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Improving Patient Safety by Calculating the QT Correction in Critical Care Patients

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Author note

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Clinical Leadership Theme

The Clinical Nurse Leader (CNL) is the first new nursing role in over 40 years (Harris, Roussel, & Thomas, 2014). The role developed in response to changing global demographics, turmoil within the healthcare system, and a dire shortage of nursing professionals. Nursing professionals and other major clinical stakeholders came together to discuss the direction of nursing in the healthcare system. A vision of nursing developed which addressed these concerns. From this vision emerged the CNL (Harris, Roussel, & Thomas, 2014).

The CNL is a masters-prepared clinician with a high level of clinical competence and knowledge (AACN, 2015). The CNL oversees care coordination and integration of care for a distinct group of patients (AACN, 2015). As a master's degree-prepared clinician, the CNL puts evidence-based practice into action and ensures that patients benefit from the latest innovations and care practices offered. The CNL evaluates patient outcomes, assesses cohort risk, and has the decision-making authority to change care plans when necessary. The CNL is a leader and active member of the interdisciplinary health care team (AACN, 2015).

This project focuses on the Clinical Nurse Leader curriculum element *Care Environment*. Working in the Surgical Intensive Care Unit (SICU), the CNL will act as a team manager. The CNL will assess the microsystem and lead the interdisciplinary team on this project. Utilizing available resources, the CNL will assess the current practice of monitoring the cardiac rhythm and mitigate barriers to calculating the QT corrected (QTc) value to improve patient safety in the unit.

Statement of the Problem

Critically ill patients are an especially vulnerable population. Their condition generally warrants close monitoring of all body systems by a specially trained critical care nurse. The

astute nurse utilized critical thinking to analyze all of the available data to intervene on his or her patient's behalf to improve the patient's overall condition or prevent further deterioration. At the beginning of each shift, the nurse performs a head to toe assessment of his or her assigned patients in the critical care unit, and uses all of this information as a baseline to develop a plan of care and make ongoing comparisons for the rest of the shift.

One such tool that the critical care team relies on is the cardiac monitor. The nurse can assess continuous EKG rates and rhythms continuously. The critical care nurse possesses knowledge to measure each wave from the cardiac cycle to assess for delays in the conduction. One measurement has been consistently missing in the documentation in nearly every patient in the Surgical Intensive Care Unit (SICU). This measurement, the corrected QT, or QTc, is important to assess regularly as many medications that are given in the critical care environment can prolong this measurement. A prolonged QTc interval has been identified as a precursor to lethal arrhythmias, such as torsades de pointes and ventricular fibrillation. The purpose of this project is to improve patient safety by giving the critical care nurses the tools needed to calculate and document the QTC identify causes of the failure to calculate the QTc. Nurses who have this knowledge of their patients can intervene by collaborating with the interdisciplinary team, specifically the physician and the pharmacist. The care can be modified by correcting electrolyte abnormalities or changing medications known to cause QTc prolongation. Improving compliance with calculating the QTc will improve patient safety.

Project Overview

This project will improve patient safety by improving the compliance to measuring the QTc. By assessing the microsystem and identifying the causes for the omission of this value in the assessment, the CNL will show the nursing staff how to measure the interval and apply the

mathematical correction, which takes into, account the patient's heart rate when measuring the QT interval. By adding this step as part of the patients' assessments each shift and after administration of medications known to prolong the interval, the nurse can readily identify prolonged QT syndrome. He or she will collaborate with other members of the interdisciplinary team to make adjustments in the medication profile to correct this syndrome prior to the patient experiencing arrhythmias.

Rationale

Patients in the SICU are commonly ventilated. The "ABCDE bundle," an evidence-based order set addressing care of the ventilated patient that was implemented a few years ago in the organization. The bundle includes the ventilator orders as well as orders for each of the mnemonics. The "A" is for awakening the patient each day by interrupting the sedation. This is coordinated with the breathing trial, "B," to assess if the patient is ready to wean from the ventilator. "C" is the appropriate choice of sedation, and currently benzodiazepines are avoided. "D" is providing care to prevent or treat delirium. "E" is early mobility, or getting the ventilated patient out of bed and ambulating him or her.

The physician can include antipsychotic medications as part of the delirium section of the bundle. Antipsychotic medications increase the risk of prolonged QTc, torsades de pointes, and sudden cardiac death. Black box warnings issued by the FDA requires intravenous doses of antipsychotic medications to be administered only to cardiac monitored patients (Narang, et al., 2010). Because of these known risks, the bundle also includes an order to notify the MD when the QTc was greater than 450 milliseconds (or greater than 0.45 seconds) and discontinue any antipsychotics. However, the order does not generate a nursing task and is usually missed by the critical care nursing staff.

Since the conversion to EHR, regular charting audits performed evaluating for deficiencies on both an individual basis as well as a common unit basis. Care or documentation that correlates to a task that has been missed is flagged. Missed care is investigated, and coaching, education, or correction is applied. Addendums may be added to the EHR when appropriate. Because the order for the QTc does not generate a task, there is no direct measurement applied during chart audits discovering a deficiency. No internal event has occurred that correlates to the missing data. However, to comply with the physician order, the staff need to be aware of the order, and they must be given the tools and education to comply.

