Developing a Closed, Intravenous Medication System for a NICU

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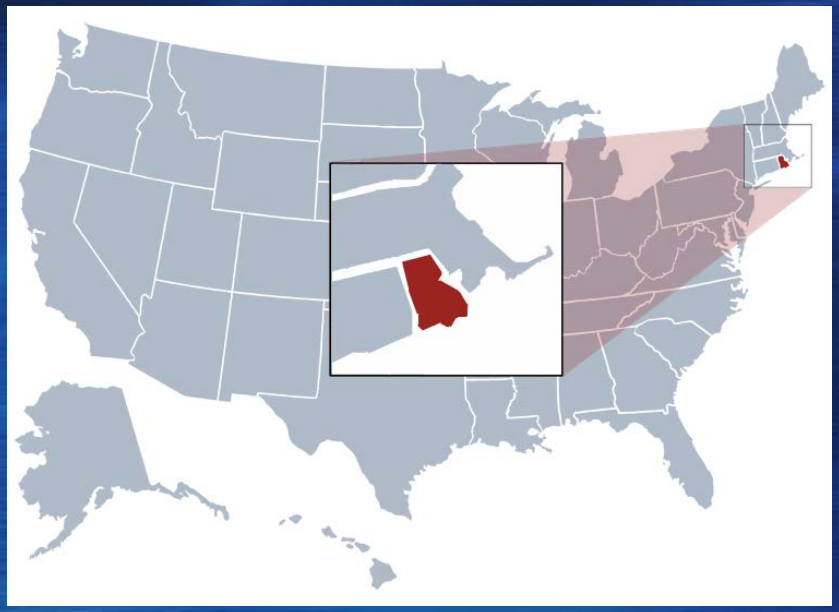
Disclosure

Honorarium provided by ICU Medical

Objectives

- To describe the history and rationale of developing a closed medication system
- To describe the processes of developing, training, and implementing a closed medication system
- To review the results of utilization of the closed medication system

Rhode Island



Wicked

Worcester

Woostah!

CLABSI

- There as been a 46% decrease in CLABSI rates in Hospitals nationwide 2008-2013
- Estimated 30,100 CLABSI still occur throughout ICU's and wards
- Still Preventable

**CDC Jan 2016

UMass Memorial Medical Center

- Largest health care system in central MA
- Consists of three campuses in Worcester MA
- Offer 41 different types of services ranging from Neonatal Care to a level one trauma center

Women & Infants Hospital

- Providence RI
- Affiliated with Brown University
- Approximately 220 beds

NICU

- 80 bed Level III NICU
- Average daily census of 65 infants
- Employ 210 nurses in the NICU
- Dispenses 175,000 medications annually
  - 3400 meds a week

Challenge of Giving NICU Meds

- Precise dosages
- Wide range of patients (Micro preemie – toddler)
- Multiple medications given through single IV access

NICU Patient Population

- Infants range in weight from 320 gm to 6 kg

Medications are weight based

Neonatal IV Access

- Difficult to obtain IV access
  - Peripheral
    - Scalp IV's
  - Umbilical Lines
  - PICC
  - CVL
- Trend is for units to utilize central lines more in NICU's

Medication Issues in the NICU

- Communication Challenges between disciplines
  - Pharmacy
  - Nursing
  - Medicine
- Errors
  - Pharmacy
  - Nursing
  - Medicine
- Needed to develop a task force

The NICU Medication Task Force

- Multidisciplinary Team
  - Pharmacy
  - Nursing
    - Staff
    - Leadership
    - Education
  - Risk Management
  - Quality
  - Medicine

NICU Medication Task Force (MTF)

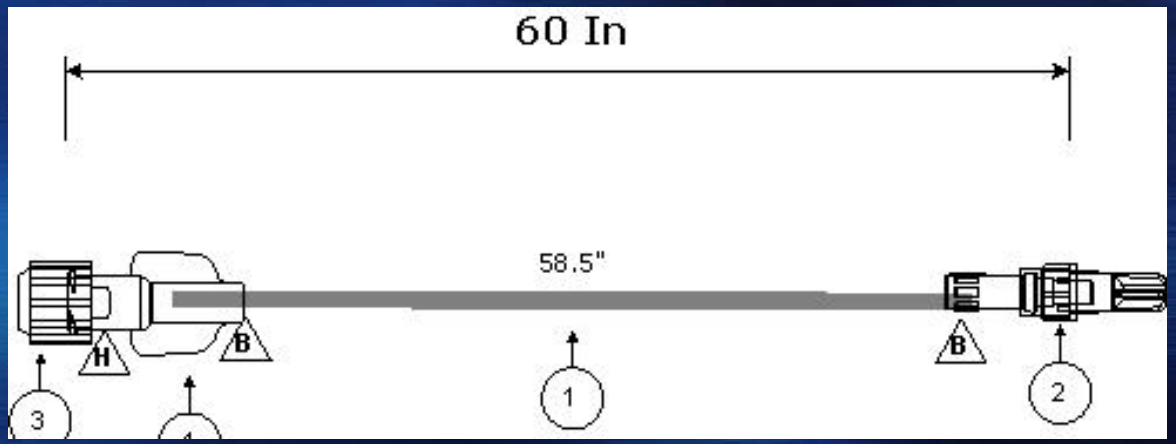
- Meets Monthly to discuss medication processes in the NICU
  - Pharmacy
  - Medicine
  - Nursing
- Review and Track occurrence screens to improve processes and prevent errors.

