Training Evaluation:
Syringe Pumps for Intravenous Furosemide

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Introduction

- Situation & Background
- Research Question & Project Development
- Project Overview & Timeline
- Results
- Limitations
- Recommendations & Implications

Situation & Background

- Hurricane Maria, Puerto Rico, September 2017
- Devastation causes a shortage of IV medication, solutions, & bags
- Healthcare Systems across the U.S. must respond urgently and safely to the emergent situation
- Evaluate delivery method and develop training modality for new procedures
- Literature review for best practices

It Takes a Team!

- Victoria “Vicki” Church, RN, MS, CNS-BC
- Damian Vazquez, MMI, BSN RN
- Nicole Carter, MS, RN, AGCNS-BC, CMSRN
- Brenda Grossnickle, MSN, RN, CMSRN
- Amar Patel, PharmD
- Nicole Russo, BSN, RN, CIC
- Allison Petersen, RN, BSN, BS

Evidence-based Practice Question

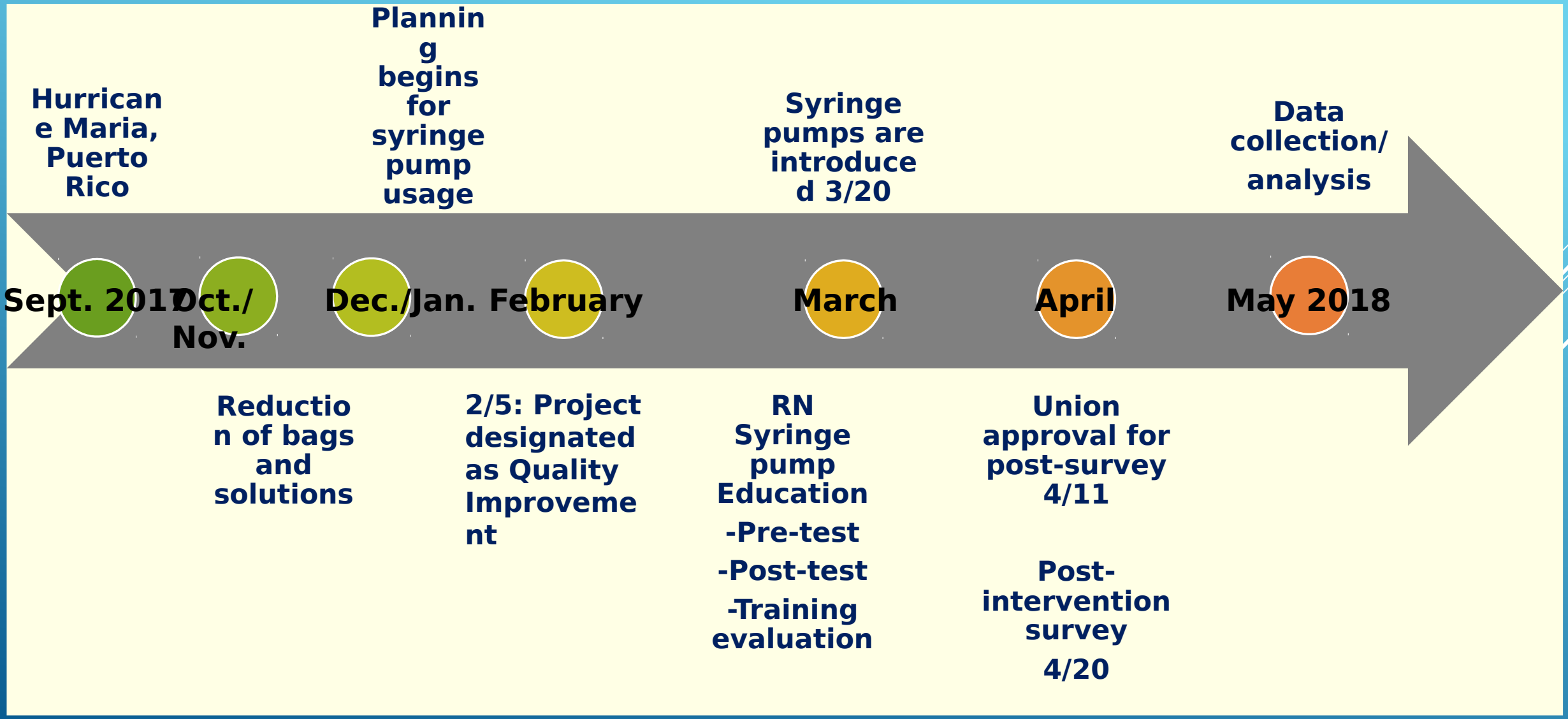
How effective is the training modality for syringe pump use of IV Furosemide (100 mg or greater) when evaluating ***safety, cost, nurse satisfaction, and knowledge retention*****?**