A gap analysis revealed gaps in nursing not calculating the QT correction (QTc). A recent change in the standard orders for ventilated patients includes orders to notify the physician when the QTc is prolonged. The order does not generate a task notification to the nurses so this order was often missed. In addition, there is no field in the flowsheet for documenting the QTc. A Nursing survey showed 10% of nurses were not familiar with performing the calculation, and at baseline, nurses measured the QTc only 3% of the time.

To identify the causes for nurses omitting this additional step in cardiac cycle measurements, assessments were done in the unit. Nurse surveys and observations were performed to assess current practice and understanding as well as concurrent chart audits to verify the current state of the assessment practice. Collected data included nurse surveys, communication assessment, and chart audits, which showed that while nurses were familiar with the QTc measurement, many were not aware of the method currently used to calculate the value. While some recalled performing the measurement regularly years ago, they felt that over time it was less necessary to complete. One nurse even remarked, “I was trained in cardiac nursing and always calculated QTc, but when I came here no one did it, so I eventually stopped doing it.”

This seemed to be a common feeling among many, and it also seemed to perpetuate a common misnomer that calculating the QTc was no longer part of the routine assessment of the patient.

Observations of nursing completing the task showed varied practice. The whole process involves collecting a printed strip from the monitor, posting it to the paper chart, sitting at the nurses' station and measuring all of the intervals, and then opening the electronic chart and transcribing the measurements that have been manually obtained. Some nurses complete this first before seeing their patient. Some run a strip and tape it in a spot where they will complete it all later, and some completely assess their patient and later run and print a strip. While not a difficult task, it is cumbersome and requires the nurse to develop consistent habits in this practice. Barriers to completing the extra measurement of calculating the QTc include not having a calculator readily available to complete the calculation (Appendix A).

A SWOT analysis was performed (Appendix B). Strengths of the project are an engaged staff, support from leadership, support from the American Association of Critical Care Nurses (AACN), and strong evidential support. Weaknesses include knowledge gaps and a perceived feeling of unimportance. Opportunities include the fact the skill can be taught and learned quickly, it will give nurses additional tools to assess their patients. Threats include the nurses' lack of time, which will make it difficult to establish consistent practice and other competing projects from leadership, which leads to increased frustration among staff.

The costs associated with this project include 125 nursing hours of the CNL at $50 an hour for research and preparation totaling approximately $6250. Unit assistants will be utilized when time permits during their shift to helping pass out surveys and preparing education boards. This will occur during regularly scheduled shifts that will not incur additional hours. Education will be provided during shift huddles in short presentations, but also will not incur additional

hours. I anticipate approximately $150 in paper and supplies to post information and updates about the project. Additional calipers and calculators for the unit so that they are readily available to the nurses who will not spend additional time searching for them will cost about $150. I anticipate the total cost to roll out the project to be $6550.

Currently, there is not an actual known rate of QTc prolongation leading to arrhythmias in the organization. Pickham, et al. (2012) found that 24% of patients had prolonged QT intervals. In addition, patients with QTc prolongation had longer hospital stays (276 hours vs. 132 hours) and had three times the odds of all-cause in-hospital mortality compared with patients without QTc prolongation. Applying these metrics to a volume of 1200 total critical care patients seen in SICU in a year, we potentially care for 288 patients with prolonged QT intervals that currently go unrecognized. By identifying these patients early, and treating them proactively by reviewing and perhaps changing their medications, we could potentially save ten hospital days annually at a rate of $4013 per day (Chargemasters, 2014). This could potentially result in a savings of $40,130 annually. The potential savings may be overestimated, as many co-morbidities may exist in a patient with QTc prolongation. However, despite any potential savings, the known risks associated with patients with prolonged QTc intervals warrants the nursing staff to be assessing for this, and they need to be given the information and the tools to perform this assessment.

Methodology

To adopt a new practice of calculating the corrected QT (QTc) interval upon the initial assessment of each patient in the surgical intensive care unit it would be prudent to apply Lewin's Three Step Change Theory (Appendix C). This theory involves three phases: *unfreezing* when preparations are made for the change, *moving* when people are aware of the needed change

and begin adopting the practice, and *refreezing* when the change is fully adopted and practiced (Grossman & Valiga, 2013). To implement the change it is necessary that the factors for change outweigh the factors against change (Change Management Coach, 2015).

Using Lewin's Change Theory, the CNL first prepared for the change by assessing the staff's current understanding of calculating QTc. The CNL received feedback from a survey that self-reports nurses' current comfort level and understanding of QTc calculations. Education was provided that discussed the rationale for completing this extra step while performing shift assessments. The example of measuring the QT interval measurement without the correction is as helpful as measuring someone's weight without his height. It would be impossible to determine if he was underweight, average, or overweight with just that one measurement. This comparison helped the staff understand why adding the calculation was important and provided a much more useful determination of a patient at risk for prolonged QT syndrome. In the moving phase, many expressed concern that adding an extra task, despite the brevity of the task, is going to take time from other necessary care. At this time, staff have an ample supply of calculators and calipers so that they are readily available and no time is lost searching for them. I have educated and re-educated the staff on how to calculate the QTc. In addition to educating staff on how to perform the calculation, I have encouraged communicating this information with the physician during daily rounds when the QTc is prolonged so that medication adjustments can be made as well as requesting the pharmacist to review the medications for potential interactions, which may prolong the QTc. Finally, during refreezing, ongoing chart audits will be conducted to meet 90% compliance with routine shift assessments and 100% compliance with the administration of antipsychotic medications. Feedback is provided regularly, both one on one and in informational posters so staff can see how the unit is adopting this change.