NICU MTF Goals

- Improve Communication Between Disciplines
- Decrease infection rates
- Decrease medication errors

Infection Rates

- Open ended medication line
- Women & Infants Hospital used a positive displacement connecting device
  - Research documents an increase in central line infection rates with the use of positive displacement connective devices



Medication Errors

- There were multiple ways to deliver medications
  - Multiple connections available that set a risk for incompatibility of medication delivery
  - Nurses utilize different methods of programming syringe pumps

What did we need to do?

- Change our connecting devices
- Needed a different way to administer medications
  - Evaluate infection risks
  - Evaluate potential errors
- **MTF findings drove a major initiative to find or develop a new med system for the unit.**

NICU Query

- Facilities were switching to neutral displacement connecting devices
- Other units were starting to use closed medication delivery systems
  - Designed with stopcocks and integrated flush systems
  - Studies showed significant reduction in infection with the use of a closed medication system (Tale of Two Cities*)

*Aly, H; Herson, V, Duncan, A, et al. *Is bloodstream infection preventable among premature infants? A Tale of Two Cities* . 2005

Next Step

- The First step was to change our IV connecting device
  - Met with multiple vendors
  - Evaluated different connecting devices
  - Perform a unit trial of new connecting device

New Connector

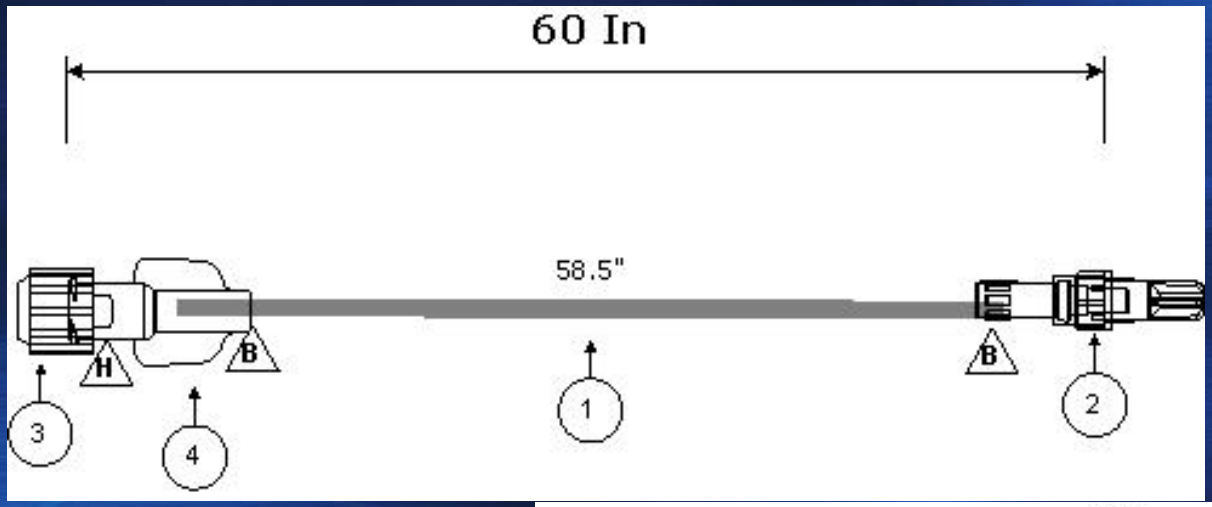
- Neutral Displacement Connector
  - Studies showed decreased infection*
  - Act as a microbial barrier
  - The manufacturer could customize tubing and connecters to what was currently used in our unit

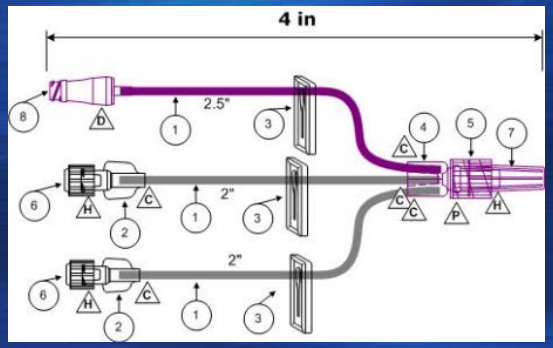
*ECRI Institute, Health Devices. Evaluation of Needless Connectors. September 2008;37(9): 259-286

