Canadian Paediatric High Alert Medication Delivery: Opioid Safety
Toward a Change in Practice

Phase 2 Report
January 28 2010

Appendices

Included in this section are the various reports, data analysis of the phase 2 surveys, and communication tools as referred to in the Phase 2 report.

I. **Patient Safety Collaborative Annual Symposium CAPHC 2006 Conference Proceedings**

II. **Advancing Medication Safety in the Delivery of High Alert Medication in Paediatrics Report on Phase 1**

III. **National Survey of Existing Practices (April 2009)**

IV. **Paediatric Opioid Mixed Focus Group – Aug 25th – Summary of Survey Results**

V. **Summary of CAPHC/ISMP Paediatric Opioid Intervention Tactics (December 2009)**

VI. **Canadian High-Alert Opioid Intervention Survey of Community Hospitals (December 2009)**

VII. **CAPHC Conference Morphine Challenge Flyer – October 2009**

VIII. **Human Factors Analysis of Standardized Morphine Infusion Concentrations – November 2009**

IX. **High Alert – Safe Opioid Use: Qualitative Psychological Study – July 2009**

X. **Opioid Safety: *The O Zone* – November 2009**

XI. ***The O-Zone* Poster/Flyer – January 2010**

Appendix I

Canadian Association of Paediatric Health Centres (CAPHC)

Patient Safety Collaborative Annual Symposium
Promoting Patient Safety and Best Practices in Paediatrics through Standardization of Medication Practices and Delivery Protocols

CAPHC Annual Conference
Sunday, October 15th 2006
Fairmont Vancouver Hotel

To read Conference Proceedings please go to:

http://www.caphc.org/documents_annual/2006/patient_safety_symposium_proceedings.pdf

Phase 1 Report
Advancing Medication Safety in the Delivery of High Alert Medication in Paediatrics
Executive Summary

Paediatric healthcare institutions face unique challenges in the delivery of care. It is well known that various patient and system factors place paediatric patients at greater risk of experiencing harm from medication errors, and that certain medications have a higher potential to cause harm when used in error. Many adult health centres have successfully adopted medication delivery processes to improve patient safety, but fundamental differences in the delivery of medications in paediatrics, particularly weight-based dosing, have hindered the adoption of some practices in paediatric care.

CAPHC and ISMP Canada have established an important partnership intended to advance medication system safety in the delivery of high alert medications in Canadian paediatric facilities. An Advisory Committee, with representation from across Canada, is providing direction to the project and assisting with the interpretation of findings. This report describes the first phase of this collaborative project.

The goals of the first phase of the project included the identifications of the top medications reported as causing harm or potential harm in Canadian paediatric healthcare settings, the identification of existing leading practices and the analysis of the information obtained to develop solutions to form the basis of a medication safety intervention.

The goals of the first phase were addressed in part by an analysis of medication incident data submitted to ISMP Canada by selected paediatric healthcare facilities, to determine the medications most commonly associated with harmful medication incidents and to categorize the types of incidents and contributing factors. Close to one quarter of all medication incidents reported as causing harm were associated with five medications, two of which were opiates. This suggests that a small number of medications account for a disproportionately large number of incidents and these medications may represent opportunities for targeted interventions.

An additional analysis of harmful and non-harmful incident reports for the top five medications and for the opioid class provided information on types of incidents and contributing factors. Although the most commonly-reported incident types varied from medication to medication, "wrong dose" and "wrong drug" incidents were reported frequently. For "wrong dose" incidents, mix ups of dosage units and calculation errors were common contributing factors; while for "wrong drug" incidents, look-alike / sound-alike medications were frequently identified as a contributing factor.

A survey of selected paediatric healthcare facilities to obtain information on leading practices was also conducted. The results of the survey provide a landscape view of patient safety initiatives in place at Canadian paediatric facilities in August 2008. The analysis of the survey data helped to identify leading practices that have been implemented in many facilities, but also suggested that safe practices are not being consistently implemented. For example, certain leading practices related to safe handling of opioids that are in place in many facilities have not been adopted by other facilities.

Based on a set of predetermined criteria and with consideration given to the results of the incident report analysis and landscape survey, the National Advisory Committee has reached a consensus on the following intervention:

To create an intervention that will assist in the implementation of safe medication practice for the delivery of opioids in paediatric settings. This includes all aspects of the opioid medication system from prescribing to storage and administration.

To see the entire Phase 1 Report please go to

http://www.caphc.org/documents_programs/patient_safety/final_phase_1_report.pdf

Canadian High – Alert Opioid Intervention
National Survey of Existing Practices (April 2009)

Introduction

The goal of this survey was to discover how hospitals currently use and administer opioids (narcotics) to pediatric patients. The respondents consisted of mainly tertiary hospitals with some representation from community hospitals.

Summary of Current Practices Relevant to the Pediatric Opioid Intervention

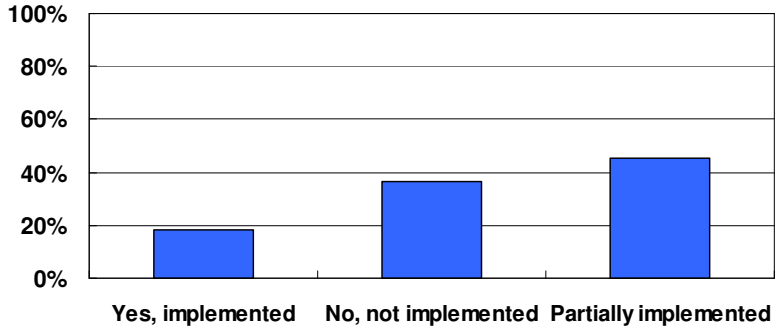
- Less than 40% of respondents have adopted standard IV opioid infusion concentrations but 100% support of the idea.
- Many of the respondents do not 'unit dose' oral liquid opioids.
- Most opioids are kept as wardstock.
- Many do not use label enhancements to differentiate different opioid concentrations.
- More than 50% of respondents have NOT limited morphine or hydromorphone injectable to 2 mg/mL or less.
- Many respondents have not removed hydromorphone from all pediatric areas.
- 90% of respondents would purchase commercially available standard IV opioid infusion concentrations.
- 50% of respondents require an independent double check on all opioid infusions and pump rate changes for opioids.
- 70% of respondents do not have a policy to return unused highly concentrated opioids to the pharmacy immediately after patient discharge.
- 90% of respondents do not audit naloxone usage.
- Less than 40% of respondents have calculation tools for front line nurses with respect to dose checking, mixing and administering opioids or calculation infusion rates.
- 100% of respondents, who have mixed adult/paediatric units, do not have a strategy to sequester paediatric opioids from adult opioids in mixed units where both are cared for.

Respondents

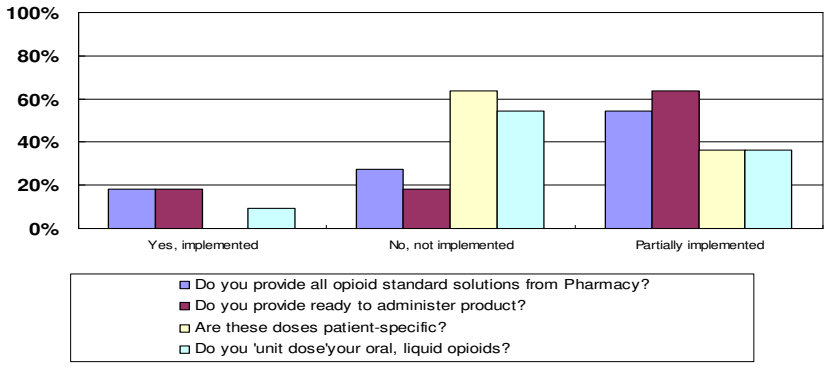
BC Children's Hospital
Sick Kids Hospital
Royal University Hospital
Winnipeg Children's Hospital
Alberta Children's Hospital
London Health Sciences
St. Joseph's Hospital
Laval Hospital
Kingston General Hospital
IWK Health Centre
Children's Hospital of Eastern Ontario

1.2 Use Commercially Available Std Conc. or Admix in Pharmacy Parenteral Solutions

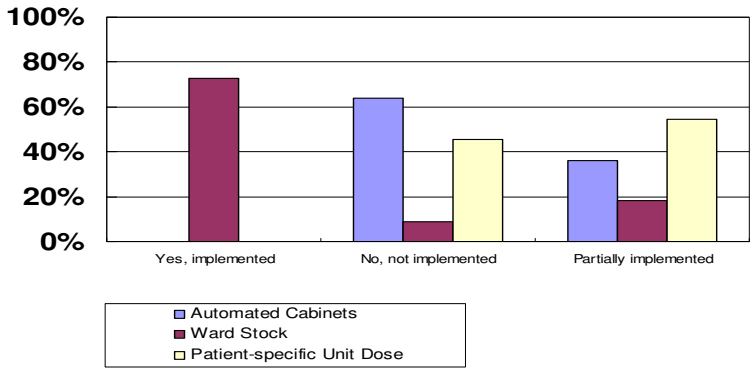
Do you pre-mix opioid infusions in your IV add room?



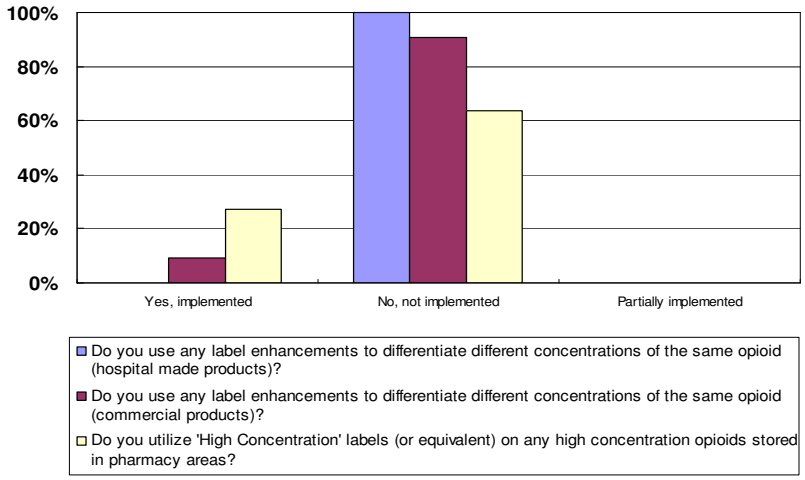
1.3 Describe your opioid distribution and storage system



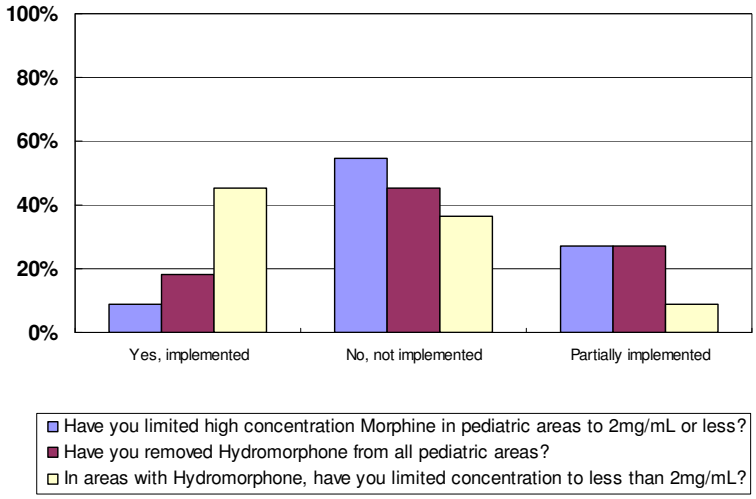
Notes:
50% of respondents do not unit dose all oral liquid opioids.
One respondent has 2 oral opioid sizes of 5-10 mL aliquots of pre-packaged oral syringes on floor. The nurse wastes the excess. With the exception of methadone which is unit/dose specific.



Note: Most opioids are wardstock.



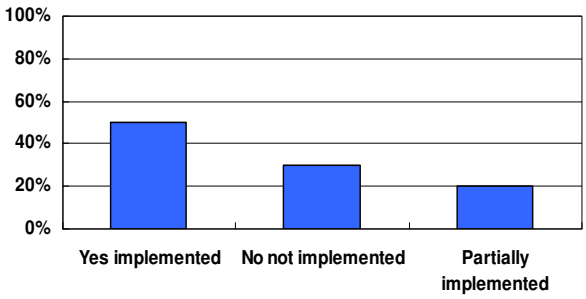
Note: Minimal use of label enhancements



Notes: 45% of respondents have NOT removed hydromorphone from all pediatric areas.
Hydromorphone is available on oncology/renal and PICU units. Palliative patients have hydromorphone stocked at the higher concentration.