As the team leader, the CNL will mitigate the reasons for implementing the change by promoting the patient safety. QTc prolongation has been linked to the development of potentially lethal ventricular arrhythmias. When change is introduced, nurses are inclined to adopt the practice when patient safety is a concern. As an advocate both for the patients in the unit and for the nurses always prioritizing their time, the CNL will continue to pursue other technologies that can possibly serve to save time and collaborate with the computer informaticist to update the EHR in a way that will calculate the QTc when the heart rate and actual measured QT interval is input into the flowsheet.

Data Source/Literature Review

The SICU is an 11-bed critical care unit for surgical patients requiring extensive monitoring after surgery, or surgical patients who are unstable post-operatively due to shock or co-morbidities that the patient is experiencing. When necessary, the SICU serves as an overflow unit for critically ill medical, cardiac, trauma, or neurologic patients as well. The manager oversees both the SICU and the Trauma ICU. There are four Clinical Coordinators, two on days and two on nights to cover charge nurse and other leadership duties 12 out of 14 shifts each week. The patient to nurse ratio is 2:1 unless the patient's condition warrants 1:1 nursing care.

One skill the critical care nurse possesses is monitoring the cardiac rhythm. Each patient is monitored continuously on the EKG monitor. The accepted standard in the critical care environment calls for the nurse to document the rhythm and run a paper strip each shift with the baseline physical assessment. The patient's EKG rhythm strip is added to the paper chart after it has been assessed for rate, rhythm, and measurements of the cardiac cycle including depolarization and repolarization intervals of the atria and ventricles. Nurses have consistently measured these intervals known as the PR, QRS, and QT intervals. The QT interval represents

the total time it takes for ventricular depolarization and repolarization and is measured using calipers from the beginning of the QRS wave to the end of the T wave (Yaldren & Richley, 2014).

A review of the literature was performed to determine the appropriateness of introducing calculating the QTc to the critical care staff to be incorporated along with their baseline shift assessments. The PICO search strategy was utilized to help focus my search. The population was critical care patients. The intervention was calculating QTc or QT correction. The comparison was risks. Finally, outcomes were Torsades de Pointes.

The QTc is an additional calculation of the measurements of the cardiac cycle. The QT interval is normally affected by the patient's heart rate (Barett, 2015). Applying a correction of the heart rate to the QT interval is important because it better identifies whether or not the interval is appropriate or prolonged. Prolonged QTc intervals are associated with Torsades de Pointes (TdP) which can lead to lethal ventricular arrhythmias. Pickham et al (2012) found that 24% of hospitalized patients experienced prolonged QTc, whereas Hoogstraaten, Rijkenberg, and van der Voort (2014) found that 52% of critical care patients experienced prolonged QTc. In addition, Pickham, et al. (2012) discovered that 6% of acute cardiac events are due to TdP. Prolonged QTc is also associated with a higher severity of illness index (Pickham et al., 2012, Hoogstraaten, Rijkenberg, & van der Voot, 2014), with these patients also experiencing longer hospitalizations and a three times greater in hospital mortality rate than those without a prolonged QTc. Nurses frequently administer medications that are known to cause prolonged QTc (Kennelly & Esaian, 2013). While drugs causing prolonged QTc alone have not been shown to cause TdP, when administered to patients with in high doses or interactions with other QTc prolonging drugs or in the presence of renal or liver insufficiency, the risk is higher (Kennelly &

Esaian, 2013). Some of these medications include antiarrhythmics, antipsychotics, antibiotics, narcotic antagonists, and even some medications commonly administered to protect the gastro-intestinal system (Kennelly & Esaian, 2013, Barrett, 2015). Electrolyte abnormalities especially in combination with any of the above factors can prolong the QTc (Barrett, 2015). These risks, alone or in combination with each other, are seen in as many as 69% or critical care patients (Pickham, et al., 2012) leading experts to concur that QTc monitoring is an essential part of critical care assessments.

While the current literature supports critical care nurses monitoring the QTc, a recent review of charts in the SICU over a week showed about 80% consistency with the nurses placing an EKG strip in the chart each shift the patient was in the unit measuring only the PR, QRS, and QT intervals. The same review showed on only two occasions or 3% was the QTc calculated.

To help determine the appropriate interventions to increase compliance, a survey was administered to the nurses to assess their understanding and comfort level with calculating the QTc (Appendix D). Consistent with the diverse experience of critical care nursing that we have in the unit, I found that about 40% of the nurses claim highest level of understanding and comfort and “always” perform QTc calculations and a total of 75% scored 4 or 5 on initial suveys. In contrast, 10% of the staff claim little or no understanding of the QTc value and rarely or never perform the calculation (Appendix E). While this did not exactly correlate with the findings from the chart audits, it did support the fact that many nurses had not been taught how or why to perform the QTc, or had not performed it in a long while and had forgotten how to do it. Further one on one discussions with nurses also supported this. One nurse claimed she had always completed the QTc at her former unit, but she no longer performed the calculation in this unit as “no one else did.”