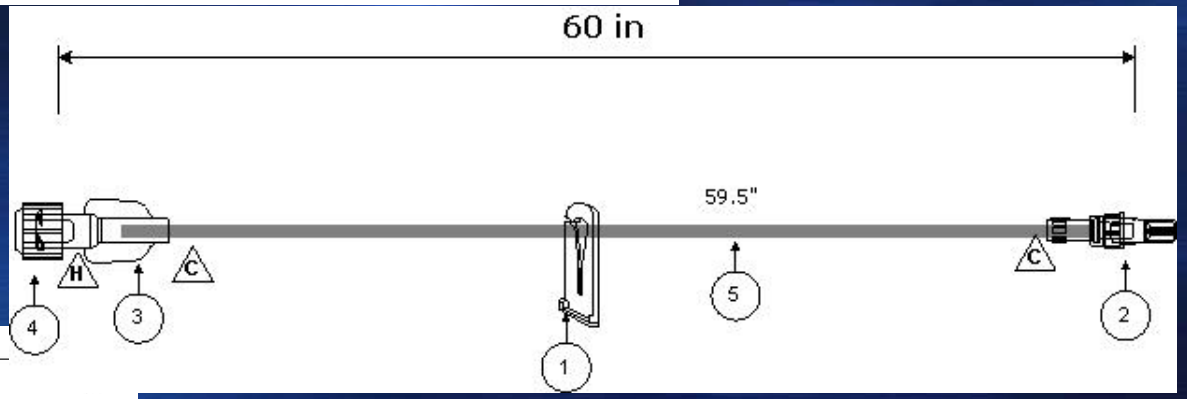
Neutral Displacement Connector

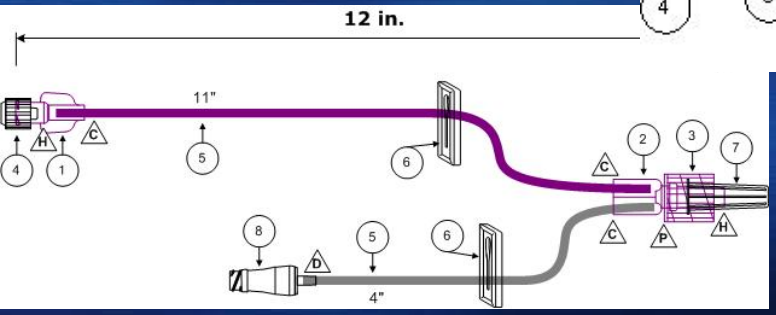
- 3 week trial
  - Replaced current IV sets with the new connectors
  - In-service for staff on the new connector
  - Gather staff feedback via questionnaires

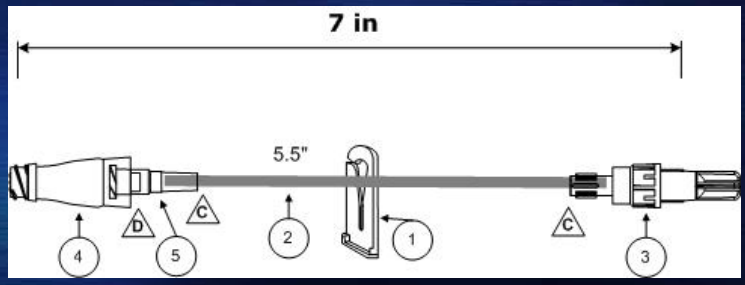
Multiple sets Adapted to our Use











What was Next?

A Closed Medication System

- What was a closed system?
  - Medication set with a dedicated flush line/reservoir
- Where could we get one?
- Could we customize one for our needs?

Goals of a New Med System

- Reduce infection
- Reduce errors
- Have our staff Administer medications the same way (uniformity)
- Make it simple to use