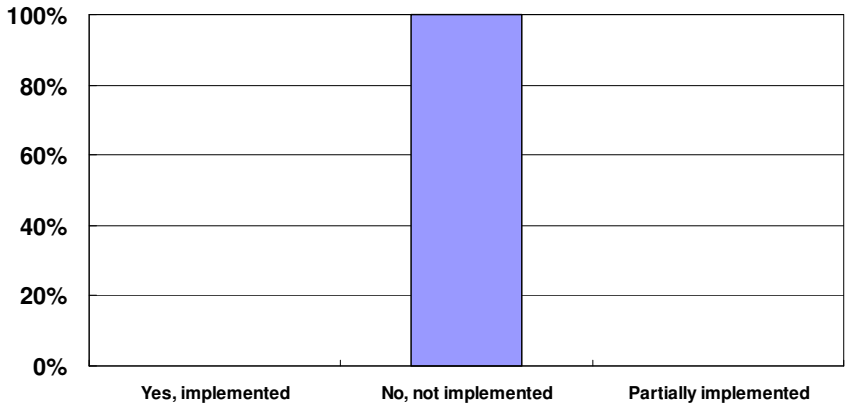
1.4 Storage Practices (Container and Bin)

In areas with Hydromorphone, have you taken steps to differentiate this product from others, including Morphine or Fentanyl



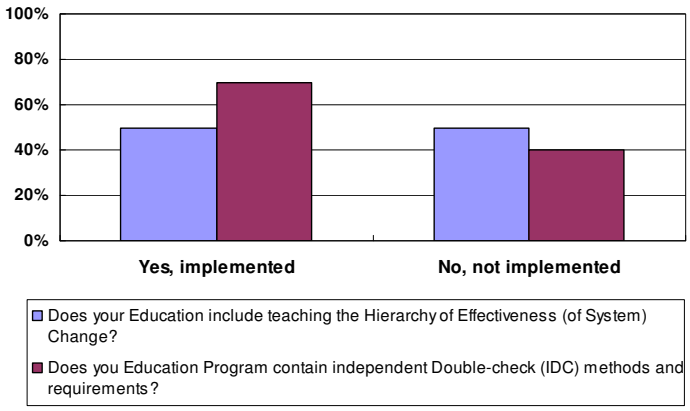
Notes: Good Progress in differentiation but some room for improvement.

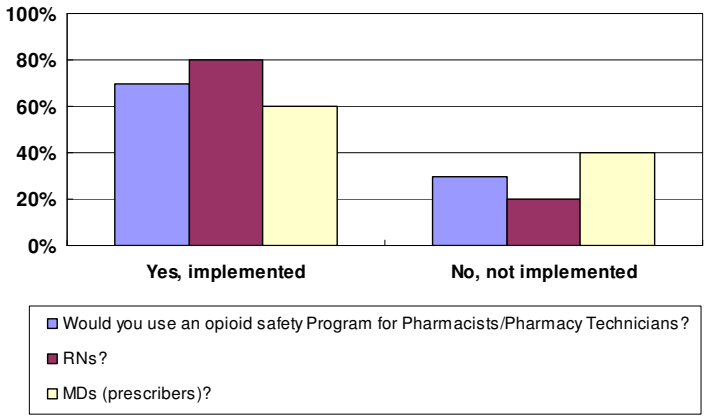
If you have mixed adult/pediatric areas do you have strategies for separating adult and pediatric stock?

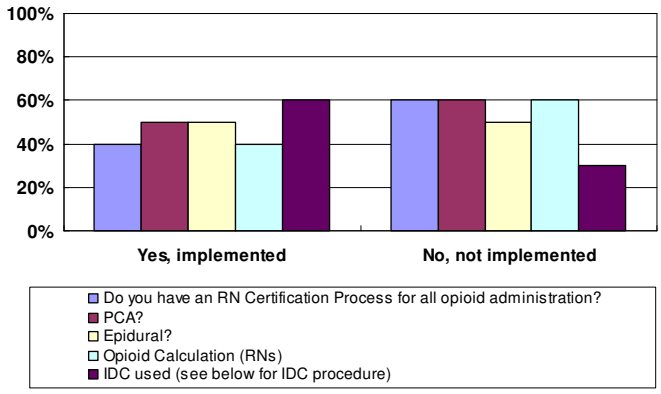


Note: Not applicable to most tertiary sites, but definitely an opportunity for community hospitals.

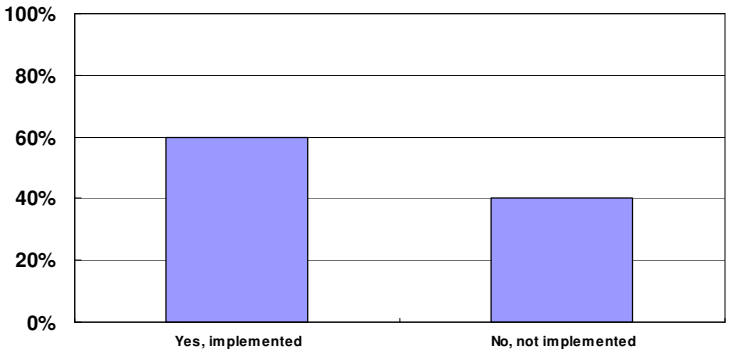
1.5 Staff Opioid Safety Education Program



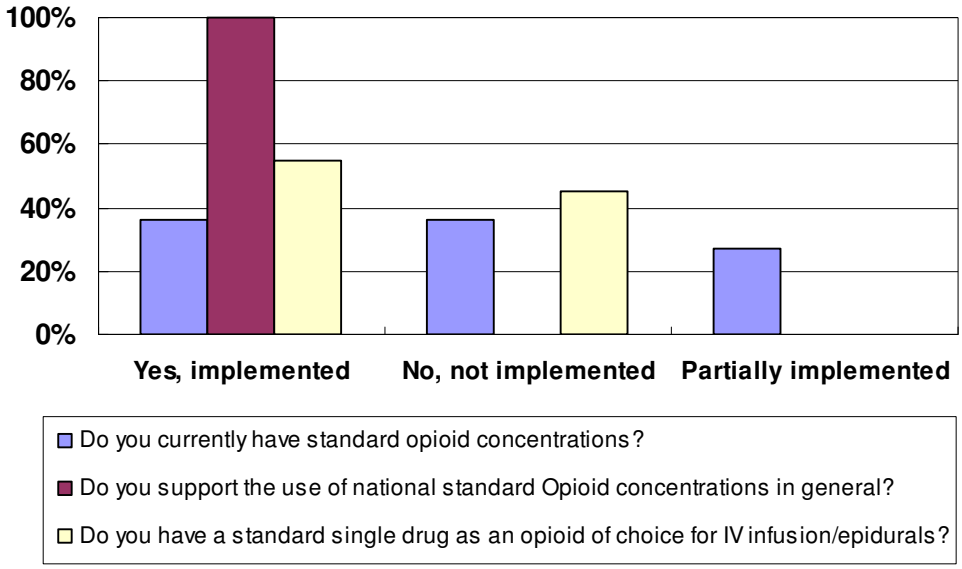




Do you have a general safety Ed and Safety Culture program for any staff?

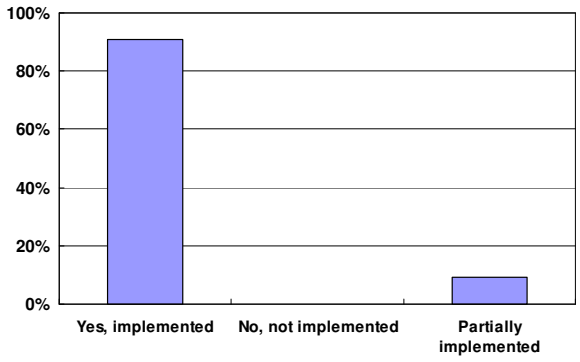


2.2 Standard IV Concentrations



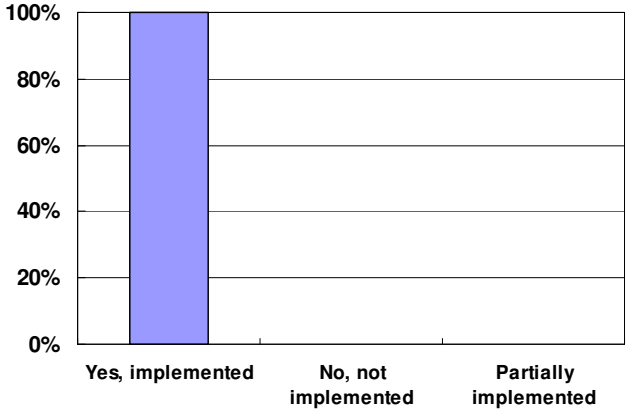
- **One respondent said that if they adopt standard concentrations without smart pumps 'someone's going to get killed'.**
- **Morphine is the standard opioid of choice. Different for palliative.**
- **100% of respondents support the use of standard opioid concentrations, less than 40% of respondents have implemented.**

Would you purchase these commercially, if available?



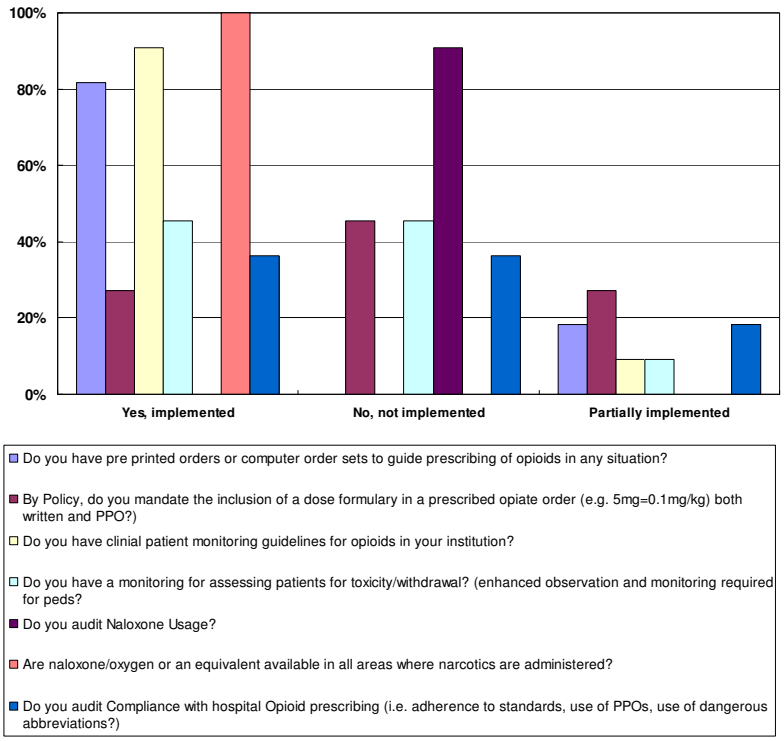
Note: Most respondents would purchase commercially available standard IV concentrations.

Do you offer PCA as an option?



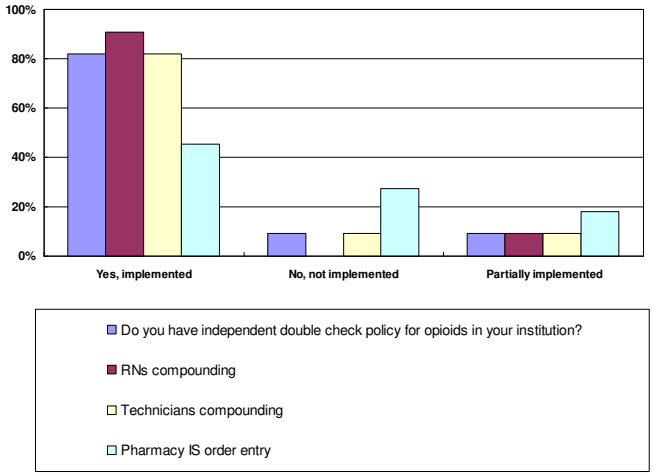
Note: 100% of respondents offer PCA by IV route.

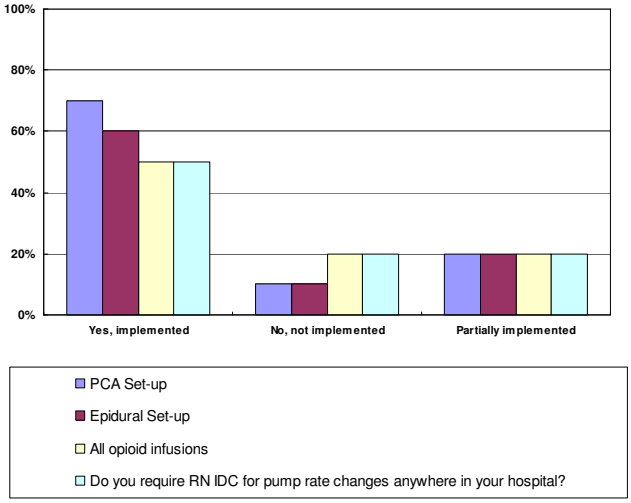
2.3 Therapeutic Treatment Protocols and Pre-Printed Orders



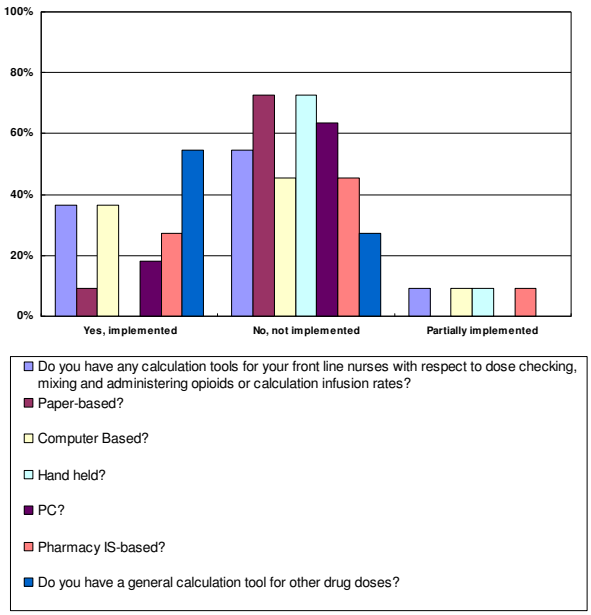
3.1 Independent Double-checks

Note: Most respondents have implemented IDC and usually this is indicated by a double signature.