Timeline

The project began in the first week of June with the unit assessment. Nursing surveys and communication assessments were conducted the second and third week in June while chart audits were completed. The first and second week of July brochures were prepared with additional communication assessments. Finally, the brochures will be rolled out the end of the second week of July during shift huddles. The third and fourth weeks of July, one on one teaching and feedback will be given and ongoing chart audits will be conducted as well as observations of the nurses while performing their assessments.

The first two weeks of August feedback will be given to the unit compliance. Observations will be made for other barriers to reaching the compliance goal. The overall timeline can be seen in Appendix E.

Future additions to the project include adding QTc to the policy regarding cardiac monitoring in the critical care unit. The CNL will collaborate with the computer informaticist to install a field for the documentation of the measurement and possibly a QTc calculator.

Expected Results

The goal is to increase compliance with calculating the QTc to 90%. The nurses will be skeptical at first about finding time to perform additional assessments in their already task-filled shifts, but the transition will be smooth once they have practiced the formula a few times. Compliance is expected to reach goal by September 2015 and this is only to give additional time for nurses who may be on vacation additional time to learn the method.

Nursing Relevance

Nurses take much pride in the work they do. In addition, nurses are fiercely protective of their patients. They are already tasked with filling every working minute with patient care and

documentation, and yet nearly weekly they learn of another new expectation related to patient care or patient satisfaction. The initial response is generally predictable no matter what the new request may be. Nurses will still always find a way to do what is right for their patients and adopt the new practice. Because the measurement of the QTc is clearly an important tool that will help them identify a potential complication, the nurses will adopt this practice and help others to adopt it as well. They will be concerned that medications they are administering to the patient to provide therapy can also have risks. They will understand that by incorporating this measurement in to their assessment of the patient, they can potentially prevent harm.

Conclusions

The global aim for this project is to improve patient safety by measuring the QTc on all critical patients in the SICU. By measuring the QTc, the critical care nurse can assess for prolonged QTc, which is a known precursor to torsades de pointes and other lethal ventricular arrhythmias. The specific aim is to improve compliance with QTc calculation to 90%.

Overall, this was a challenging and time consuming project despite the narrowed focus. There was much enthusiasm during the initial communication and microsystem assessments. There were discussions with nurses who had great knowledge of the measuring and assessing cardiac rhythms. Many were excited to see a return to earlier learning and were helpful with ideas to implement the project. Meetings were arranged with “champions” to help spread the education in huddles. This was all done on shift time to help keep costs down.

After performing additional literature reviews, nursing surveys were developed to assess the overall understanding among the staff of how to perform the QTc and even why it is done. The data found when reviewing the surveys indicated 75% of staff reported a very high understanding of QTc calculation, and only 10% had little understanding of the calculation. The

chart audits did not correlate with the nursing audits as the baseline compliance with measuring and documenting the QTc was only 3%. Realizing that documenting the QTc was not an expectation was one reason explaining the discrepancy in the findings. Education was provided in huddles on how to perform the calculation. Fliers were posted on the staff bulletin board and updated weekly with new information, uplifting thoughts, successes, and other quick tips. Staff expressed enthusiasm during one on one conversations, weekly chart audits still showed inconsistent compliance. In fact, chart audits over one weekend showed not only poor compliance with QTc calculation, several charts over several shifts had no EKG strips posted at all.

Observations were made on all shifts of staff completing the EKG strips. As noted previously, staff vary in practice on when they complete the EKG assessment with some not completing the measurement until several hours into the shift which would prevent communicating findings with the MD during daily rounds should there be a problem. Ongoing conversations with nurses came up with solutions such as the charge nurse completing the strip and measurement or having the unit assistant post the strip. It was agreed that in a crisis this was an option, but for the routine it was preferred that the patient's bedside nurse complete the measurement to be aware of the information. Some who had difficulty consistently measuring the cardiac rhythms, had difficulties with completing other areas of patient care as well. This did promote discussion between the charge nurse and a younger novice nurse who asked for a checklist of items to complete each day and had been working off the checklist with much greater overall management.

A secondary nursing survey went out to the nurses which showed an increase in comfort level with those reporting 4 or 5 had reached 95% and no one reported a 1 (Appendix G). Chart

audits of QTc measurements still have not reached the 90% compliance goal, but there has been overall improvement and reached 82% in the last week of measurements (Appendix H). There is success in the fact that nurses are more aware of this measurement. I have also heard an increase in awareness of the QTc measurement when high-risk medications are administered. Two patients have had profoundly long QTc intervals, one was found by the intensivist, which was disappointing, but one was discovered by the patient's nurse. Both had medication adjustments and had resolution of the prolongation. Both of these events were shared with all of the staff. On days following these events, there was a higher compliance with measurements. This helps support continuing attempts to improve compliance, as it shows the nurses do want to find problems that they can help make a positive impact.