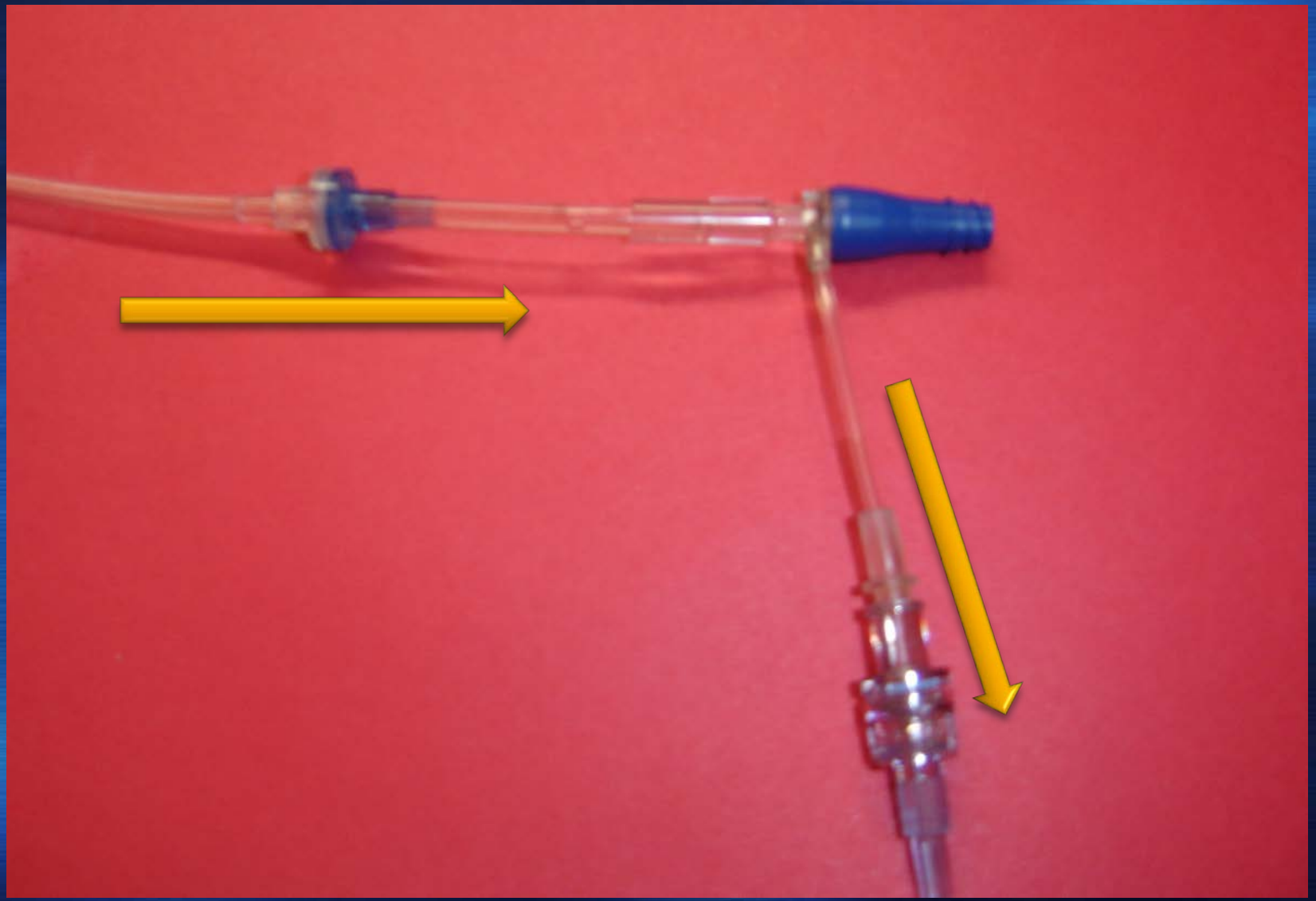
Developing a Closed System

- We looked at different devices
  - Stopcock delivery systems
  - Medline systems
  - Different connectors

Development of the System

- Manufacturer introduced a check valve system that could be adapted to a med system for the NICU
  - Consisted of 2 one way check valves
  - This could be used to keep the system closed without the use of stopcocks

Check Valve System



KISS

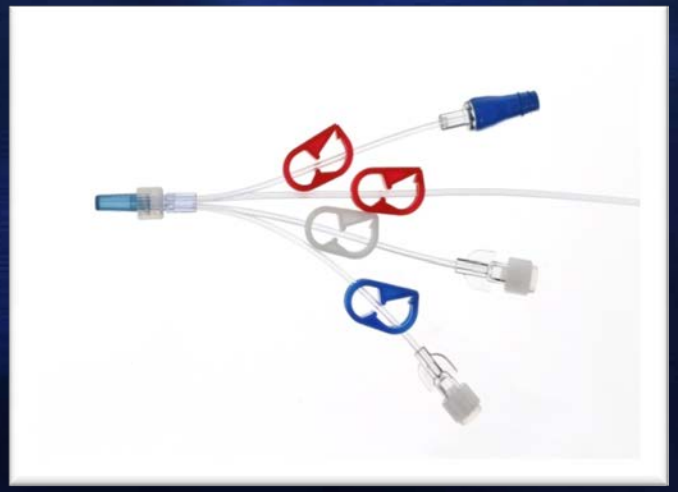
- Keep
- It
- Simple
- Silly

Designing System

Met with the manufacturer:

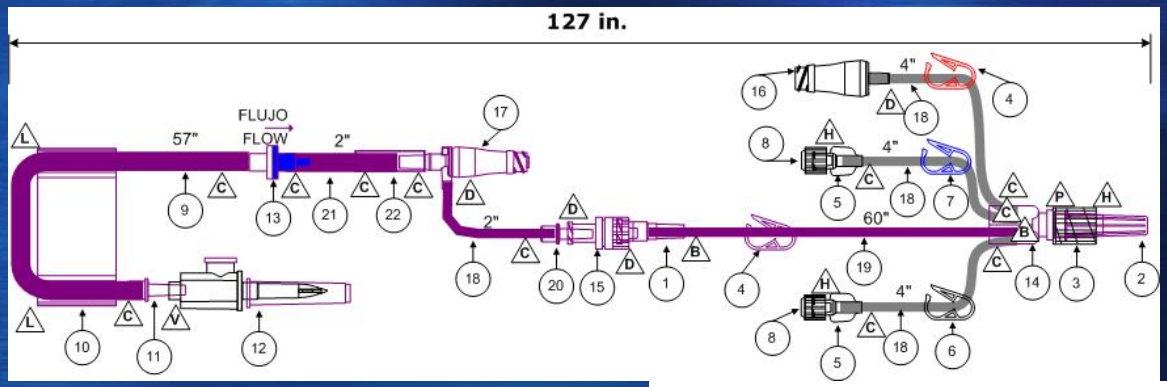
- To customize and design a system utilizing the check valve device and the Neutral Displacement Connecter