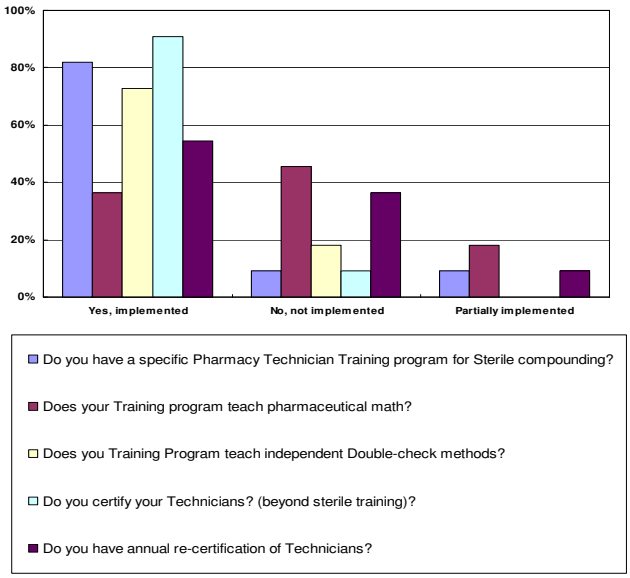


3.2 Use Pharmaceutical Calculation Aids



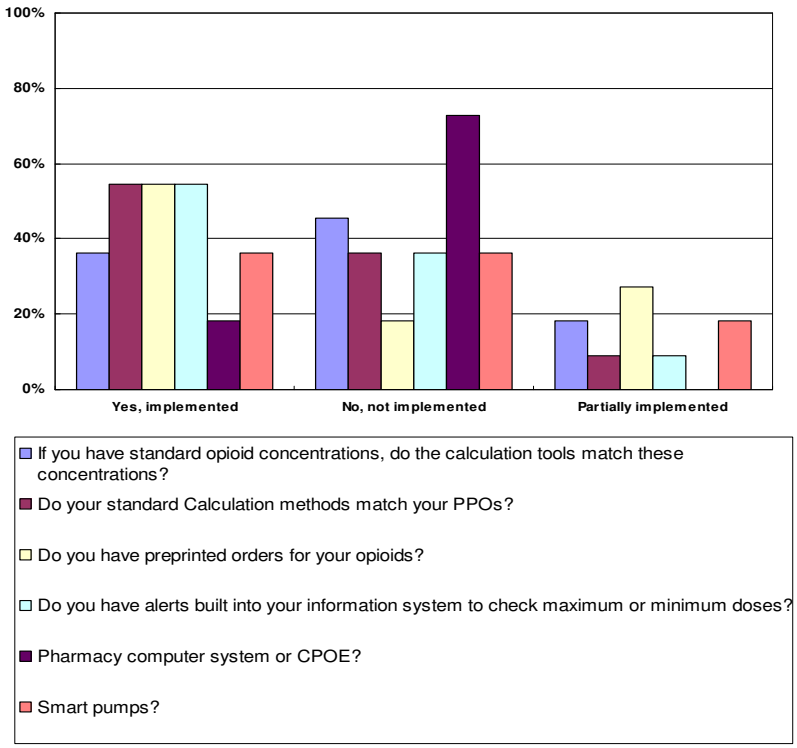
3.3 Pharmacy Compounding Practices

Note: Close to 50% of respondents do not teach pharmaceutical math.

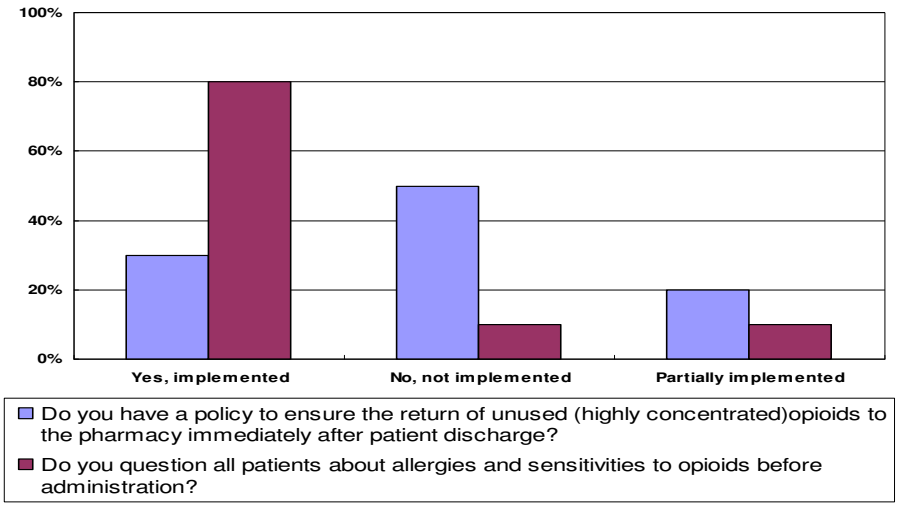


3.4 a) Standard Calculations Processes, based on PPO's

Note: Opportunities to synchronize calculation tools with PPOs with alerts into information system.



Misc



Conclusion:

This survey has been instrumental in helping to identify opportunities for recommendations about opioids used in pediatrics to hospitals. The results of the survey also helped to confirm the validity and need for the tactics used to improve the safety of opioids in pediatrics. Many of the respondents shared innovative processes, tools and forms they use in practice that relate to opioids used in pediatrics along with case reports of opioid-related incidents, which will be instrumental to this initiative. The need to further investigate the difference between community hospital practice of pediatric opioids from tertiary hospitals remains and will be the next step of the initiative.

Revised: December 8, 2009

CAPHC Paediatric Opioid Focus Group – August 25th, 2009
Summary of Survey Results

Summary Analysis

- All hospitals providing paediatric service support the relevance of the proposed tactics and consider them to have a positive impact on safety.

- The needs the needs of tertiary/quaternary hospitals and community hospitals are **different** and therefore recommendations made regarding opioids to tertiary/quaternary and community hospitals should reflect their differing needs.

- The community hospitals providing paediatric service appear to be able to standardize to a fewer number of opioids and fewer concentrations of opioids for standard infusions.

- Community hospitals have greater oral opioids usage and are concerned about the recent controversies surrounding the use of oral codeine in paediatric patients.

Limitations:

Opinions are of a small number of professionals from a variety of occupations and not all the tactics might be relevant directly to their practice.

Who:

6 sites (2 quaternary/ 4 community sites)
9 responses, 6 from community, 3 from paediatric hospitals (Sick Kids collated their results from 3 people).
2 Paediatric Pharmacists, 2 Paediatric Nurses, 3 Nurse Educators, 2 Directors

Top 3 Tactics

Standard IV Concentrations
Safe Storage and Labelling
Prescribing Standardization

P&T reviews/Staff Opioid Education

How often are paediatric patients prescribed the following opioids in your facility?

Morphine/Codeine oral: 100% of quaternary respondents said many patients daily

- 83% of community said many patients daily

IV morphine intermittent: 100% of quaternary respondents said many patients daily

- 33% of community said 'many patients daily' and monthly
- 16% of community respondents said rarely or monthly

IV morphine continuous infusion: 100% quaternary said many patients daily

- 16% of community said never
- 16.7% of community said daily
- 50% said weekly
- 16% said monthly

Oral Morphine Storage and Preparation

67% of quaternary responses have a stock bottle of greater than 25 ml of liquid oral morphine on their wards, 0% of community responses have stock bottles.

100% of community responses prep have pharmacy prepare Unit Dose syringe prepared as 2 mg dose

100% of responses in quaternary prepare oral doses of morphine in the med room compared with 40% of community responses. The remaining 60% of community responses oral doses of morphine are prepared by pharmacy.

Oral Opioids on formulary

100% would include oral **morphine on formulary** for both quaternary and community.

100% of quaternary responses would keep **hydromorphone** on formulary while only 16.7% of community hospital responses would keep hydromorphone.

100% of community hospital responses would keep **codeine** on formulary; only 33% of quaternary hospital responses would keep codeine.

100% of quaternary hospitals would keep methadone, 0 % of community hospitals would keep methadone.

Injectable Opioids on Formulary

100% of respondents would keep injectable Morphine

100% of Quaternary hospitals would keep Hydromorphone and Fentanyl

While only 50% of community respondents would keep hydromorphone

**And 66.7% of community respondents would keep fentanyl.

Only 22% of respondents would keep fentanyl with Bupivicaine.

Intermittent Oral/IV paediatric Opioids
Only 57% of respondents **always** labelled oral and iv intermittent doses.
For those who responded no, IV doses were labelled but not oral doses.
Blank labels for nurse to fill in for IV doses.

Audits
Trigger Tool audit would be most useful to all respondents.

Standard Concentrations for opioid iv infusions and oral liquids
56% of all respondents have already implemented standard iv infusion concentrations
And the remaining 44% of respondents **would** want to adopt standard concentrations.
78% of all respondents have adopted standardized concentrations for oral opioid liquids
While 22% **would** want to adopt standard concentrations for oral opioids.

Oral Liquid Standard concentrations
Codeine 5mg/ml
Codeine 3mg/ml
Morphine 1mg/ml

Evaluation of Tactics

Overall Relevance to Facility Ranked in order of highest to lowest	Overall Impact to Safety Ranked in order of highest to lowest	Overall Difficulty to Implement Ranked from Lowest to Highest
1.4 Safe Storage: Storage and Product identification 2.1 Standard IV Concentration Use 2.2 Prescribing Standardization 3.1 Independent Double Checks 3.3 Pharmaceutical Compounding Practice	3.4 Clinical Pharmacist reviews Opioid Prescriptions 3.1 Independent Double Checks	3.1 Independent Double Checks
1.3a Limit the number of drug agents available 1.3b Restricting concentrated opioids to patient care areas 1.5 Staff Opioid Safety Education Program 3.2 Incorporation of Standard Iv Concentrations into Opioid Practice 3.4 Clinical Pharmacist reviews Opioid Prescriptions	2.2 Prescribing Standardization 3.3 Pharmaceutical Compounding Practice	1.3c Monitoring of Opioid Use

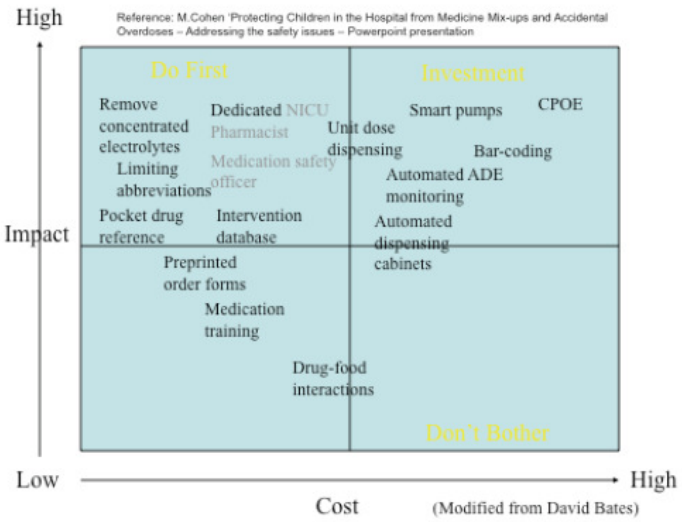
Appendix IV continued

Overall Relevance to Facility Ranked in order of highest to lowest	Overall Impact to Safety Ranked in order of highest to lowest	Overall Difficulty to Implement Ranked from Lowest to Highest
1.3c Monitoring of Opioid Use	1.4 Safe Storage: Storage and Product identification 1.5 Staff Opioid Safety Education Program 3.2 Incorporation of Standard Iv Concentrations into Opioid Practice	1.4 Safe Storage: Storage and Product identification
1.2 Use of Commercially-prepared product	1.3b Restricting concentrated opioids to patient care areas	3.4 Clinical Pharmacist reviews Opioid Prescriptions
1.1 Contracting and Vendor Product Selection	1.3a Limit the number of drug agents available 2.1 Standard IV Concentration Use	1.3b Restricting concentrated opioids to patient care areas
	1.3c Monitoring of Opioid Use	1.5 Staff Opioid Safety Education Program 3.2 Incorporation of Standard IV Concentrations into Opioid Practice
	1.2 Use of Commercially-prepared product	1.3a Limit the number of drug agents available 2.1 Standard IV Concentration Use
	1.1 Contracting and Vendor Product Selection	3.3 Pharmaceutical Compounding Practice 2.2 Prescribing Standardization
		1.1 Contracting and Vendor Product Selection
		1.2 Use of Commercially-prepared product