Using this project as an introduction to the role of the CNL is exciting. Promoting change in the care of all of the patients in the unit is most rewarding, much like the feeling of the novice nurses who have intervened in a critical situation and observed improvement in their patients. There is constant searching for ways to improve the care of the patients in the microsystem and searching for the right tools for the nurses to make that happen.

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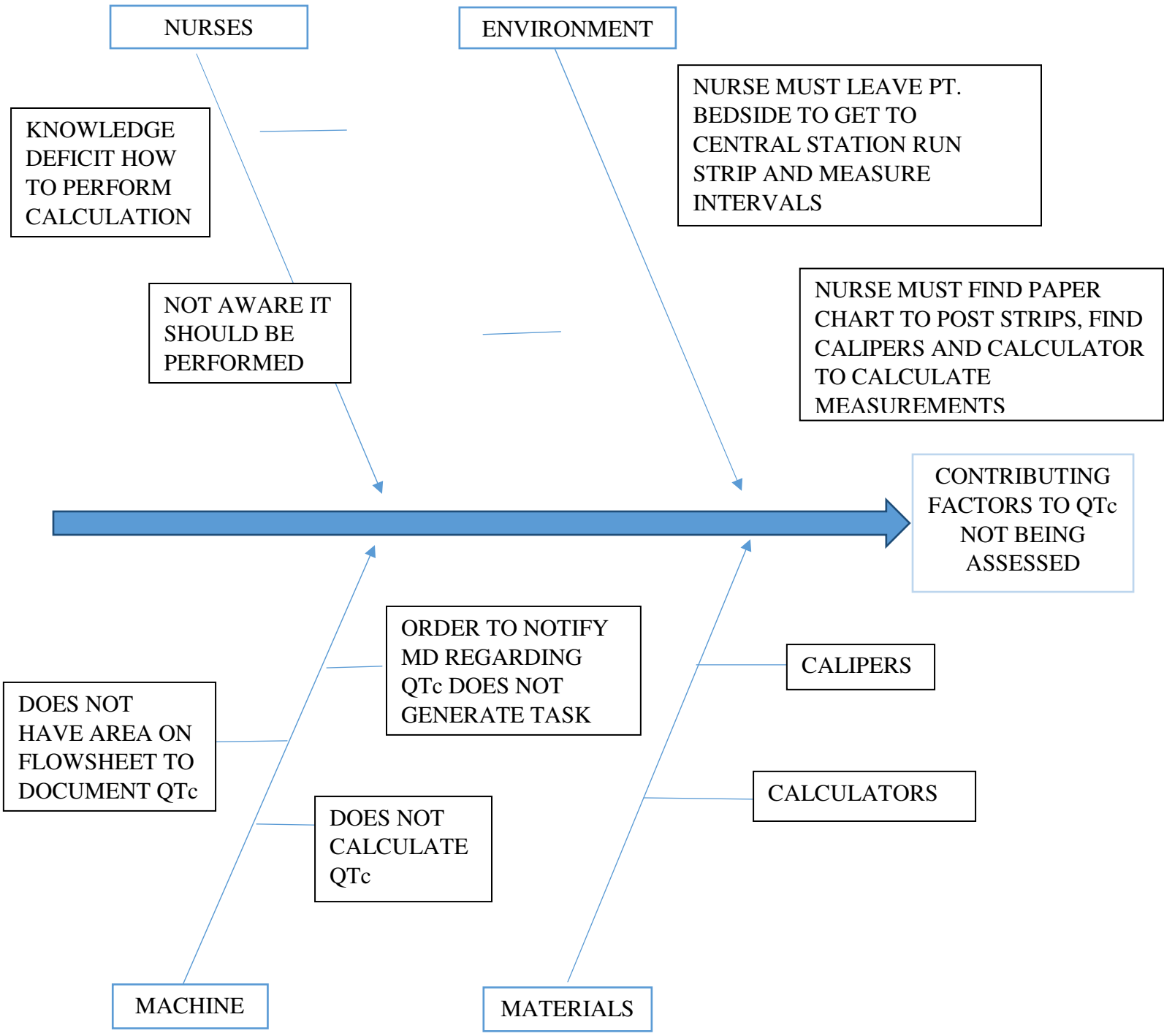
Appendix A