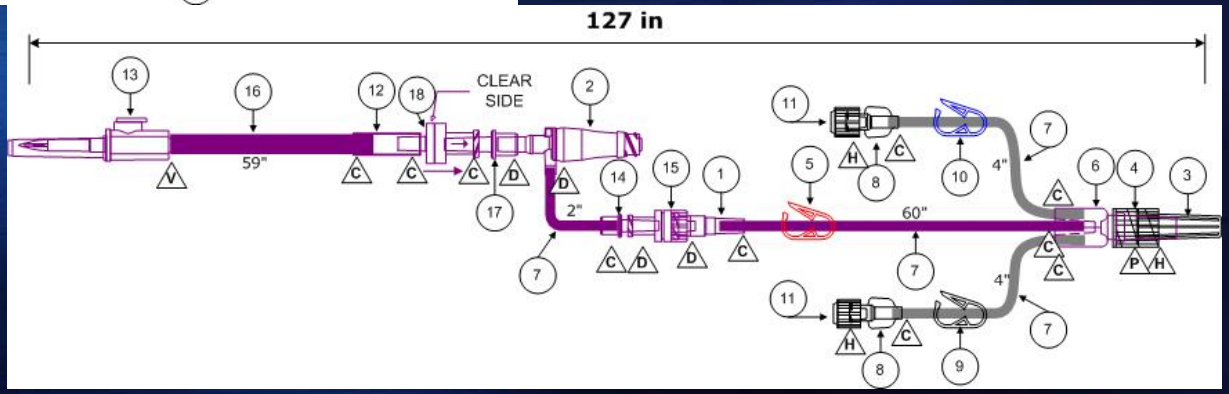
- The system consisted of a tri-fuse set and a med-line with a Connector and flush line



Prototypes

- Several prototypes were developed & tested
  - Particular attention to volume of the medication line
  - Needed a balance of appropriate length but low volume





Difficulties with Volume

- Getting the right volume was difficult
  - There needed to be enough tubing length for mobility of our patients
  - There needed to be a low volume in the tubing
  - To small of gauge of tubing created too much pressure in the system and would not work with syringe pumps

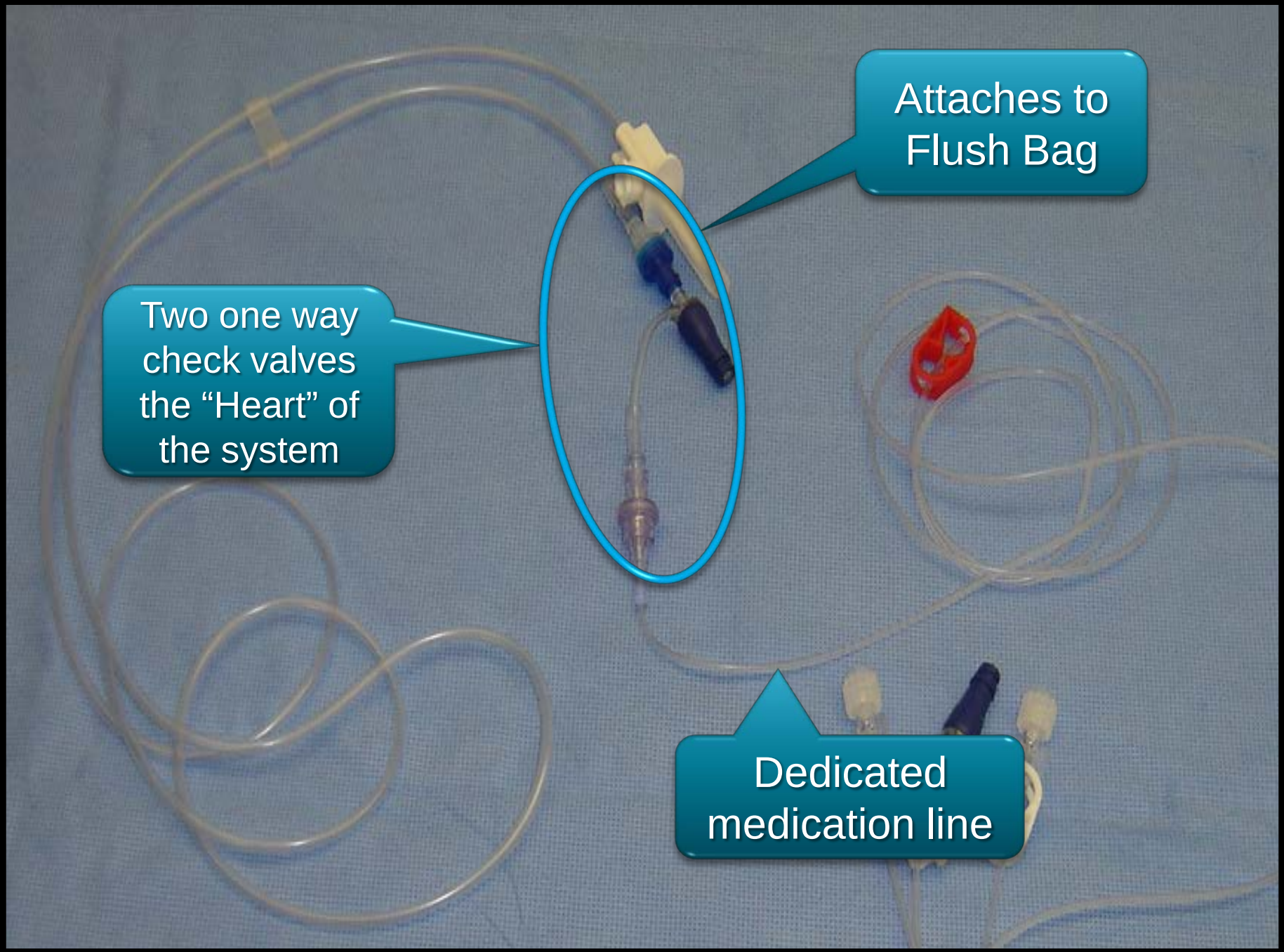
Testing

- Each Prototype was tested
  - Looking for volume
  - If the system would work on the pump
  - If the length of the med-line was adequate for our patients and families
- Once testing was completed a sterile system was developed for trial