Syringe Pump

Training Structure & Delivery

- Training Modality: Hands on/ psychomotor
- Timing: 30 minutes
- Education: Repeat demonstration with assessment of skills
- Small group learning
- No print materials or f/u

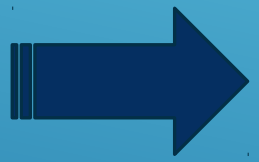
Timeline: September 2017- May 2018



Program Evaluation

Improved job performance:

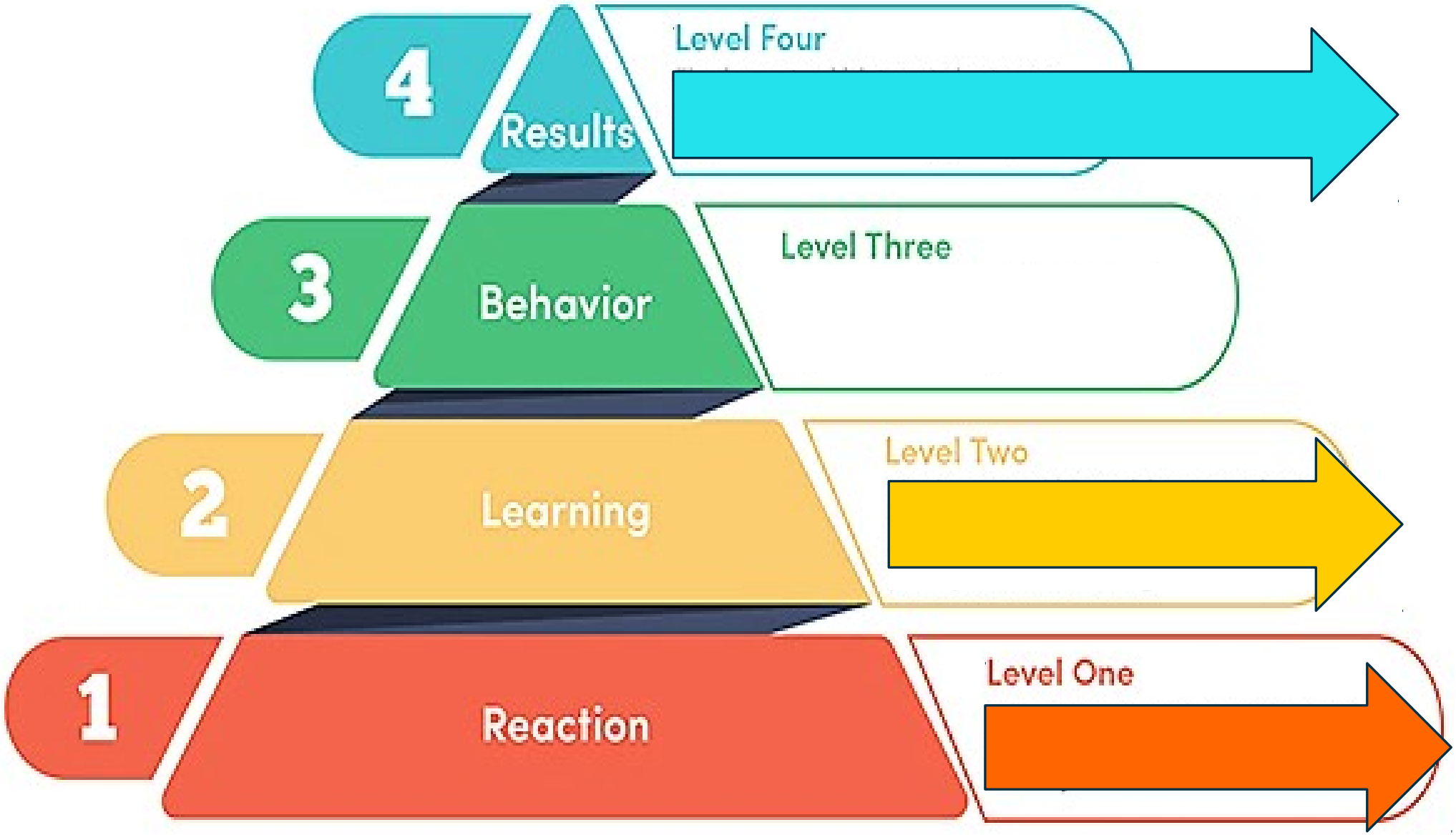
Acquisition of new skills and knowledge



OUTCOME VARIABLES

- **Safety: MERS, self-reported errors**
- **Cost: Supplies and Training**
- **Knowledge retention after educational intervention**
- **RN satisfaction with training and skill delivery**