FISHBONE DIAGRAM

CAUSES WHY QTc NOT CALCULATED AND DOCUMENTD

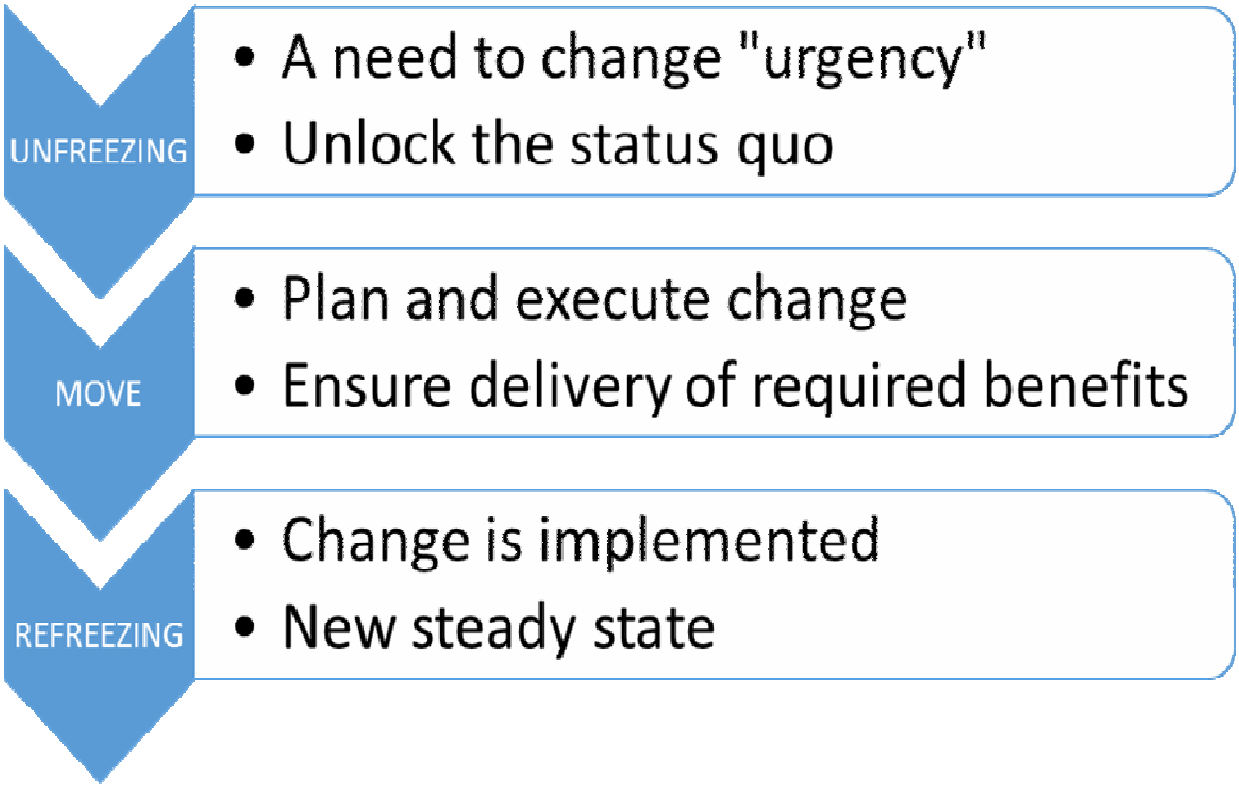


Appendix B

SWOT Analysis

Appendix C

Lewin's Model of Change



Appendix D

Nursing Survey

Are you QT Savvy?

I know how to measure and document the QT interval:

- ☐ Yes
- ☐ No

I understand what it means to correct the QT interval:

- ☐ Yes
- ☐ No

On a scale of 1-5 (5 most comfortable, 1 least comfortable):
How comfortable are you measuring and correcting the QT interval:

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5

I measure, correct, and document the QT intervals at the beginning of the shift:

- ☐ Always
- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

I make it a point to measure, correct, and document the QT interval when I administer antipsychotic medications:

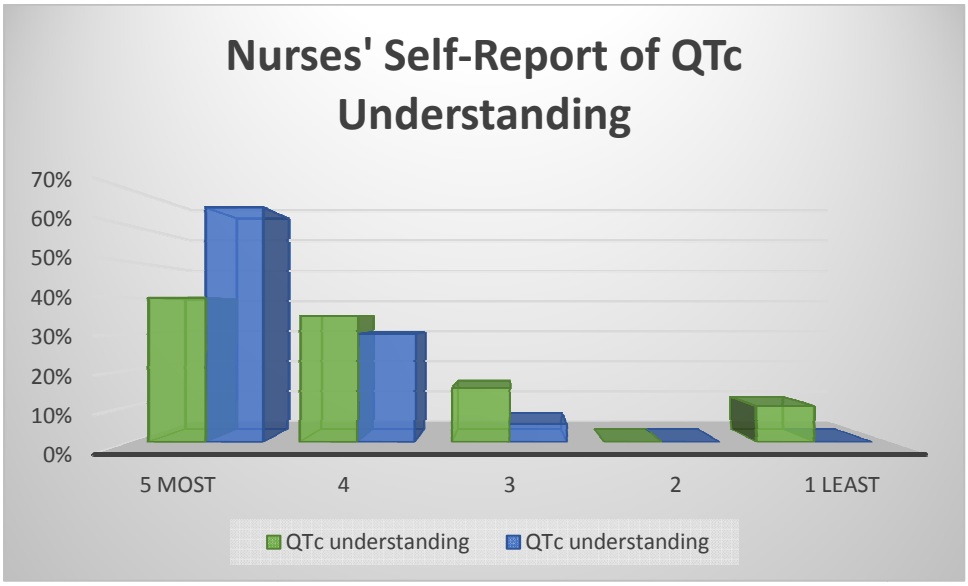
- ☐ Always
- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

Thank you for your time completing this survey. Your feedback will be used to help improve patient safety in our unit.