Relevance of Standard IV Concentrations of Opioid Infusions

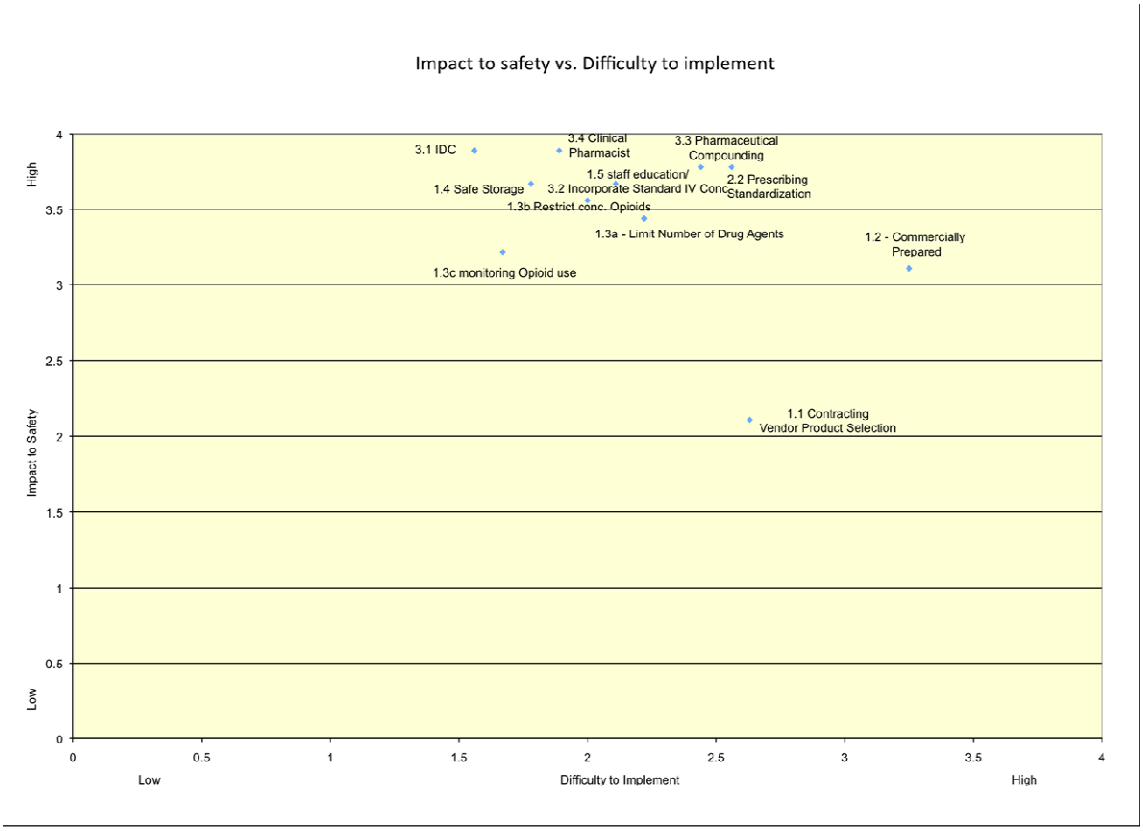
Drug	Relevant	Breakdown of Responses
Morphine 1mg/ml	YES	100% of quaternary and 83% of community hospital respondents said YES
Morphine 0.5 mg/ml	NO	100% of quaternary and 67% of community respondents said NO
Morphine 0.2mg/ml	Maybe	33% of respondents said YES, 67% said NO from both community/quaternary hospitals
Hydromorphone 250mcg/ml	NO	100% of respondents from both community/quaternary said NO
Hydromorphone 40mcg/ml	Maybe	100% of community respondents said NO, 50% of quaternary said Yes.
Fentanyl 50 mcg/ml	Yes	100% of community said NO, 100% of quaternary said YES.
Fentanyl 25mcg/mL	No	100% said NO

Drug	**Which of the Concentrated opioids would you stock in paediatric areas**
Non-critical, non-palliative areas	
Morphine 2mg/mL – 1 mL amp	100% of respondents said YES
Morphine 10mg/ml and 15mg/ml	Some respondents felt it would be useful to keep for older children and sickle cell pts
Critical Care areas	
Morphine 2mg/ml 1ml Amp	Yes, 55.6% of respondents
Morphine 15mg/ml – 1 mL amp	Yes, 44% of respondents More relevant to quaternary hospitals than community
Hydromorphone 2mg/mL	100% of quaternary and 33% of community said yes
Hydromorphone 10mg/mL	66% of quaternary 0% of community
Fentanyl all strengths	100% of quaternary, 33% of community
Morphine 10mg/ml	One respondent said they would want this strength
Palliative Care (3/9 respondents do not have a palliative care ward)	
Morphine 2mg/ml	Yes, 55% of respondents
Morphine 15mg/mL	Yes, 44% of respondents
Hydromorphone 2mg/mL	Yes, 100% of quaternary 33% of community



*

The CAPHC tactics were developed with the intent to be in the "do first" (top left) quadrant with the high impact to safety with relatively low cost and difficulty/time to implement. Respondents of the survey were asked to rank the tactics in relation to each other. The following is a graphical representation of the results.



*Reference: M.Cohen 'Protecting Children in the Hospital from Medicine Mix-ups and Accidental Overdoses – Addressing the safety issues – PowerPoint presentation

Appendix V

Summary of CAPHC/ISMP Opioid Intervention Tactics (December 2009)

1. Procurement/Storage & Labelling **The following tactics provide a basic level of purchasing, storage and labeling control.**	
1.1 Contract/Vendor Selection	• **Ensure contracting and purchasing business practices are standardized to reduce the potential for vendor-related error potential such as, package confusion, labelling, look-alike or sound-alike problems.**
1.2 Use of Commercially-Prepared Products	• **Use commercially-prepared standard concentrations of opioid oral or parenteral solutions when available.** • **If commercial CIVA is not available, it is advisable to produce all IV or spinal opiate products utilizing centralized Pharmacy production doses. (See also Standard Concentrations)**
1.3 P&T Reviews: Restricted Access to Opioids	**Ensure Pharmacy and Therapeutics Committee (P&T) reviews and decides the available opioid drug agents.**
1.4 Safe Storage and Labelling	**Develop standardized labelling and visual identification policies for all opioid storage locations, including those altered by pharmacy or nursing practices.[1]**
1.5 Staff Safety Education Program	**A. Review both general staff orientation and specific opioid training for your institution.** **B. Ensure a general medication system safety education module is provided to all clinical staff members, and contains a specific section on opioid risks and safety measures.** **C. Where both complex patient care and high risk opioid practices exist together, such as in critical care, palliative care or oncology, or epidural administration, ensure a formal RN opioid certification process is established, and that RN staff**

[1] The recommendations contained herein relate to physical storage of opioids utilizing traditional bin and shelf systems. They are not meant to replace or delay the acquisition of superior automated methods of storage, stocking, and identification, such as automated drug storage systems and barcode identification.

	are required to complete the certification annually. **D. Assure a Pharmacy Technician certification process exists which includes the following essential components of compounding safety, including Independent Double-Check procedure.**
2. Prescribing Standardization Elements	
2.1 Standard IV Concentrations	**The use of national pediatric standard concentrations for opioid IV infusion should be adopted and utilized. These include:** • **Morphine 1 mg/mL, Morphine 0.2 mg/mL** • **Hydromorphone 40 mcg/mL, 250 mcg/mL** • **Fentanyl 25 mcg/mL, 50 mcg/mL** ****Additional concentrations may be required in hospitals with extremely premature babies or hospitals without 2 decimal pumps.**
2.2 Prescribing Standardization	**Develop standardize approaches to prescribing opioid therapies.** **Develop institutional therapeutic maps for pain control, utilize standard concentrations, and align pre-printed orders to these standards.** **Such standard documents should adhere to site P&T policies for abbreviations and safe prescribing. (See Tactic 1.3).**
3. Standardize Administration - Using standard concentrations and dosing maps established in Element , we recommend the following tactics:	
3.1 Independent Double Checks	**Incorporate formal RN Independent Double-checks (IDCs) into identified high-risk processes.** **For all other opioid practices, assure that dose checking aids are available.**
3.2 Implementing Standard Concentrations	**Approve and implement the recommended standard IV opioid concentrations (Tactic 2.1) into all current and/or future medication system processes.**
3.3 Compounding Practices	**Develop calculation aids for pharmacy and RN staff, as appropriate to the practice.**

3.4 Clinical Pharmacist Reviews Opioid Prescriptions	**Clinical pharmacist resources should be present in all high risk opioid areas and perform patient therapeutic and safety checks on a routine basis.**

References for each tactic are available.

Canadian High Alert Opioid Intervention
Survey of Community Hospitals

Introduction

The goal of this survey was to discover how community hospitals currently use and administer opioids (narcotics) to pediatric patients. The respondents consisted of all community hospitals.

Fourteen Completed Surveys from the Following Community Hospitals

Joseph Brant Memorial Hospital
Markham Stouffville Hospital
Orillia Soldiers' Memorial Hospital
Rouge Valley Health care system
Saint John Regional Hospital
St. Joseph's Health Centre
Toronto East General
William Osler Health System - Brampton Civic Hospital
Windsor Regional Hospital

Summary of Current Practices Relevant to the Pediatric Opioid Intervention

- In mixed population areas where pediatric patients are cared for alongside adult patients, 85.7% and 57.1% of respondents do NOT separate the storage of their pediatric opioids from the adult opioids in the ER dept and in the general pediatric units respectively.
- Usage of Opioids
    - IV intermittent morphine used weekly and more frequently across all units
    - Oral Codeine is used more often than oral Morphine in all areas except palliative/oncology and PICU.
    - A large percentage of respondents NEVER use oral methadone and IV hydromorphone and fentanyl continuous infusions

- Elimination of Opioids
    - Most respondents could eliminate the use of Hydromorphone/Fentanyl and Fentanyl with Bupivicaine in the ER, General pediatrics.
    - In PICU/Palliative/Oncology – 60% of respondents could eliminate injectable hydromorphone, 40% could eliminate injectable fentanyl, and 80% could eliminate fentanyl with Bupivicaine.
    - 75% of respondents could NOT eliminate injectable Fentanyl from their NICU
- 60% of respondents could use only morphine 2 mg/mL in non-critical, non-palliative areas as their injectable opioid of choice.
- Most other areas would need Morphine 2 mg/mL and fentanyl injectable

- 28% of respondents would not adopt standard concentrations for opioid continuous IV infusions. 70% have already implemented or would be willing to adopt standard concentrations.
- Most would like to adopt Morphine 1 mg/Ml or Morphine 0.2 mg/mL as their standard morphine concentration..
- General pediatric units could eliminate Hydromorphone IV continuous infusion from paediatric practice, PICU/Palliative care/Oncology/NICU.

- General pediatric units and PICU could eliminate Fentanyl IV continuous infusions, but NICU would still need it.
- ORAL opioids – ER
    - 64% of respondents could not eliminate oral codeine, 35% could not eliminate oral morphine
    - General pediatrics – 71% could not eliminate oral codeine, and 21% could not eliminate oral morphine.
    - Majority of respondents could eliminate methadone, although 15% say they could not eliminate it from all areas.
- Some of respondents have a stock bottle of oral morphine solution greater than 25 mL in their ER and general pediatrics and Level 1 nursery.
- Most respondents have prepared oral syringes of 5 mL or less of oral morphine solution.
- 92% of respondents do not routinely label oral opioid syringes prior to transporting them from the medroom/med cart to the bedside. (But some respondents have pre-labeled syringes from pharmacy)
- 50% of respondents do not routinely label IV opioid syringes from the med room to the bedside.
- 23% of respondents do not routinely label IV opioid continuous infusions prior to transporting them from the med room, although 53% always do.
- 93% of respondents have a pharmacist review all paediatric opioid prescriptions within the first 24 hours of treatment in general medicine.

Conclusion:

This survey has been instrumental in helping to identify opportunities for recommendations about opioids used in pediatrics specific to community hospitals. Community hospitals have areas where mixed adult and pediatric beds are in the same unit especially in the Emergency department do not routinely separate adult opioid stock from pediatric opioids stock. As well, hydromorphone IV and oral seem to be rarely used in the community setting along with fentanyl IV except in the NICU/PICU population. Both oral codeine and oral morphine are used in community hospitals and IV intermittent morphine is the drug of choice in most community hospital institutions.

Revised: December 30, 2009

Appendix VII

Morphine Challenge Flyer – October 2009 CAPHC Conference

See Attachment – Appendix VII Conference Morphine Challenge

2009

Appendix VIII

HUMAN FACTORS ANALYSIS OF STANDARDIZED MORPHINE INFUSION CONCENTRATIONS

Contents

Executive Summary

Paediatric patients present several unique challenges to health care providers. Due to wide ranging variations in weight and fluid restrictions, best practices that work well for opioid infusions in adult patients do not transfer well to paediatric patients. As a result, an initiative entitled 'Advancing Medication Safety in the Delivery of High Alert Medications in Paediatrics' investigated ways in which errors in situations where high-alert medications are used can be reduced or eliminated. Standardizing concentrations of opioid infusions was one of the recommendations put forward. In order to evaluate the effectiveness of transitioning from non-standardized concentrations, a human factors analysis was conducted to investigate the implications of changing to standard concentrations. Results from task analyses and an experimental investigation support the transition to standard concentrations. It is important to note that we conducted a high level prospective analysis and it is not possible to identify all the factors that influence error rates. It is therefore important to pilot test the introduction standard concentrations before wide scale adoption.

Introduction

Paediatric healthcare providers are faced with challenges above and beyond what is faced when providing health care to adult populations. Due to weight and fluid based dosing requirements present in paediatric patients, medication errors are more likely to occur, and when they do can have severe consequences for the patient. Implementing practices to improve patient safety as it relates to paediatric high-alert medication became a priority for paediatric institutions across Canada following the annual CAPHC meeting in October, 2006, in Vancouver. One outcome of this meeting was the partnership between CAPHC and ISMP Canada, formed with the intention of advancing medication system safety in paediatric health care settings.

CAPHC and ISMP Canada formed an advisory group to identify the main causes of harm events for high-alert medications in paediatric populations, and design and implement interventions to reduce the occurrence of these events. Phase 1 of this project analyzed medication incident data from 11 Canadian paediatric hospitals with the goal of identifying the top medications reported as causing, or potentially causing, harm to patients. A second goal was to identify in what contexts these medications were causing harm.