Kirkpatrick's Four Levels Of Training Evaluation



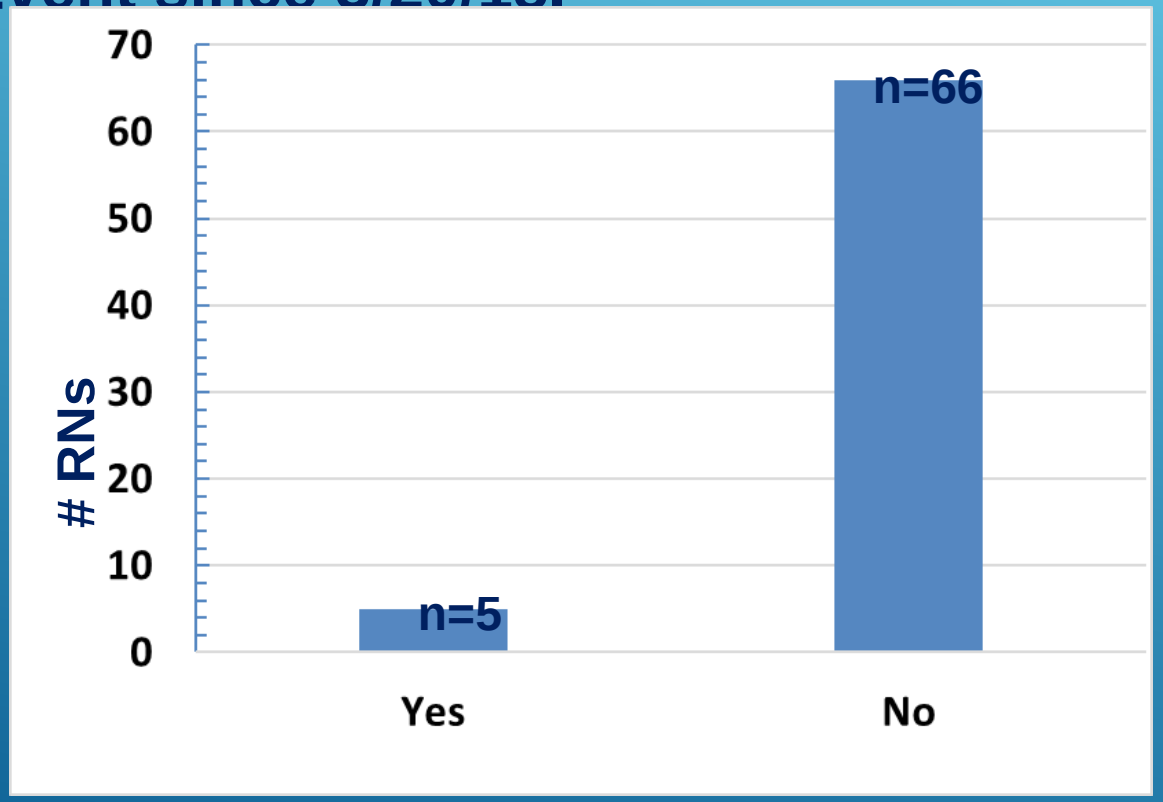
Safety

Cost

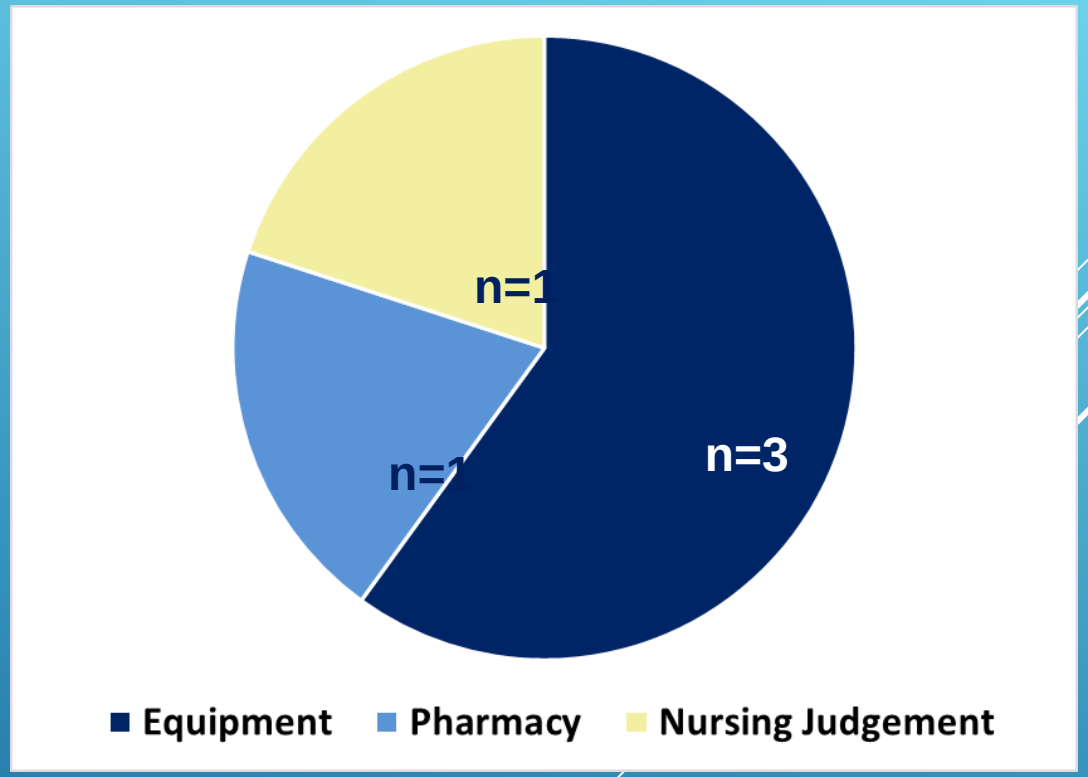
Knowledge retention

RN satisfaction

“I have experienced an Error or Adverse Event since 3/20/18.”



Error or Adverse Event by Type



Results: Cost

The cost of continued syringe pump use does not appear to be limiting.

The cost difference between delivery methods is < 5% (excluding tubing).

Results: Safety

MERS (February- April 2018)

Date	Shift	Error Type	Implications
2/13/2018	Night	Incomplete dose	Prior to syringe pump use.
3/27/2018	Night	Missed Dose	Using syringe pumps.

Results: Cost

IV furosemide (bag)	Cost per Item	Total Cost of Delivery
D5 100 mL Mini Bag	$1.00	
Tubing	$4.80	
Medication	$3.64- 5.19	**$9.44- 10.99**
Syringe Pump Furosemide	**Cost per Item**	**Total Cost of Delivery**
Syringe	$0.22	
Tamper evident cap	$0.35	
Tubing	$4.80	
Medication	$3.64- 5.19	**$9.01- 10.56**

4/17/- 5/17/18 Total Doses- All Areas/ Wards	**IV Bag**	**Syringe Pump**
272	$2,567.68- 2,989.28 (month)	$2,450.72- 2,872.32 (month)
	$30,812.16- 35,871.36 (year)	**$29,408.64- 34,467.84 (year)**