Testing

- Many of the Prototypes were tested on Syringe Pumps

First system for trial


Attaches to Flush Bag
Two one way check valves the “Heart” of the system
Dedicated medication line


TRANSWARMER®
INFANT TRANSPORT MATTRESS
TPN
IL
OXYGEN

Priming the System

- Once developed we needed a process to prime the system
- We needed to use a 20 ml syringe to prime
- We tested different methods to prime the system in order to train for trial

Supplies

- 20 ml syringe
- Flush bag (standard is NS)
- Alcohol wipe
- Non sterile gloves

Priming System

- Turn the syringe upright so the air is towards the plunger.
- Then Push the syringe filling the lower part of the medication system completely but stop before pushing any air.

Unit Trial

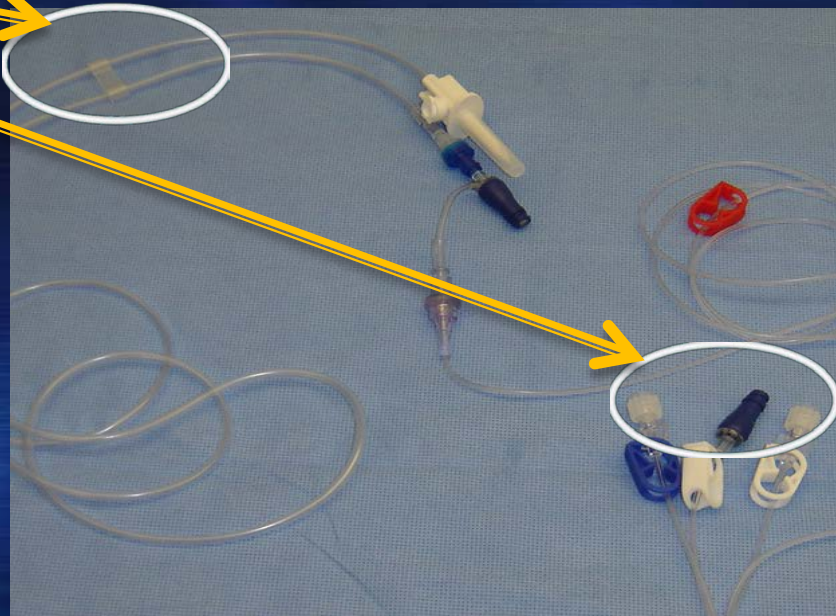
- Length June 28th-July 25th 2009
- 80 % of the nurses were trained on the trial med system
  - Poster boards
  - In-services
  - Power Point SharePoint postings
- Limited to patients on intermittent IV medications
  - No drips
  - Non-critical

Feedback from frontline staff is vital

- What is the difference between a NICU nurse and a Pitbull??

Unit Trial (cont.)

- Questionnaires were given to nurses using the system
- Feedback was critical to the process
  - Input improved the design
  - Added clip to prevent tangling of tubing
  - Added an extra port
    - Drips
    - Evaluating peripheral IV's
    - Emergency medications



Smart Pumps

- The Hospital Purchased Programmable pumps
- We wanted to coordinate training and roll-out to coincide with the new pumps

Establishing a Go Live Date

- Needed to coordinate enough product from the manufacturer
- Establish a Training process and schedule for both the pumps and the closed med system
- Make sure that the pump and med system would be ready simultaneously

Training

- Utilized a Super User model
  - 26 Super Users
  - Assisted in training/teaching classes
  - Used as resource during “Go-Live”
- Classes were scenario based simulating actual medication delivery
  - Showing how to program the syringe pump
  - Demonstrating how to use the med system with different medications used in the NICU

Introducing Change

Training (cont.)

- 100% attendance
- Competency check list for each person
- Super Users were scheduled as resource personnel for 3 weeks after “Go-Live”

Initial Problems

- Low volume medications
  - Took too long to deliver low volume medications when administered properly
  - Flush of 1mL utilized
- Who do we use the Closed Set on?

