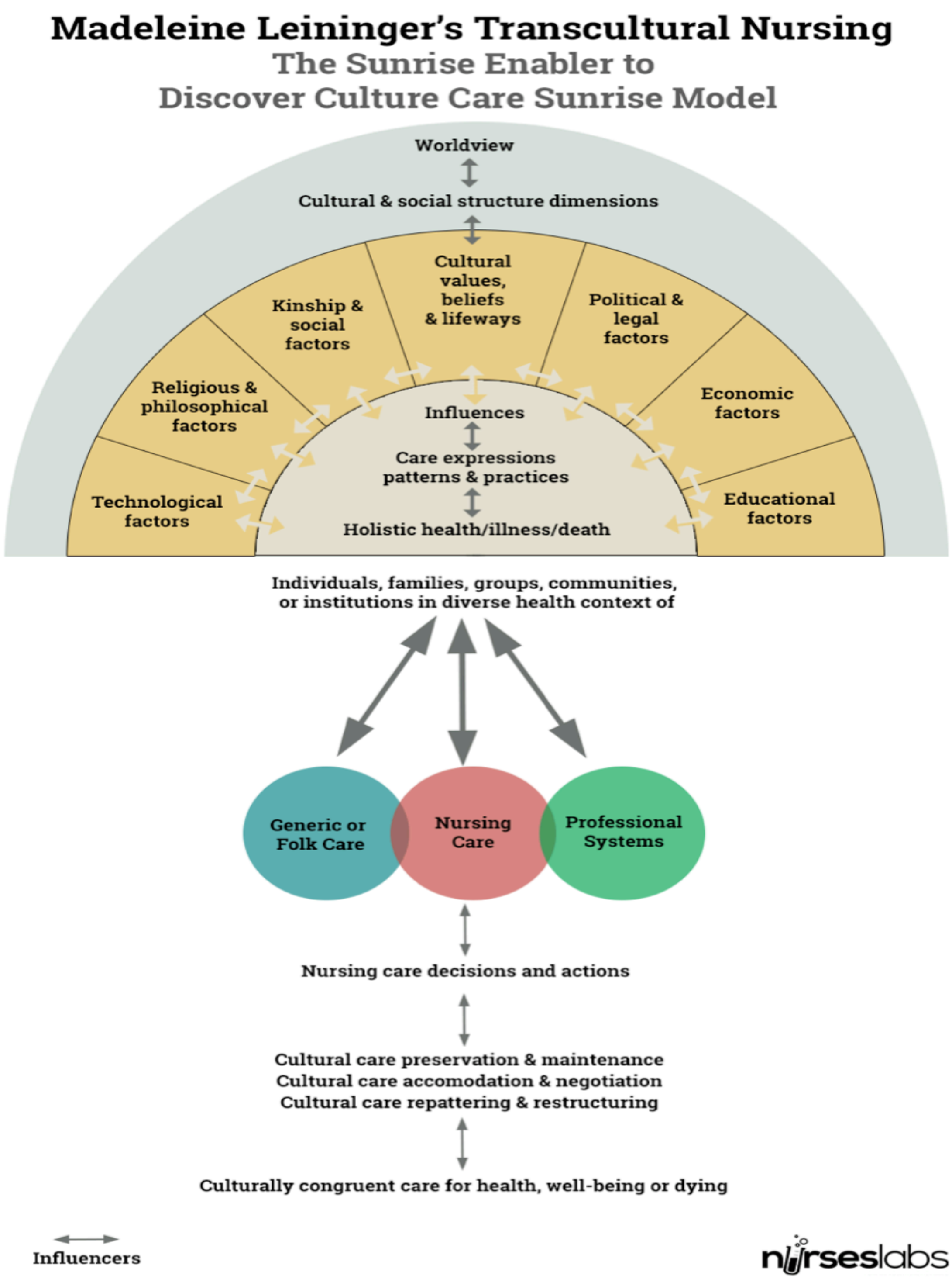
Cost	Hours	Cost
CNL student (project manager) (volunteering time)	220 Hours	$0.00
Team meeting time • The supervisor of the Avon Breast Center ($67/hr) • Radiologist representative ($85/hr) • Technologist representative ($44/hr) • Patient navigator representative ($19/hr) **Material cost** • Copying, laminating, ink for printer, pens, binders, folders • Foods and beverages • Meeting room, projector, printer, software	5 Hours 5 Hours 10 Hours 2 Hours —— —— ——	$335 $425 $440 $38 $50.00 $100.00 $0.00
Mammography case review and feedback session on April 25th • 1 Lead Radiologist ($85/hr) • 7 Technologist ($44/hr)	1.5 Hours	$128 $462
Self-study materials and consulate visit • Eight copies of positioning books by Louise Miller • Louise Miller's in-person consultation at the breast center	—— ——	$280 $2,000
Total Project Cost	——	**$4,258**
Revenue Loss from Additional Views	**January, 2018**	**Annually**
From Medicare Reimbursement	$6,531	$78,382
From Staff Salary	$701	$8,412
Total Revenue Loss	——	**$86,796**