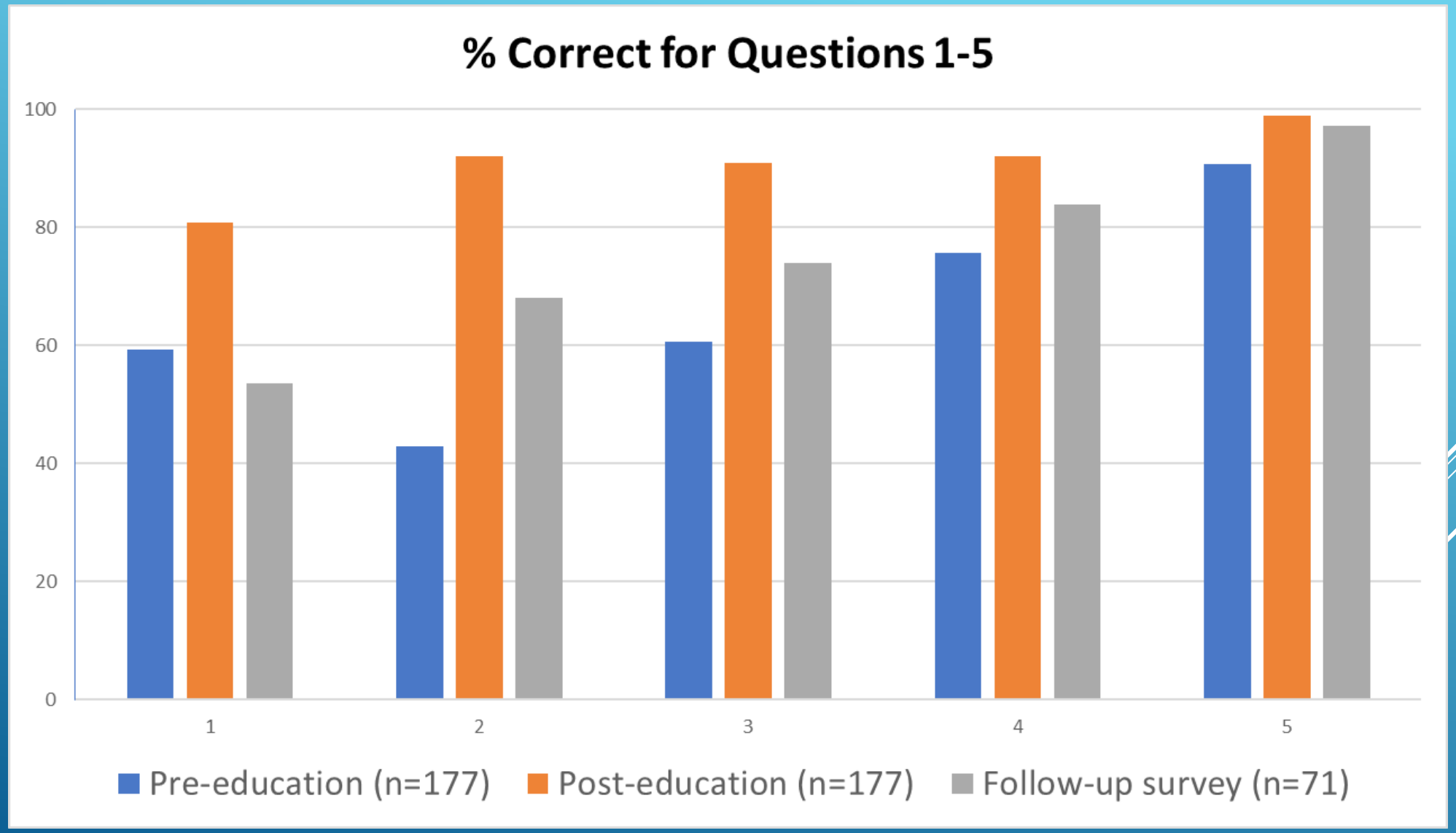
Results: Cost

Education/ training

(Est. Hourly RN Wage: $40 x 0.5) x 254**= $5,080**