Appendix E

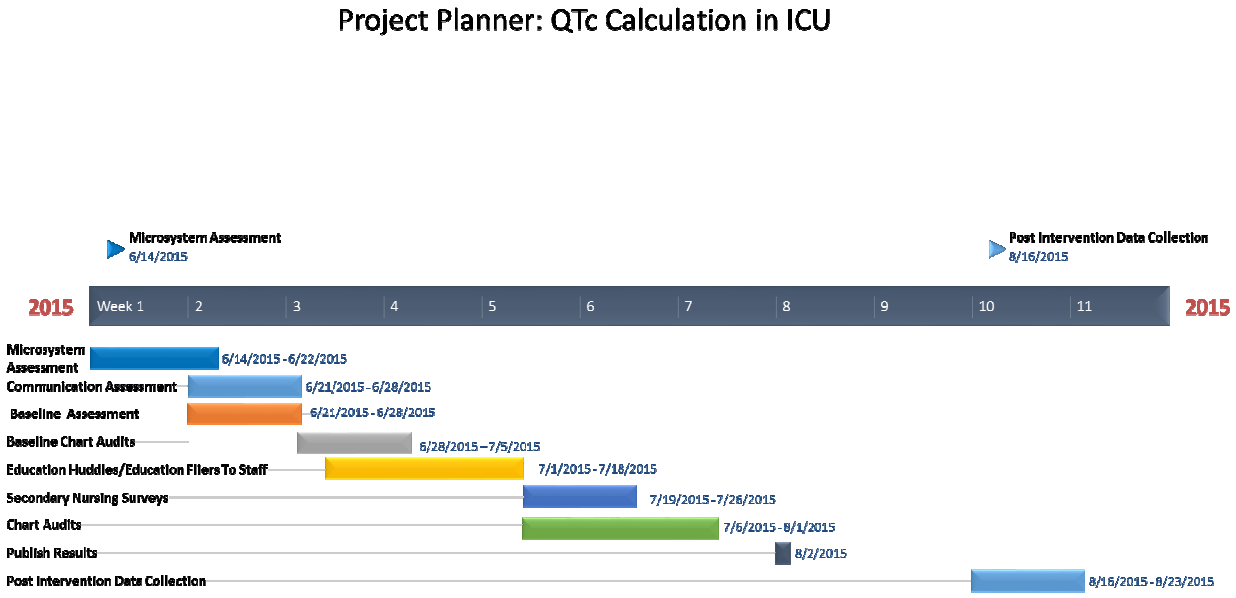
Assessing Nurses Knowledge and Comfort Level

	QTc understanding			perform and document QTc	
	6/28/15-7/4/15	7/19/15-7/25/15		6/28/15-7/4/15	7/19/15-7/25/15
5 most	40%	65%	always	25%	20%
4	35%	30%	often	50%	55%
3	15%	5%	sometimes	15%	25%
2	0%	0%	rarely	0%	0%
1 least	10%	0%	never	10%	0%



Appendix F

Timeline



Appendix G

1. QTc Calculation Survey

[Company Name] requesting your help. Please complete the following Survey based on my project to improve patient safety by increasing compliance with calculating the QTc. After receiving education from huddles and fliers, I would like to see how staff feel about measuring QTc. Thank you for your time ~ Diane

Project Name:

☐ Calculating QTc

Date:

QTc Calculation Survey

1. I currently calculate QTc with my baseline assessment of my patients:

- ☐ Always
- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

2. I feel comfortable calculating QTc: (1-5, 5 most comfortable, 1 least comfortable)

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5

Please list any barriers you experience to calculating and documenting your QTc measurements:

_____

_____

_____

Any additional comments:

_____

_____

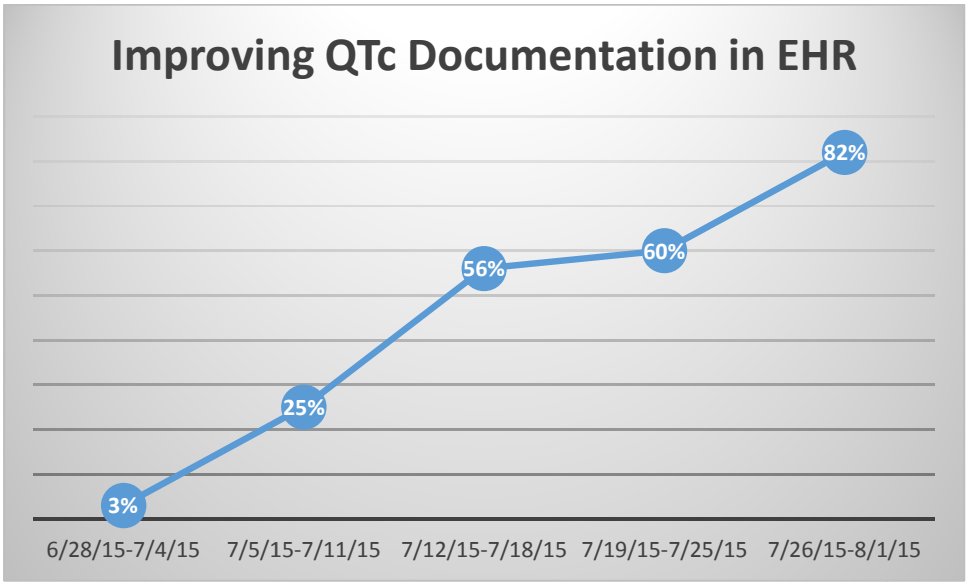
_____

Thank you very much for taking the time to complete this survey. Your feedback is very valuable and very much appreciated.