Solutions

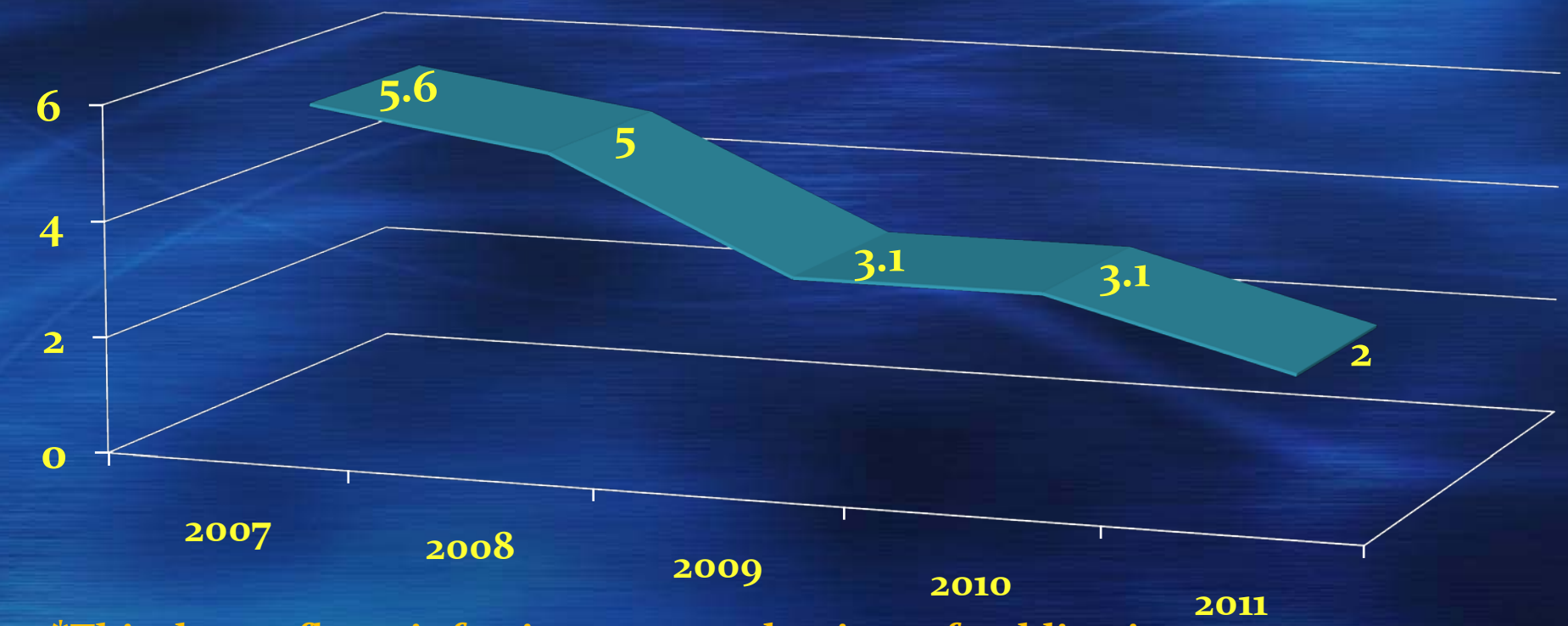
- Changed our low volume dilutions
  - Fentanyl
  - Versed
  - Morphine
- Use Closed Medication System on all patients receiving intermittent IV medications

Results of Using the System

- Since implementation
  - Infection rates were tracked
  - Occurrence screens (errors were tracked)
- Infection rates decreased by more than 50 % (initial data)
  - Attributed also to Central Line Bundle
    - Two person sterile line change
    - CHG
    - Single family Rooms
- Reduction of medication administration errors of 54.3%