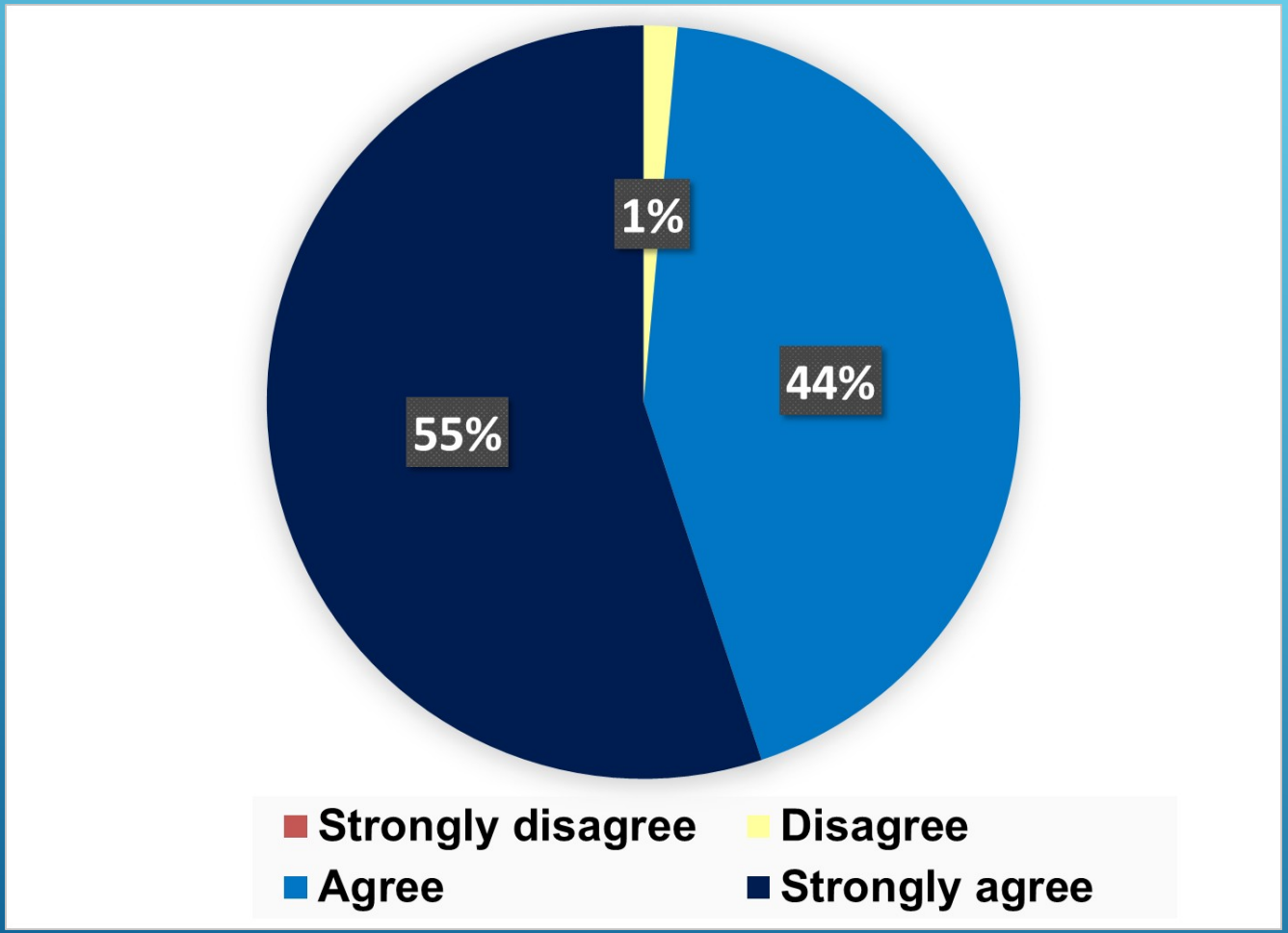
Does not include investment in syringe pump equipment or intervention planning, development, & implementation