The results of this phase of the project found that a handful of medications were responsible for a disproportionate number of adverse incidents. In particular, opiates were found to be involved in a disproportionate number of adverse effect incidents. The two most common ways in which these drugs were administered improperly were the administration of the wrong drug, or the correct drug in the wrong dose. For these wrong dose incidents, errors included confusion about units and calculation errors. These findings lead to the advisory board recognizing the need to develop and implement an intervention that facilitates the safe delivery of opioids in paediatric hospitals, from prescription to delivery.

Phase 2 of the project is designed to develop several recommendations on how to improve paediatric patient safety surrounding the opiate delivery process. Phase 2 focuses on standardizing all processes involved in delivery, from physician order entry to the use of smart pumps with drug libraries. The goal of standardization is to remove ambiguity in the processes and to eliminate the need for nurses to perform calculations and prepare solutions for opioid infusions. It is assumed that through standardisation and automation the opportunity for error is reduced, as the level of involvement of people has been reduced.

One of the recommendations is the introduction of standardized concentrations of opioid infusions as these were identified as improvement opportunity in Phase 1 of the project. Standardizing opioids concentrations has several benefits. Nurses would not have to prepare different solutions for every patient because they would already be prepared by the pharmacy, or would be purchased pre-prepared. In this case, the only calculation the nurse would need to make would be to calculate the infusion rate for the pump (in the absence of smart pump technology). Standard concentrations are also beneficial in the unfortunate situation where a patient receives an overdose, because knowing the concentration of the opioid administered facilitates treatment.

Another benefit is that standardized concentrations can be used with Smart Pumps, further reducing possibilities for error.

However, it is important to test the extent that the intervention has the intended effect, to reduce error rates in infusions of paediatric morphine. To accomplish this, a human factors analysis was conducted to determine if implementing standardized concentrations of morphine will result in fewer errors as compared to the current, non-standardized method of preparing morphine infusions. Human factors analysis breaks complex processes into smaller component parts in order to identify steps in the process where users are able to make decisions or are required to give input. These points are potential sources of error, and human factors analysis can offer recommendations on how to best mitigate these errors. For this project, the human factors analysis focused on the preparation of morphine solutions for infusions. This was done in two phases. Phase one compared task analyses for the current practice of using non-standard concentrations of morphine with the proposed method of using standardized concentrations. Phase two sought to identify the types of errors healthcare workers make when calculating an infusion using both the current and proposed process at a recent CAPHC conference in Halifax, held in October, 2009. The results of both phases of this project are contained in this report.

It is important to conduct a prospective human factors assessment of the introduction of standard concentrations of opioids, to systematically consider the impact of the change. The introduction of standard concentrations is designed to address some of the challenges in the current process, but it is possible that the change might introduce new risks that might limit the effectiveness of the intervention. Although it is not possible to identify all eventualities before implementation it is important to take systematic approach to evaluating the proposed intervention.

Task Analyses

Rationale

It is useful to consider the human factors implications of a change in practice before implementing this change. We have identified the introduction of standard concentrations of opioids within paediatric acute care settings as a strategy to reduce the risk of serious medication error. Task Analysis (TA) is a standard human factors technique to describe the goals, tasks and operations involved in performing an existing or novel task. The systematic approach of TA facilitates the comparison between the existing process (producing individualised opioid concentrations for each patient using the 'rule of six') and the proposed process (selecting one of a limited number of standard concentrations and calculating the infusion rate).

Method

The TA was compiled through a combination of literature reviews and telephone interviews with those who have experience with preparing opioid infusions. Initially, a review of relevant literature was conducted to produce a broad overview of opioid infusion process. A preliminary TA was completed based on this literature and sent to two pharmacists for revisions and comments. Their comments were used to revise the TA, which was then submitted to a larger group of healthcare experts for feedback. The opioid TA identified three main phases in opioid infusions namely: prescription, preparation, and infusion. It was decided to focus on morphine infusions as these are used the most frequently and the calculation of the infusion dose is similar to other opioids that may be used. The results of the task analysis are presented in Appendix A.

Results

Two situations were considered for the TA (from a possible 24 permutations of equipment and practices), namely the calculation of individualised morphine concentrations using the rule of six and the use of standardized pre-prepared concentrations (See APPENDIX A for full TAs).

The use of rule of six consists of four steps and involves two separate computations. Firstly the nurse must calculate the concentration of morphine required using the rule of six (calculate the amount of morphine to use, convert from mg to ml, calculate amount of diluent required). Secondly the nurse must calculate the infusion rate based on the physicians prescription.

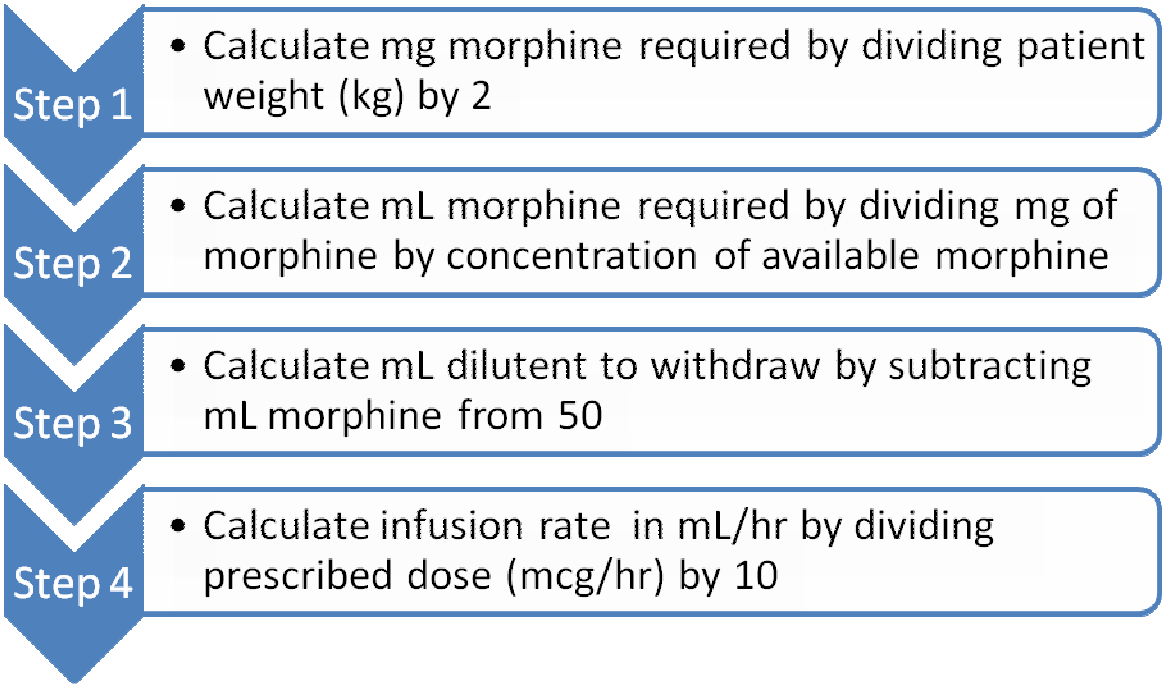
Step 1: $patient\ weight\ in \frac{kg}{2} = mg\ of\ morphine\ to\ be\ mixed\ with\ 50\ mL\ of\ dilutent$

Step 2: $\frac{mg\ of\ morphine}{concentration\ of\ morphine\ available} = mL\ of\ morphine\ to\ withdraw$

Step 3: $50 - mL\ of\ morphine = mL\ of\ dilutent\ to\ mix\ morphine\ with$

Step 4: $10\mu\frac{\frac{\mathbf{g}}{\mathbf{kg}}}{\mathbf{hr}} = 1\frac{\mathbf{mL}}{\mathbf{hr}}$

Figure 1: Calculation steps necessary to prepare 50mL morphine infusion solution



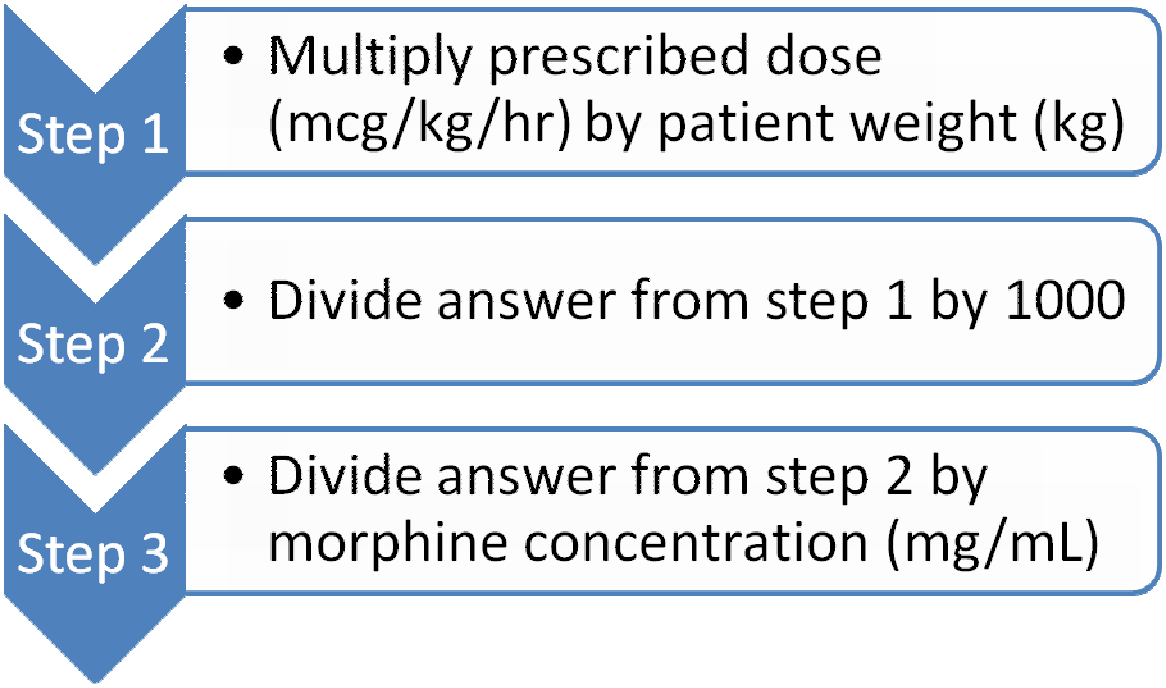
Conversely, the standardized scenario only requires the nurse to calculate the infusion rate. This calculation has only three steps (see figure 2)

Step 1: $prescribed\ dose * patient\ weight\ in\ kg = \mu\frac{g}{hr}$

Step 2: $\frac{\mu\frac{g}{hr}}{1000} = \frac{mg}{hr}$

Step 3: $dividide\ \frac{mg}{hr}\ by\ concentration\ of\ morphine = \frac{ml}{hr}$

Figure 2: Calculation steps necessary to calculate infusion rate in mL/hr (standardized method)



Calculating the rate of infusion for a standard concentration has one fewer step and is less complex. However, the standardized concentration scenario is open to 10, 100, and 1000 fold errors when calculating the rate, which in the event that the infusion pump accepting rates of this magnitude, could cause serious harm to the patient.

Discussion

The TA results support the conclusions from the phase 1 of this ISMP-CAPHC study that highlighted the potential for calculation error when preparing opioid infusions. In short, standardized calculations, while offering potential for very large magnitude errors, have fewer steps and the calculations are less complex in comparison to using the rule of six to calculate infusions.

Limitations

While the task analyses shown here are presented at the appropriate level of detail, they cannot accurately capture the full complexity of the morphine infusion process for a number of reasons. The TAs presented above are general in nature and may not describe actual practices, due to variations in hospital specific practices as a result of differences in equipment, policies, and training. To accommodate this, the task analyses attempt to reach a level of detail that is as specific as possible without becoming non-representative of any particular hospital. Also, breaking down the component steps of the prescribing and infusing process is beyond the scope of this report and as a result was not expanded upon in TAs.

Calculation Task

Rationale

The TAs presented above provide an overview of the steps involved in preparing an infusion using the rule of six and using standard concentrations. The most frequent error potential identified with both processes was calculation error. It is therefore important to consider the nature and frequency of calculation errors for the rule of six and the proposed introduction of standardized concentrations.

Method

To compare the complexity and error frequency of the current individualised concentration with that of the use of standard concentrations a small study was conducted at CAPHC's annual health care conference, held in Halifax in October, 2009. Participants (described below in *Demographics)* were asked to calculate infusion rates and morphine concentrations based a fictional prescription and patient (See APPENDIX B for experiment materials). One calculation was modeled on the 'Rule of Six,' the calculation technique favoured by health care employees who have to prepare individualised morphine solutions. The full calculation for the Rule of 6, is detailed in Phase 1. The second calculation was based on the method that pharmacists and nurses would have to follow given standardized concentrations of morphine. All participants completed both calculations, and the order of completion was counterbalanced so as to remove any order effects. Since we were testing the introduction of a new method for calculating infusions, participants would not be familiar with the process. We therefore decided to provide step by step instructions for each calculation on the calculation sheets as a reference. Calculators were also supplied, and were used by all participants. In general, there are fewer (and less complicated) steps involved in the standardized concentration calculation, and as a result it was hypothesized that this calculation would result in fewer errors, and more correct responses.

A second component of the project was to investigate whether being distracted during the calculations had an effect on error rates. The rational for this was that the research team wanted to mimic a real life situation as closely as possible, so a distraction condition was implemented in the experiment. Half of the participants were asked questions about the fictional patient at various times during the experiment, and participants had to answer the question by locating the correct information on the patient order form before they could continue (see APPENDIX B).
Finally, all participants were timed with a stopwatch to add a time pressure component to the situation, again to make the experiment more life-like. To add weight to the timing, participants were informed before beginning the study that a $50 gift certificate would be awarded to the person who completed both calculations accurately in the quickest time.