- By decreasing additional screening mammography views by half
- Fifty percent of loss saving is projected which amounts to $43,398 annually ($ 8,6796/2)

ROI: $43,398 - $4,258 = $39,140 /annually

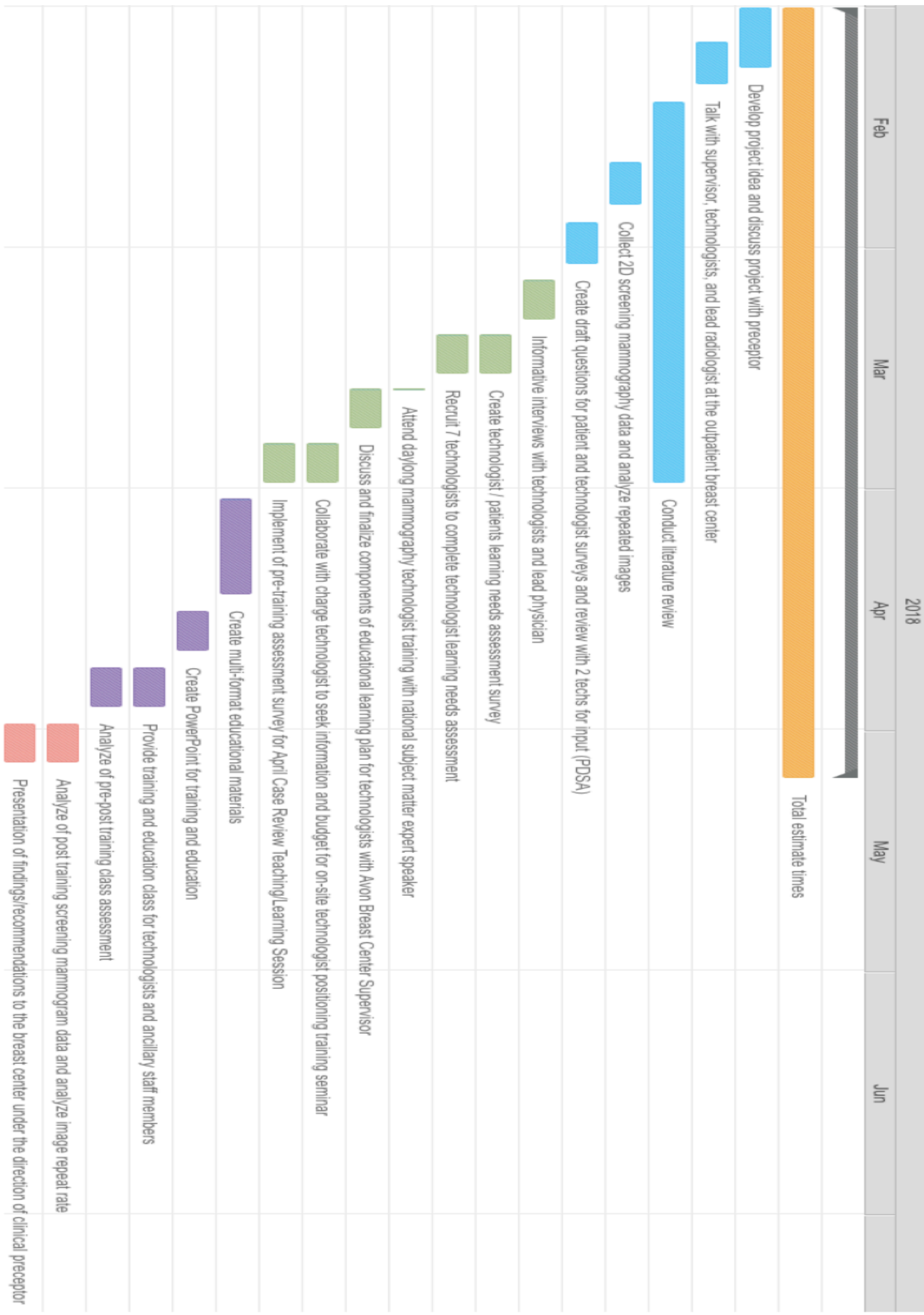
Appendix L

Sunrise Enabler



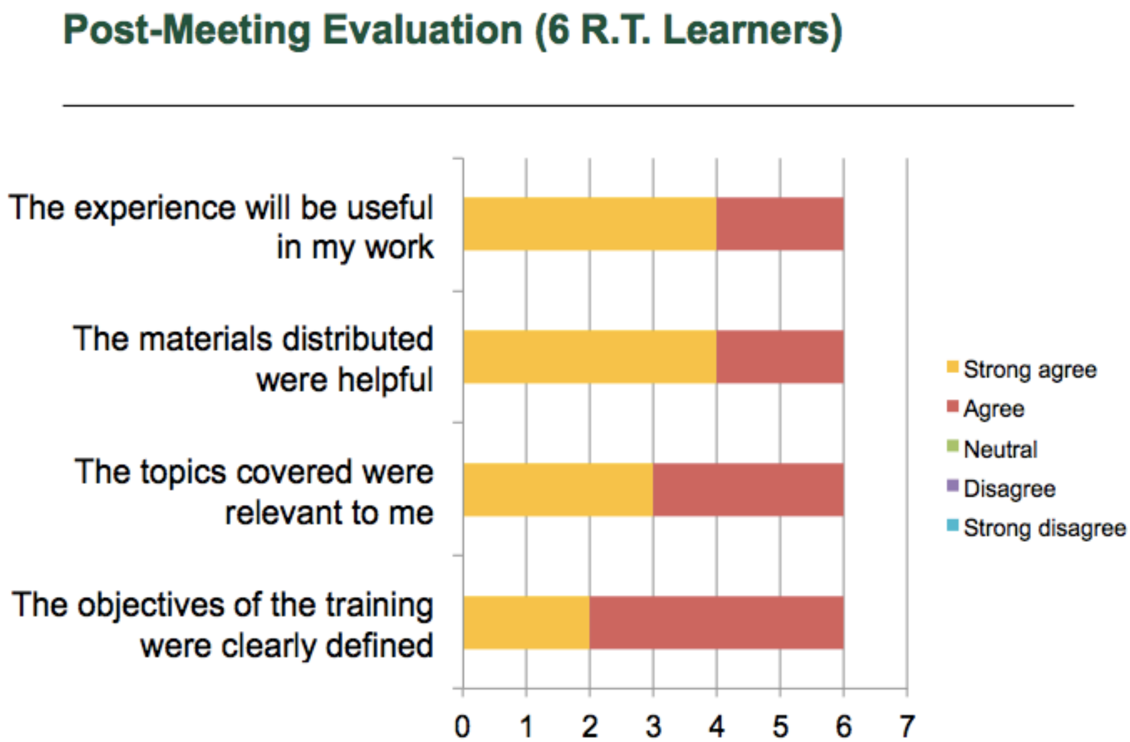
Appendix M

Gantt Chart



Appendix N

Post-Meeting Evaluation Questionnaire Results



Appendix O

Comparative Data

Comparative Data

- Within a 7-day period after the meeting, the CBC produced ***393*** 2D screening mammographic views for **78** "regular" patients.
- If all patients received 4 images, the number would be ***312***.
- ***(393 – 312) / 312 ≈ 26%***

Three Dimensional Digital Breast Tomosynthesis Studies —— Excluded	
Patients —— Excluded	**Number of Cases**
Patients with breast implants	3
Patients with big/dense breasts	5
Patient history of mastectomy	1
Patient with pacemaker	1
Patients in wheelchair/ Limited mobility	3
Incomplete mammography (refused to take certain views)	2

Appendix P

Edgar Dale's Cone of Experience