Results: Knowledge Retention



Results: RN Satisfaction

One Month F/u Survey: *"I am satisfied with the education/ training I received"*



Results: RN Satisfaction

One month f/u survey qualitative data

Positive	Neutral	Negative	Feedback
Enjoyed training	Other IV mediations should be used for syringe pumps	No follow-up/ reinforcement of learning	Need written Handouts/ procedure
Feel competent		Did not try skills out after training	
Simple, easy procedure and skill		Unable who to ask for help	
Education was effective in teaching skills needed		Unclear where to access resources related to syringe pumps	
"This was the best in-service I have ever experienced in 23 years. Truly!!!"			

Limitations

- Data collection may not be sufficient to draw conclusions about errors.
- Selection bias (self-reporting)
- Structural limitations
  - Wrong color cap and/or label
  - Unable to obtain syringe pump
  - Wrong programming

Implications

Effective training modalities:

Conserve time & resources

Optimize key outcome variables.

Effective training may prevent Adverse Drug Events (ADEs).

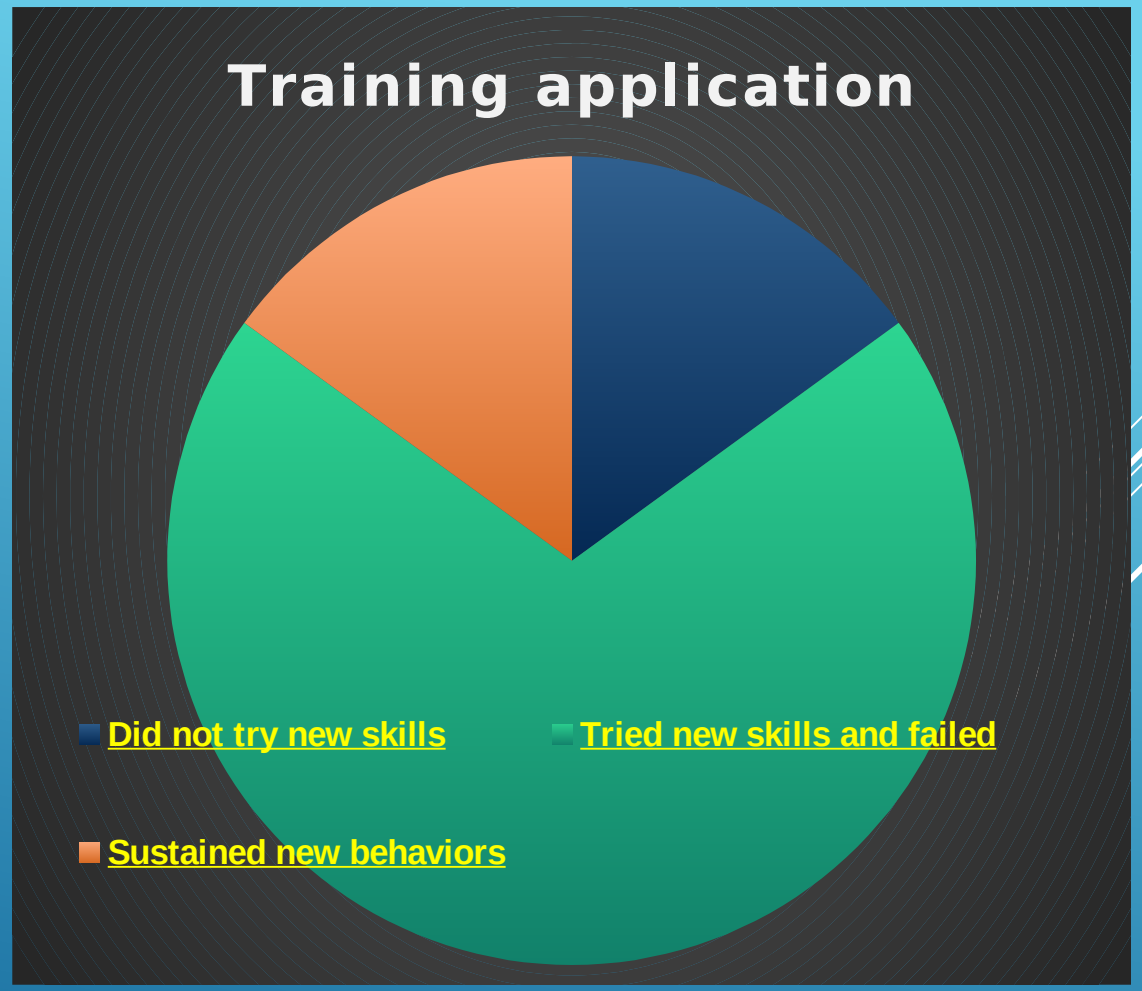
The cost of one ADE is estimated at $1851.44, although variable by setting (Poudel et al, 2017) (Vallano, 2012).

Recommendations

- Pre-education/ intervention knowledge and materials (asynchronous training)
- Increased follow-up with added written procedures to augment training
- Increased availability of subject matter expert after intervention
- Involving nurses in project development process/ Rapid Improvement
- Training evaluation standards and benchmarks