Results of Using the System

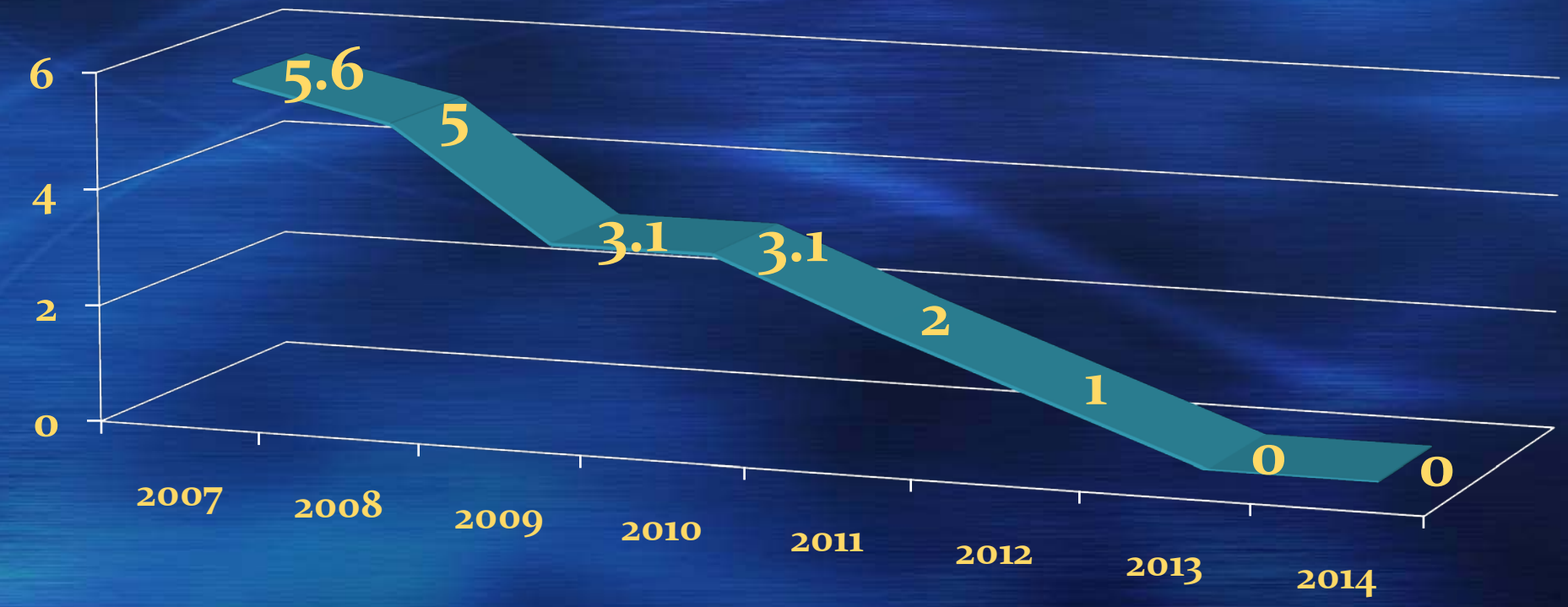
Infections per 1,000 line days



*This data reflects infection rates at the time of publication

Results of Using the System

Infections per 1,000 line days



Results also reflect line bundle

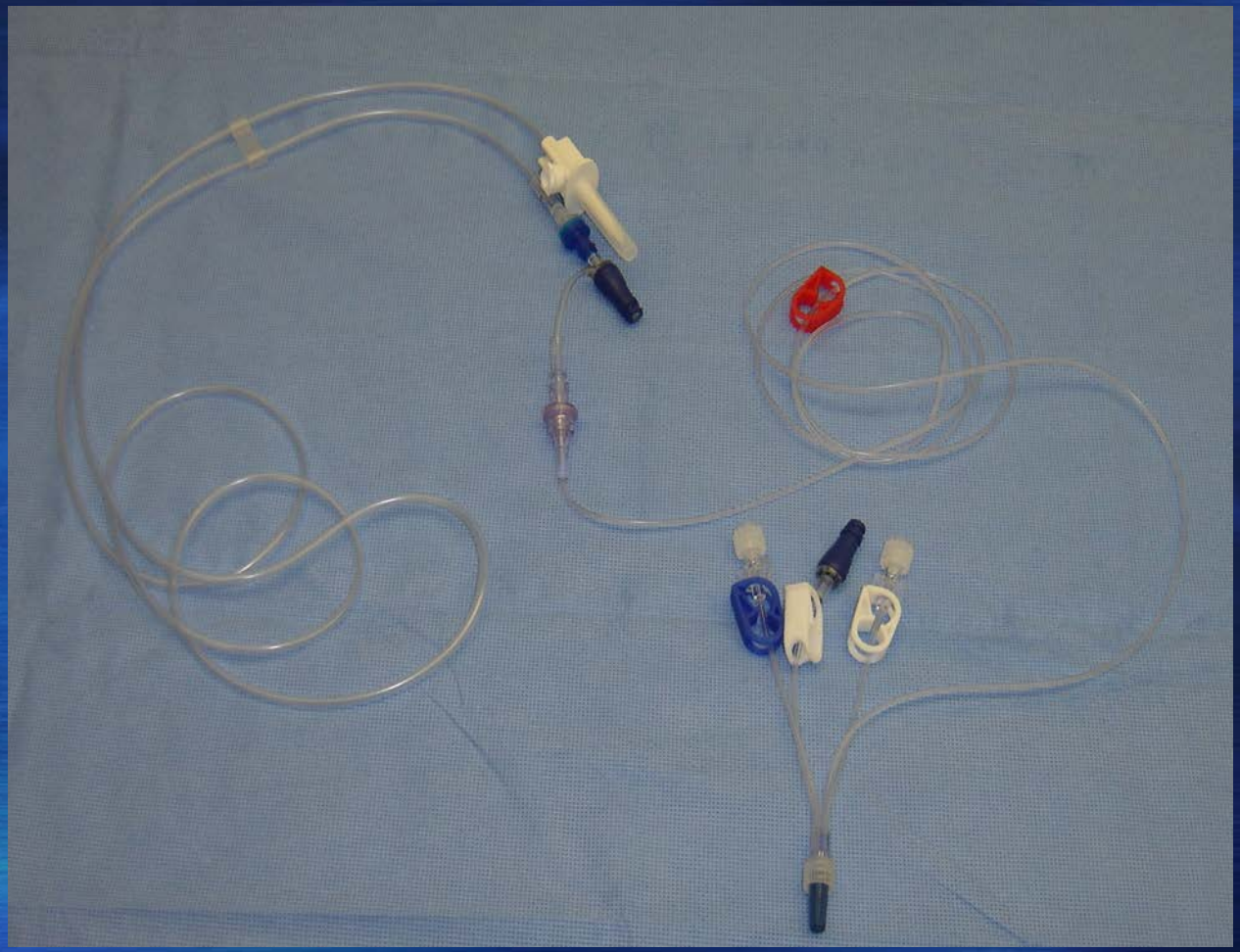
Positive Outcomes

- The system works well with Smart Syringe Pumps
- Nursing accustomed to using System

Lessons Learned

- It was not just the closed med set
  - Planning
  - Process
  - Product
- The technology and capability is available for change

The End

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Customized Check Valve System and MicroClave Connector

Customized Tri-Fuse set and a med-line with a MicroClave flush line