Appendix H

QTc calculation compliance

Week of:	Per cent QTc completed	Charts audited	QTc compliant
6/28/15-7/4/15	3%	66	2
7/5/15-7/11/15	25%	56	14
7/12/15-7/18/15	56%	30	17
7/19/15-7/25/15	60%	68	41
7/26/15-8/1/15	82%	60	50



Appendix I

Educational Fliers

QTc

- Calculating the QTc
- First clear all information on the calculator
- Enter your measured QT interval
- Press the divided by sign (either ÷ or /)
- Enter your measured R:R value
- Press the square root sign (√)
- Press the equal sign (=) or enter
- That is your QTc

Calculating the QTc in Afib

- From your strip measure your longest R:R
- Measure the QT interval just after the 2nd R wave
- Calculate the QTc
- Measure your shortest R:R
- Measure the QT interval just after that 2nd R wave
- Calculate the QTc
- With these two values, you can determine an average QTc

Prolonged QTc > 0.45 seconds

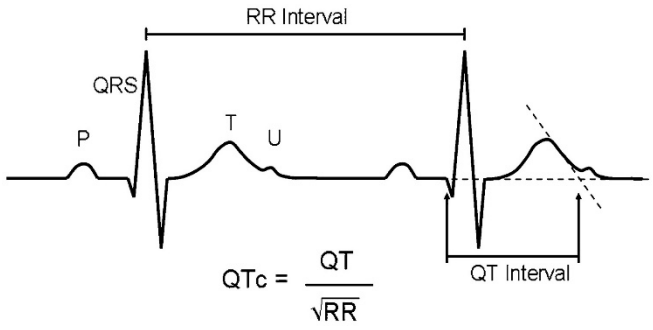
Table 1. Some Drugs Associated With QTc Interval Prolongation Used in the Critically Ill[a]

Class			
Antiarrhythmics	Class IA	Class IC	Class III
	Quinidine	Flecainide	Amiodarone
	Procainamide	Propafenone	Sotalol
	Disopyramide		Ibutilide
			Dofetilide
Antimicrobials	Macrolides	Azole Antifungals	Other
	Erythromycin	Ketoconazole	Pentamidine
	Clarithromycin	Itraconazole	Chloroquine
	Azithromycin	Fluconazole	
	Fluoroquinolones	Voriconazole	
	Moxifloxacin	Antiviral	
	Levofloxacin	Amantadine	
	Ciprofloxacin	Foscarnet	
	Ofloxacin	Atazanavir	
Psychiatrics	Antipsychotics	Antidepressants	Mood stabilizer
	Thioridazine	Citalopram	Lithium
	Chlorpromazine	Escitalopram	
	Haloperidol	Sertraline	
	Ziprasidone	Paroxetine	
	Quetiapine	Amitriptyline	
	Olanzapine	Nortriptyline	
	Risperidone	Desipramine	
	Paliperidone	Doxepin	
	Clozapine		
Gastrointestinal	Antiemetics		
	Granisetron		
	Ondansetron		
	Dolasetron		
Others	Methadone	Famotidine	
	Ranolazine	Felbamate	
	Dronedarone	Fosphenytoin	
	Alfuzosin	Octreotide	
	Diphenhydramine		

List taken from www.QTdrugs.org

QTC

We give medications to our patients every day that may prolong the QT interval putting them at risk for the development of Torsades de Pointes or other lethal ventricular arrhythmias. Did you know patients with prolonged QTc have longer hospital stays (276 hours versus 132 hours) and a 3 times greater in hospital mortality rate (Pickham, et al., 2012)?



1. Statistics show 69% of critical care patients are at risk for prolonged QTc

2. 52% of critical care patients have prolonged QTc

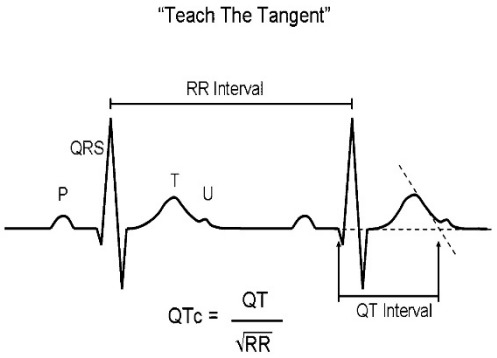
3. Prolonged QTc puts the patient at risk for TdP

4. 6% of cardiac arrests due to TDP

St. John ICU currently monitors PR, QRS, QT intervals 73% of the time

St. John ICU measures QTc 3% of the time

QTC



- **Calculating the QTc**

Knowing only the measurement of the QT interval without correcting it to the patient's HR is like knowing someone's weight without his height. Is he underweight or overweight at 150 lbs.?

Calculate and document the QTc every time you measure your PR, QRS, and QT intervals!

Notify MD when QTc > 0.45 seconds