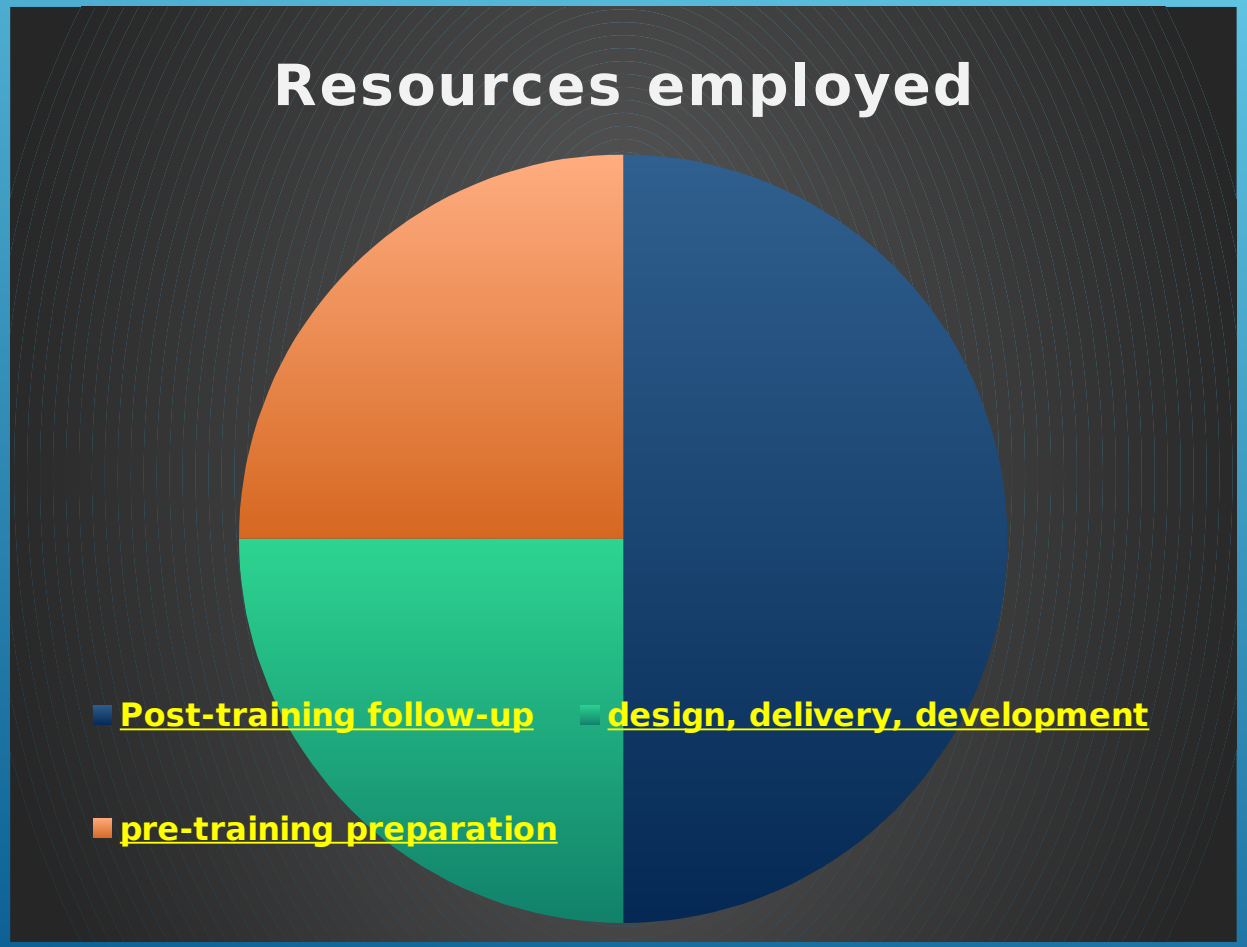
Traditional Training Approach

(Brinkerhoff, 2006)



Recommendation: Learning And Performance Training Approach

(Brinkerhoff, 2006)



Additional Recommendations

- **Syringe Pumps for other medications (e.g. antibiotics)**

- **Measure LOS in HF patients**
  - Increased accuracy of dosing with syringe pumps
  - Less fluid used per dose with syringe pumps

- **Measure Infection rates with new tubing**
  - Syringe pump tubing changed with each dose of medication

Conclusion

- Crisis situation and emergent training
- More follow-up leads to better outcomes
- Nurses retained knowledge of skills 1 month post intervention
- Overall safety of syringe pumps was effective with no major adverse events or errors/ no increase in error rate
- Nurse satisfaction was positive
- Cost analysis indicates possible long-term sustainability

References

For complete reference list, please see attached documents/ handouts.

Chan, A., Purcell, A., & Power, E. (2016). A systematic review of assessment and intervention strategies for effective clinical communication in culturally and linguistically diverse students. *Medical Education*, 50(9), 898-911.

Ejaz, A. A., & Mohandas, R. (2014). Are diuretics harmful in the management of acute kidney injury? Current Opinion in Nephrology and Hypertension, 23(2), 155-160.

Ferguson, A., Delaney, B., & Hardy, G. (2014). Teaching medication administration through innovative simulation. *Teaching & Learning in Nursing*, 9(2), 64-68.

Gjeraa, K., Moller, T. P., & Ostergaard, D. (2014). Efficacy of simulation-based trauma team training of non-technical skills. A Systematic Review. *Acta Anaesthesiologica Scandinavica*, 58(7), 775-787.

Kirkpatrick, J.D. & Kayser-Kirkpatrick, W. (2016). *Kirkpatrick's Four Levels of Training Evaluation*. Virginia: ATD Press.

References

Lee, J., & Oh, P. J. (2015). Effects of the use of high-fidelity human simulation in nursing education: A meta-analysis. *The Journal of Nursing Education*, *54*(9), 501-507.

Maki, D. G., Rosenthal, V. D., Salomao, R., Franzetti, F., & Rangel-Frausto, M. S. (2011). Impact of switching from an open to a closed infusion system on rates of central line-associated bloodstream infection: A meta-analysis of time-sequence cohort studies in 4 countries. *Infection Control and Hospital Epidemiology*, *32*(1), 50-58.

Poudel, D. R., Acharya, P., Ghimire, S., Dhital, R., & Bharati, R. (2017). Burden of hospitalizations related to adverse drug events in the USA: A retrospective analysis from large inpatient database. *Pharmacoepidemiology and Drug Safety*, *26*(6), 635-641.

Vallano Ferraz, A., Agusti Escasany, A., Pedros Xolvi, C., & Arnau de Bolos, J. M. (2012). Systematic review of studies assessing the cost of adverse drug reactions. [Revision sistematica de los estudios de evaluacion del coste de las reacciones adversas a medicamentos] *Gaceta Sanitaria*, *26*(3), 277-283.