Demographics

Sixty three females and 4 males participated in the study. The participants were predominantly from the health care field. Nineteen participants were currently involved in direct patient care, 39 were healthcare administrators in various capacities, and 9 represented other professions (university professor, engineer, etc). The majority (48 of 67) of participant had experience in delivering direct patient care. The mean length of service in the health care industry was 22 years (SD=9.48). RN was by far the most commonly held qualification; with 36 of 67 participants indicating that they were qualified as an RN (some held additional qualifications).

Table 1: Participant experience with infusions

	Yes	No	Not Applicable
Do you have experience delivering morphine infusions?	30	8	29
Do you have experience using a basic infusion pump?	34	3	30

Despite 48 of 67 participants reporting that they have had direct experience with patient care, only 34 reported that they have had experience with infusion pumps. This may have an impact on the generalizability of the results to direct care hospital staff.

Results

Participants made fewer errors and more correct responses when using standard concentration when compared to using the 'rule of six' to calculate an individualised concentration.

Table 2: Error rates for each calculation

Calculation	Correct		Incorrect		Mean Errors
Rule of six	29	45%	36	55%	1.14
Standardized	57	85%	10	15%	0.26

*it should be noted that an erroneous answer from one step is carried through the subsequent steps.

A non-parametric Wilcoxan test of dependant means indicated that the Standardized calculation had significantly more participants correctly answer the standardized calculation than did the rule of six calculation $Z=-4.74$, $p<.01$. This finding was also significant when those with non-health care related credentials were removed from the analysis $Z=-3.162$, $p<.01$.

Twenty seven participants correctly completed both calculations, with 18 of these 27 being RN's, two coming from other health care related backgrounds, and the other seven participants coming from non-health care related backgrounds.

It is also of interest that 67% participants indicated that they found the Standardized calculation easier. This question was answered before feedback had been given concerning whether or not their calculations were performed correctly so should be free of bias from information concerning their actual performance.

Analysis of Errors

Summary of errors for the Rule of Six Calculation

Step in which error occurred	Description of Error	Number of times error committed
1	Misread Instructions: divided patient weight by 0.5 instead of multiplying by 0.5	2
	Multiplication error: multiplied 23 by .5 and got 13	1
	Multiplication error: multiplied 23 by .05 and got 1.15	1
2	Units: substituted L for ml in concentration of morphine. Resulted in 5750mL morphine to withdraw instead of 5.75mL	1
	Misread instructions: divided by prescription instead of concentration of morphine	3
	Division error: divided by 10 instead of 2	2
	Division error: divided by 66 instead of 2	1
	Miscalculated amount of morphine. Resulted in 2.5mL instead of 5.75mL	1
	Misread instructions	3
3	Did not finish the calculation	1
	Subtraction: Did not subtract volume of morphine from 50mL correctly to calculate volume of dilutent to be used	2
4	Carried value from step 3 instead of referring to prescription	26
Total		***44***

Demographics

Sixty three females and 4 males participated in the study. The participants were predominantly from the health care field. Nineteen participants were currently involved in direct patient care, 39 were healthcare administrators in various capacities, and 9 represented other professions (university professor, engineer, etc). The majority (48 of 67) of participant had experience in delivering direct patient care. The mean length of service in the health care industry was 22 years (SD=9.48). RN was by far the most commonly held qualification; with 36 of 67 participants indicating that they were qualified as an RN (some held additional qualifications).

Summary of errors for standardized calculation

Step in which error occurred	Description of error	Number of times error committed
1	Multiplication error	2
	Multiplication error: Carried number through improperly	1
2	Division error: divided by 10,000 instead of 1,000	1
3	Multiplied instead of divided. Resulted in a rate of 0.62mL/hr instead of 1.61mL/hr	1
	Division error: got answer of .16mL/hr instead of 1.61mL/hr	1
Total		***6***

An analysis of errors committed at this level of detail shows several things. First, both types of calculations were prone to mathematical errors. However, the 'rule of six' calculation had more varied types of errors (possibly just due to the higher number of errors). The TA identified the potential for large errors of magnitude (e.g. 1000 fold) with the use of standardized concentrations. In the current study none of the participants made errors of this magnitude, in fact the highest magnitude was a 10 fold error. It is also important to note that 26 of the 'rule of six' errors occurred at the last step i.e. calculating the infusion rate. Participants used the result of the previous calculation rather than going back to the beginning to the physician's prescription. This may be due to a lack of understanding of what they were doing and they were just blindly trying to follow the steps. Anecdotally it seems that many participants had experience using different variants of the 'rule of six', which biased their understanding of the steps laid out on the calculation form (i.e. they were trying to impose their own experience onto the calculation presented in the study). This suggests that people calculating these rates are very sensitive to the way the instructions are laid out. It is possible that if the calculation steps were laid out differently, fewer participants would have made this error. This should be taken into account when preparing calculation aids for the nurses who will be preparing infusions using standard concentrations, as the layout of the instructions seems to be a major factor in error rates for the 'rule of six' method. Several participants commented that the 'rule of six' calculation was not logical, and the standardized method of calculation made more intuitive sense. This may be one of the reasons why more people calculated the standardized infusion correctly.

Distraction Results

The results of the distraction condition generally showed that being distracted did not significantly increase the number of errors made $t(62)=1.375$, ns, distraction = 1.93 no distraction = 1.41. Interestingly, participants responded significantly quicker for calculation B in the distraction condition than they did in the non distraction condition $t(63)=-2.115$, $p<.05$, distraction = 40.67, no distraction = 56.35. While not significant, participants also took less time to complete calculation A in the distraction condition $t(64)=-.516$, ns dist = 32.7, no dist = 34.8. Overall, participants in the distraction condition completed both calculations quicker $t(62)=2.275$, $p<.05$, distraction = 213.07, no distraction = 250.76. This effect was not found for those who answered both calculations correctly $t(25)=1.048$, ns, distraction 219.11, no distraction 247.78.

Based on a discriminate analysis, distraction condition also did not significantly predict whether participants would correctly answer the Rule of Six or the Standardized calculation correctly (Wilks Δ=.963, χ^2=2.33, ns; Wilks Δ=.993, χ^2= .444, ns). This indicates that distraction was not a factor that influenced participants' ability to correctly answer the questions.

Discussion

The results provide some support for the proposition that the calculating a morphine infusion using a standard concentration was easier to perform accurately than calculating an infusion using the 'rule of six'. One of the challenges that we encountered was that healthcare workers who were familiar with preparing individualised concentrations used different variants of the 'rule of six'. For example a PICU nurse indicated that she would start with the infusion rate that was possible given fluid restrictions of the patient. In her opinion this made our 'rule of six' calculation more difficult. This illustrates the complexity of the process and the limitation of testing calculations in a standardised setting.

The distraction manipulation did not work as intended, as it did not increase error rate or time to complete the task. This is likely due to the fact that the distraction that we used was not powerful enough. It was intended that participants would have to stop the calculation and turn over the page and search for the answer, but in reality most participants were able to answer the questions from memory.

Limitations

One major limitation may have been the way in which instructions were given on how to complete the 'rule of six' calculation. The step by step instructions were based on the steps necessary to complete the 'rule of six' calculation, but were laid out in a way that participants would not be intimidated by a complete formula. Several participants made comments while completing the calculation that, while they had experience with the 'rule of six', they performed the calculations differently than the steps they were given (different order, different calculations). This may have caused errors in a sub-group that would have performed the calculation properly had they not been given step by step instructions. Unfortunately the demographic information gathered did not include a question regarding experience in using the 'rule of six' to calculate morphine infusions so this cannot be investigated further. In addition, due to time constraints we only tested the calculation of an infusion rate for one of the potential standard concentrations (0.5 mg/ml). It would have been useful to calculate the infusion rate for all three standard concentrations (0.2, 0.5 and 1.0 mg/ml) and assess participants ability to select the most appropriate concentration.

Another limitation that was already mentioned was that the sample at the CAPHC conference is most likely not representative of the population of health care providers that will be most affected by the roll-out of standardized concentrations of morphine. However, it can be inferred that given that since most of this sample has had experience with direct patient care at some point in their career that the two populations may be more equivalent than appears at first glance.

Conclusions

The results of both the TA and the calculation test support the conclusions from the phase 1 ISMP-CAPHC report that highlighted the potential for calculation error when preparing opioid infusions. The prospective human factors analysis provides some support for moving away from the current 'rule of six' method to the use of standard concentrations for the delivery of paediatric morphine infusions. The TA showed that introduction of standard concentrations simplifies the calculations required. Calculation test participants made more errors when using the 'rule of six' method that they did using the standard concentrations method.

It is recommended that ISMP and CAHPC move forward by conducting a control trial of the introduction of standard concentrations to assess the impacts of the change in operational environments. It is important to recognise that while prospective human factors analysis is useful it is no substitute for field testing proposed interventions.

Appendix A: Task Analysis

Task Analysis 1: Manual Prescription, Individualised Concentrations, Basic Infusion Pump

TASKS	ACTIONS	STEPS	ASSUMPTIONS	OPPORTUNITIES FOR ERROR	OPPORTUNITIES FOR RECOVERY
Prescription	Interpret physician's order	Order received from physician (Nurse copies order if given verbally)	Prescription in mcg/kg/hr	Misinterpretation of order	Identify inappropriate dose by checking against dosing chart
		Ensure all required information is on prescription (Obtain any missing information e.g. Weight)		Missing info	
		Check dose against acceptable dosing charts		Do not check does	
Drug preparation	Calculate volume of drug		Assumes 50 ml syringe		
		Calculate mg dose by multiplying .5 by patient weight in kg to produce mg to mix with diluents to create 50ml		Calculation error, inaccurate weight	Independent double check by another nurse
		Select appropriate vial and drug concentration from the narcotic cabinet	based on fluid requirements and patient weight	Select wrong / unintended concentration/drug	Independent double check by another nurse

TASKS	ACTIONS	STEPS	ASSUMPTIONS	OPPORTUNITIES FOR ERROR	OPPORTUNITIES FOR RECOVERY
		Divide mg required (obtained above) by concentration of selected stock in mg/ml to get volume of stock to withdraw		Calculation error	Independent double check by another nurse
	Calculate volume of diluent				
		Subtract ml's of drug calculated above from 50 to obtain amount of diluent required		Calculation error	Independent double check by another nurse
	Prepare Solution				
		Withdraw appropriate ml's of diluent into syringe		withdraw incorrect amount	Independent double check by another nurse
		Withdraw appropriate ml's of drug into syringe		withdraw incorrect amount	Independent double check by another nurse
		Combine drug and diluent into new syringe			
		Label syringe		Do not label syringe and give drug to another patient	
Pump setup					
	Calculate appropriate ml's/hr				

TASKS	ACTIONS	STEPS	ASSUMPTIONS	OPPORTUNITIES FOR ERROR	OPPORTUNITIES FOR RECOVERY
		Divide physician's order (mcg/kg/hr) by 10 to produce ml/hr rate	(based on 1ml/hr = 10mcg/hr)	Calculation error	Independent double check by another nurse
	Enter calculated rate into pump			Enter incorrect rate	Independent double check by another nurse
Begin Infusion					

Task Analysis 2: Manual Prescription, Standard Concentration with Premade Solutions Available, Basic Infusion Pump

TASKS	ACTIONS	STEPS	ASSUMPTIONS	OPPORTUNITIES FOR ERROR	OPPORTUNITIES FOR RECOVERY
Prescription	Interpret physician's order	Order received from physician (Nurse copies order if given verbally)	Prescription in mcg/kg/hr	Misinterpretation of order	Identify inappropriate dose by checking against dosing chart
		Ensure all required information is on prescription (Obtain any missing information e.g. Weight)		Do not obtain missing information and make an estimate (e.g. child weight)	
		Check dose against acceptable dosing charts		Do not check dose	
Drug preparation	Select pre-made solution of correct drug			Selects wrong concentration	
Pump setup	Calculate appropriate ml's/hr				
		Multiply Physicians dose in mcg/kg/hr by patient weight in kg's		Calculation error	Independent double check by another nurse
		Divide that number (mcg/hr) by 1000 to get mg/hr		Calculation error	Independent double check by another nurse
		Divide that number by standard concentration to get ml/hr infusion rate		Calculation error	Independent double check by another nurse

	Enter calculated rate into pump	Enter incorrect rate	Independent double check by another nurse
Begin Infusion			

Appendix IX

High Alert- Safe Opioid Use: Qualitative Psychological Study – July 2009

See Attachment – Psychological Research Presentation

High Alert Medication Delivery in Paediatrics: Opioid Safety

Barnes Associates
November 2009

Background

Opioid errors can have deadly consequences.

"The treatment of acutely ill infants, children and youth presents unique challenges in the realm of medication safety. A variety of factors, including the age, size, and physiological status of these patients, can increase the likelihood that medication incidents, particularly those involving high-alert medications, will result in harm."
ISMP Safety Bulletin: Volume 9, Number 6 – August 2009

The environments or work situations where opioids are administered are:

1. Highly stressful settings where work involves multiple and precise tasks
2. Time pressured
3. Often understaffed.

People who work with opioids include physicians, pharmacists and nurses, and each of these groups has a different role – prescribing, preparing, administering.

Psychological Profile Research

The goal of this research was to gather data to support an innovative approach to intervention for practitioners who are involved in the administration of pediatric opioids using psychological theory and methodology.

The participants were paediatric practitioners at three Ontario hospitals:

- Hospital for Sick Children – Toronto
- Credit Valley Hospital – Mississauga
- Children's Hospital of Eastern Ontario -- Ottawa

They included:

- 12 front-line nurses
    - 6 in ICU, 2 in Oncology, 4 in Infant-Toddler/Surgical Recovery
- 1 Physician – Head of Pediatric Department
- 1 Team Leader
- 1 Director of Nursing
- 1 Pharmacist

Note: only the 12 nurses completed all three aspects of the study.

The methodology had three components:

1. BarMar Traits Inventory
2. Emotional Response Imagery Exercise
3. One-to-one interviews

The researcher also spent time in two ICUs and one pharmacy.

Key Findings

BarMar Inventory
The findings identified that:

- Participants lean toward a more inner –oriented focus of energy
- There are two distinct group in terms of information intake; those who require concrete facts (*doers*), and those who also require the conceptual picture (*theorists*)
- Decision making is based in logic and is strongly influenced by values and beliefs
- There are two distinct groups in terms of life/work style: those requiring more structure, those requiring more flexibility.

In this study, the ICU nurses are in the group of theorists who require flexibility and the other nurses are in the group of doers who require more structure.

Emotional Response Imagery
Participants chose images from a deck of 90 works of art in response to three questions and were asked to explain the significance of their choices.

The key points expressed by participants about the images they chose are as follows.

Why nursing?

- Caring
- Companionship
- Complexity

What are the difficulties of work?

- Waiting
- Not knowing (complexity, uncertainty)
- Distress
- Aloneness

What supports do you need?

- Teamwork/collegiality
- Family and friends
- Time on my own
- Humour

Participants were asked to describe what happens when the support they need is not available:

- They all describe a loss of morale and say they get more easily overwhelmed and over-tired.
- Depending on their psychology:
    - They will either withdraw and become less likely to consult with others – i.e., they lose connection

- Take on more and more in an attempt to "become all things to all people" –i.e., they lose focus.

Interviews

In discussion, these key points emerged:

- Overall, the participants in this study have a positive and enthusiastic outlook and attitude, even though the majority estimate their stress levels on an average day "are 7 out of 10" on a scale of 1-10, 10 being the most stressful.
- Humour is essential for success.
- ICU nurses are a distinct group among nurses:
  - Function as team players and independent thinkers
  - Respect for traditional methods but openness to change and innovation.

Recommendation

Based on these findings, the recommendation is that to support nurses and others involved in the delivery of opioids, it is necessary to identify and describe the optimal psycho-physiological state for working with opioids – the 'O' Zone.

What is the 'O' Zone?

The 'O' Zone – for all individuals involved in opioid delivery – is **a moderate stress level**, a psycho-physiological state that is:

- Alert
- Engaged
- Focused.

The 'O' Zone requires a moderate level of stress, or 'managed' stress, the need to be alert, focused and prepared, but not overwhelmed.

Stress Level Continuum

Low Stress	Moderate Stress	High Stress
No anxiety	**Moderate anxiety**	**High anxiety**
Carefree	**Alert**	**Vigilant**
Detached	**Engaged**	**Reactive**
Unmotivated	**Motivated**	**Overwhelmed**
Unfocused	**Able to concentrate**	**Easily distracted**
Unconcerned	**Responsive**	**Frustrated**
Complacent	**Flexible**	**Rigid**
Relaxed	**Focused**	**Scattered**

The ultimate performance goal, stress-wise, is to move the individual along the continuum into a state of Moderate Stress where the person feels psychologically capable of handling a degree of uncertainty**.** Too much anxiety leads to feeling out of control and too little anxiety leads to diminished motivation.

Managing while in stressful situations means:

- The ability to acknowledge a state of stress
  - Ability to perceive a risk
- Good training and self-efficacy – "Do I believe I can do it?"
  - Perception that one has the skills to deal with it
- Confidence that supports are available as back up.
  - Ability to ask for help.

How to Get in the 'O' Zone

Everyone who works with opioids needs to run regular, short 'self-checks': AM I IN THE O ZONE?

5 Steps into the 'O' Zone

1. Picture the 'O' Zone as a real place.
2. Acknowledge that you are about to enter the 'O' Zone.
   - *I am about to prescribe, prepare or administer opioids*
3. Check your stress level.
   - *Where am I on the stress level continuum – Low, moderate, high?*
4. Where does that put you in relationship to the 'O' Zone?
   - *I need to be at the moderate stress level.*
5. Decide what you need to move into the 'O' Zone
   - Getting into the 'O' Zone is usually about learning what helps to lessen high stress. Different techniques, alone or in combination, will work best for each individual. Suggestions based on research are:
     - Connect with colleagues
       - Tell someone how you are feeling
       - Get colleague to double check
     - Pacing
       - Take a 'time-out', a moment between tasks
     - Physical relaxation –
       - Upper body stretch
       - Breathing exercises
     - Visualization
       - Imagine a peaceful place
       - Draw on all the senses

     None of these techniques takes a long time.

Communications about the 'O' Zone

Background

Recognizing and communicating to the different types of individuals identified by the BarMar Inventory will be key to any success of the intervention.
When it comes to taking in information, participants fall into two distinct groups: ***Doers*** and ***Theorists.***
To be effective, communications messages and materials must incorporate the needs of both groups:

- Facts and details should be presented with symbolic language– metaphors, analogies, etc.
- Structured, sequential information should be in the context of the 'big picture' and move between ideas and tasks
- Immediate 'how-to' information should include possibilities for future patterns, trends and adaptations.

Most importantly, 'fear' messaging will not work – it merely reinforces high anxiety.

Objectives

Create communications that are:

- Clear
- Specific
- With humour.

Audiences

- Frontline practitioners
  - Theorists (Inner-oriented)
  - Doers (Outer-oriented)
- Frontline team leaders/directors
- Pharmacists
- Physicians
- Administrators
- Educators/Trainers

Key Messages:

- There is an 'O' Zone.
- You can quickly assess if you're in it.
- You can get there efficiently.

The O-Zone Poster/ Flyer – January 2010

See Attachments – Appendix XI a and XI b - The O-Zone Poster

High-Alert Medication Initiative

Safe Opioid Use

Barnes Associates

July 16, 2009

Qualitative Psychological Research

Goal

Using psychological theory and methodology, gather data to support an innovative approach to intervention for practitioners who are involved in the administration of pediatric opioids

Participants

Pediatric practitioners at 3 hospitals:

Where

- Hospital for Sick Children – Toronto
- Credit Valley Hospital – Mississauga
- Children's Hospital of Eastern Ontario -- Ottawa

Who

- 12 front-line nurses (ICU/Oncology/Infant-Toddler/Surgical Recovery)
- 1 Physician – Head of Pediatric Department
- 1 Team Leader
- 1 Director of Nursing
  1 Pharmacist

Methodology

3 Components:

- BarMar Traits Inventory
- Emotional Response Imagery Exercise
- One-to-one interviews

Plus visits to ICU and Pharmacy

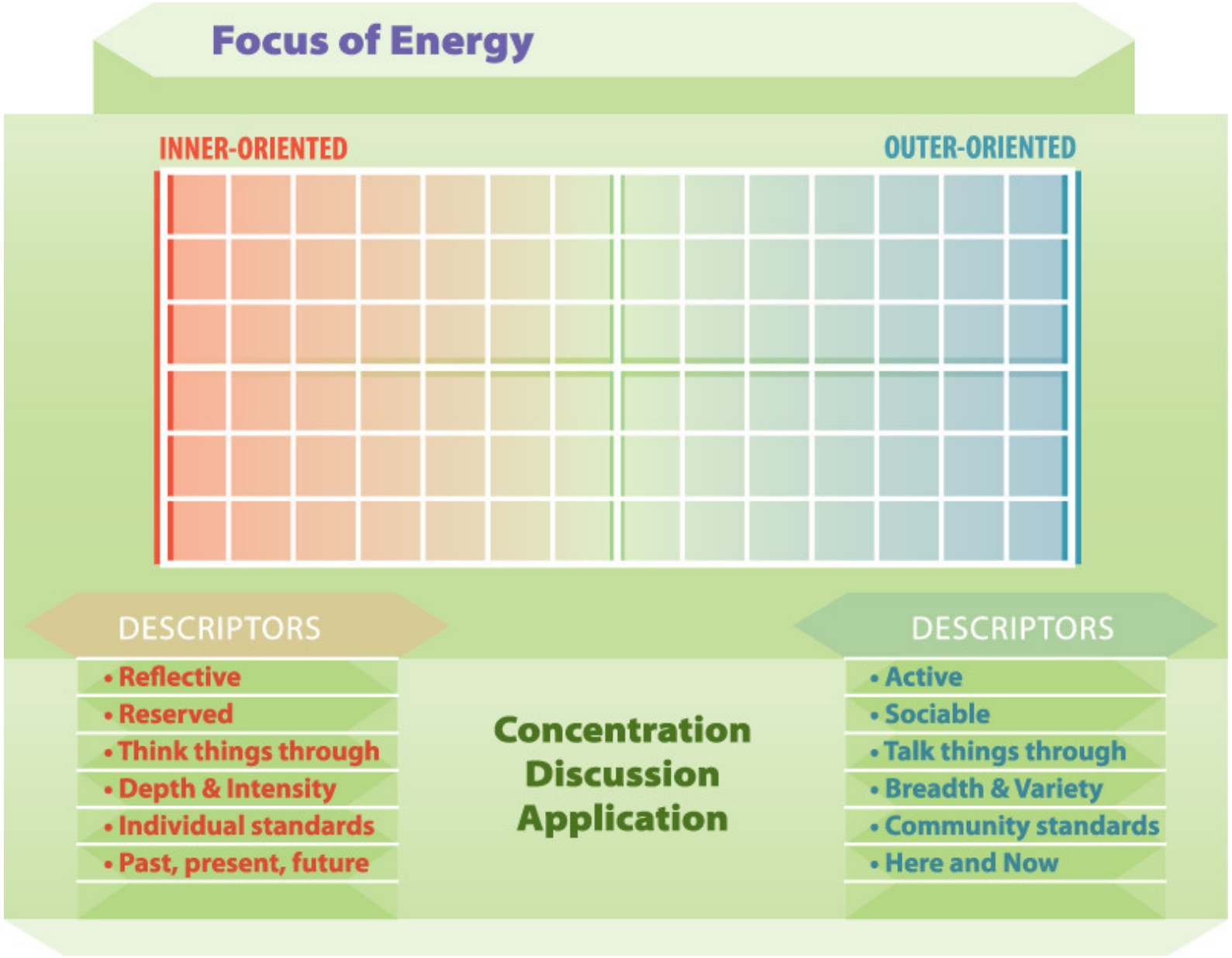
Findings

1. **BarMar Traits Inventory**

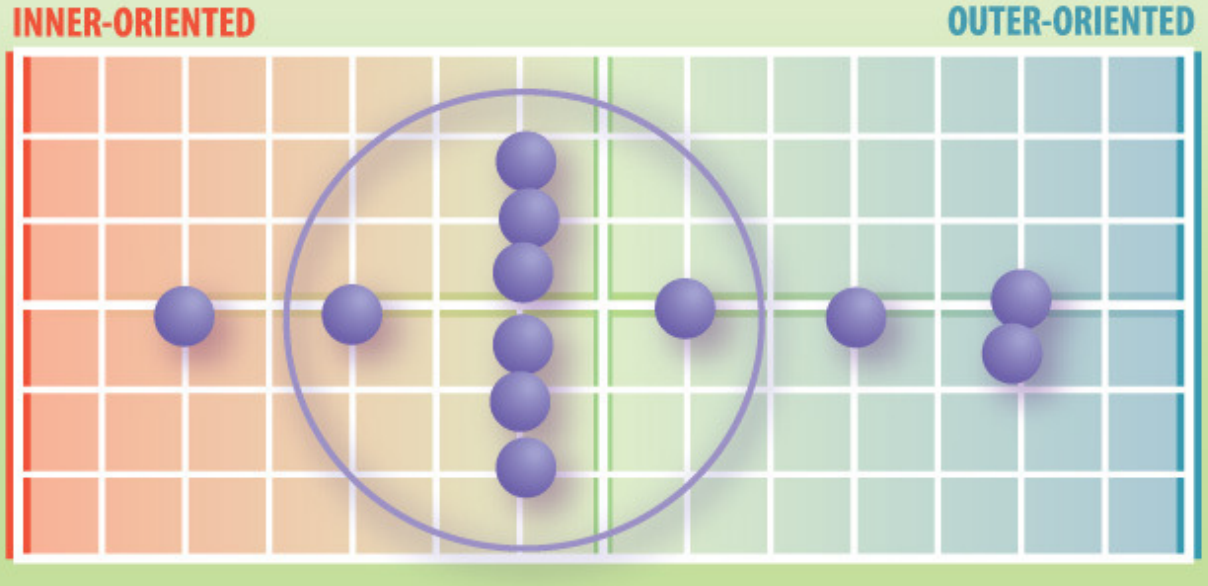
Participants' psychological dynamics:

- Focus of Energy
- Taking in Information
- Making Decisions
- Life & Work Style

Focus of Energy



Focus of Energy



DESCRIPTORS

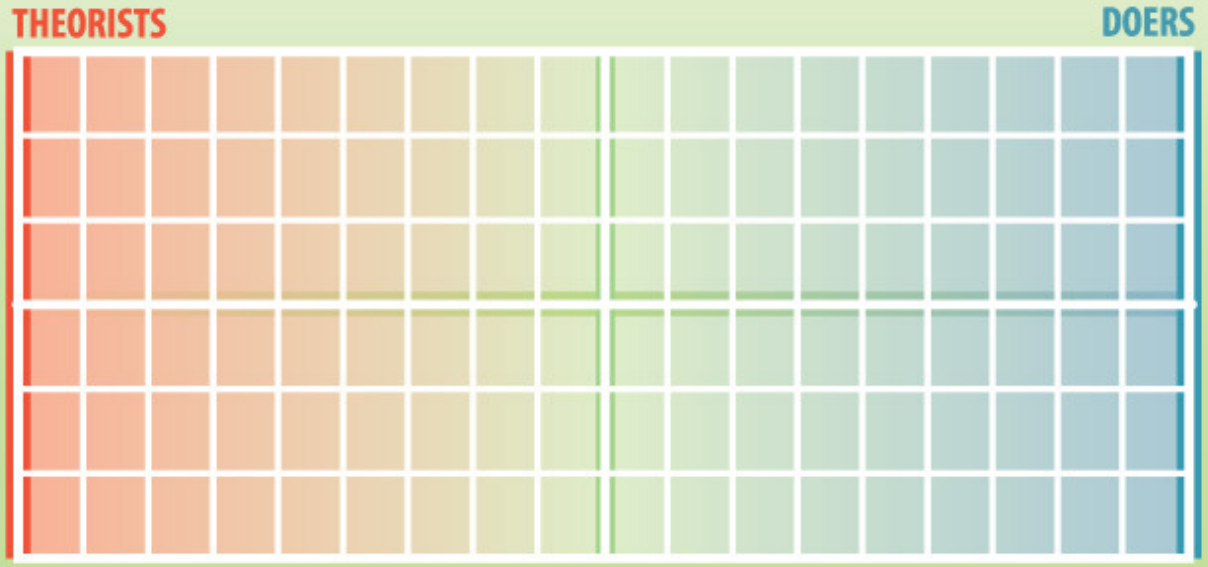
- Reflective
- Reserved
- Think things through
- Depth & Intensity
- Individual standards
- Past, present, future

Concentration
Discussion
Application

DESCRIPTORS

- Active
- Sociable
- Talk things through
- Breadth & Variety
- Community standards
- Here and Now

Taking in Information



DESCRIPTORS

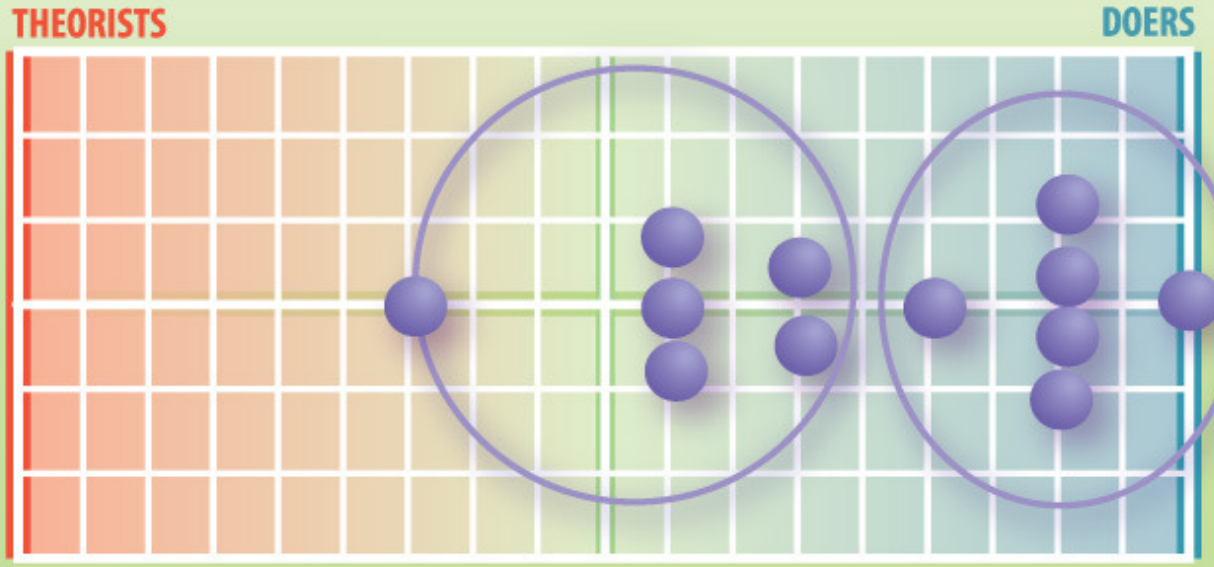
- Conceptual
- Abstract
- Symbols
- Ideas
- What could be

Facts in Context of "Big Picture" & Openness to New possibilities

DESCRIPTORS

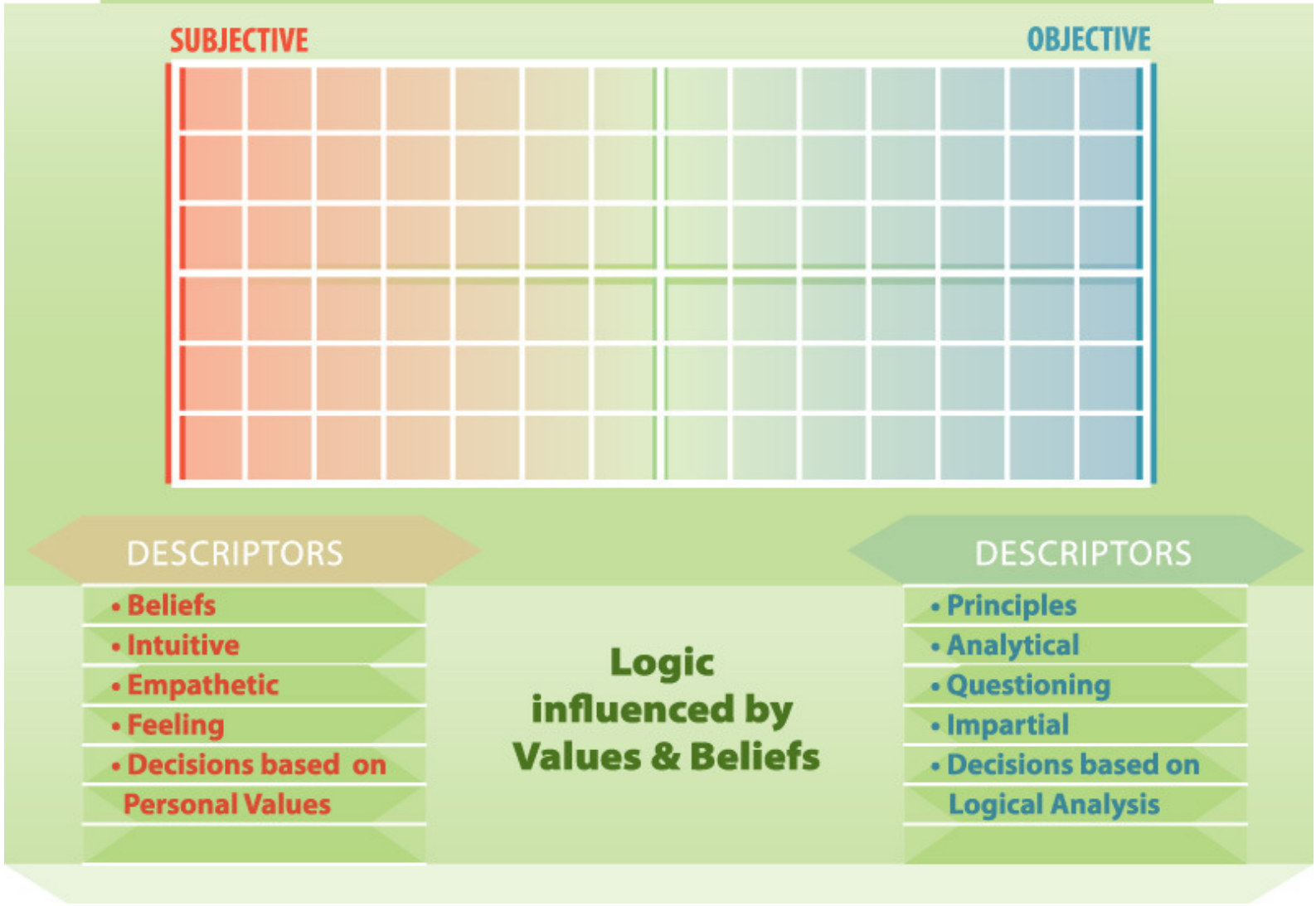
- Practical
- Concrete
- Facts & Details
- Experiences
- What is

Taking in Information

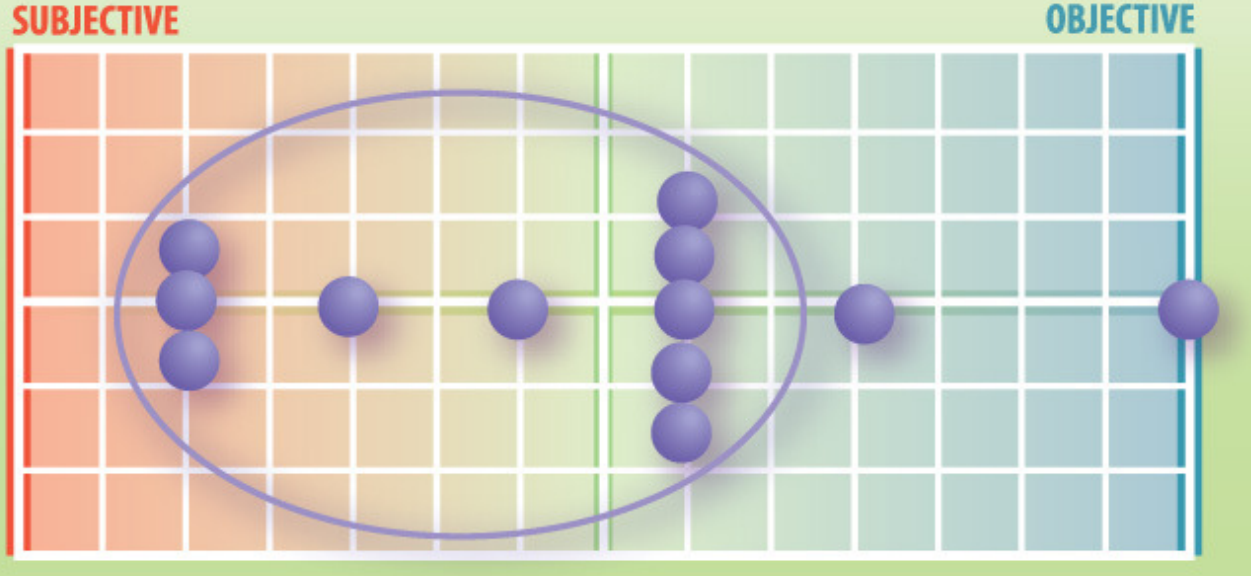


DESCRIPTORS		DESCRIPTORS
• Conceptual		• Practical
• Abstract	**Facts in Context of "Big Picture" & Openness to New possibilities**	• Concrete
• Symbols		• Facts & Details
• Ideas		• Experiences
• What could be		• What is

Making Decisions



Making Decisions



DESCRIPTORS

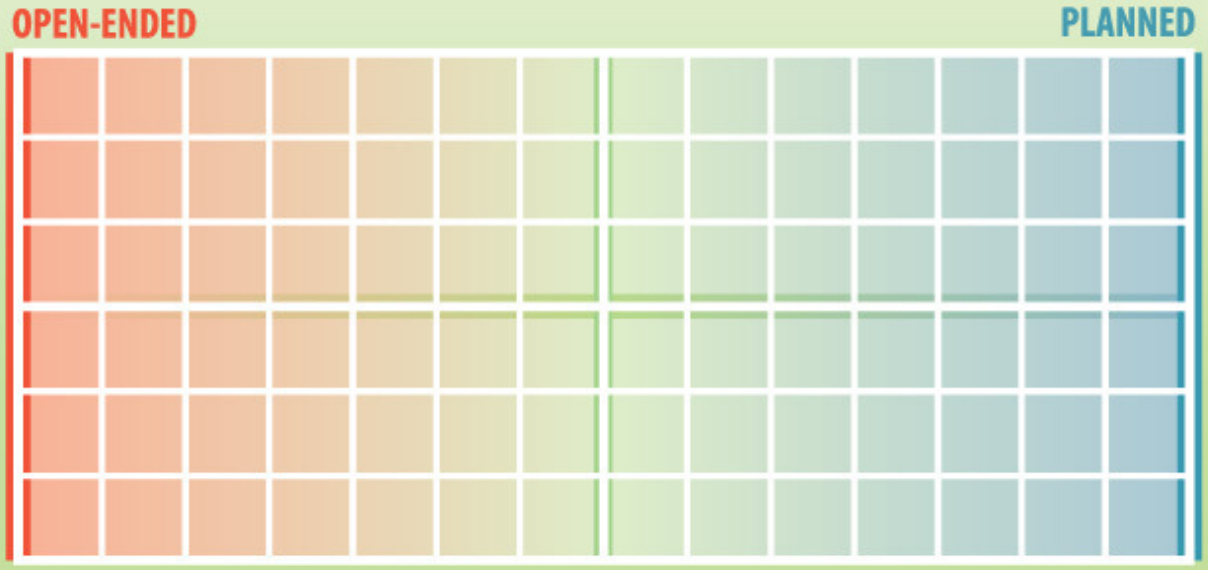
- Beliefs
- Intuitive
- Empathetic
- Feeling
- Decisions based on Personal Values

Logic influenced by Values & Beliefs

DESCRIPTORS

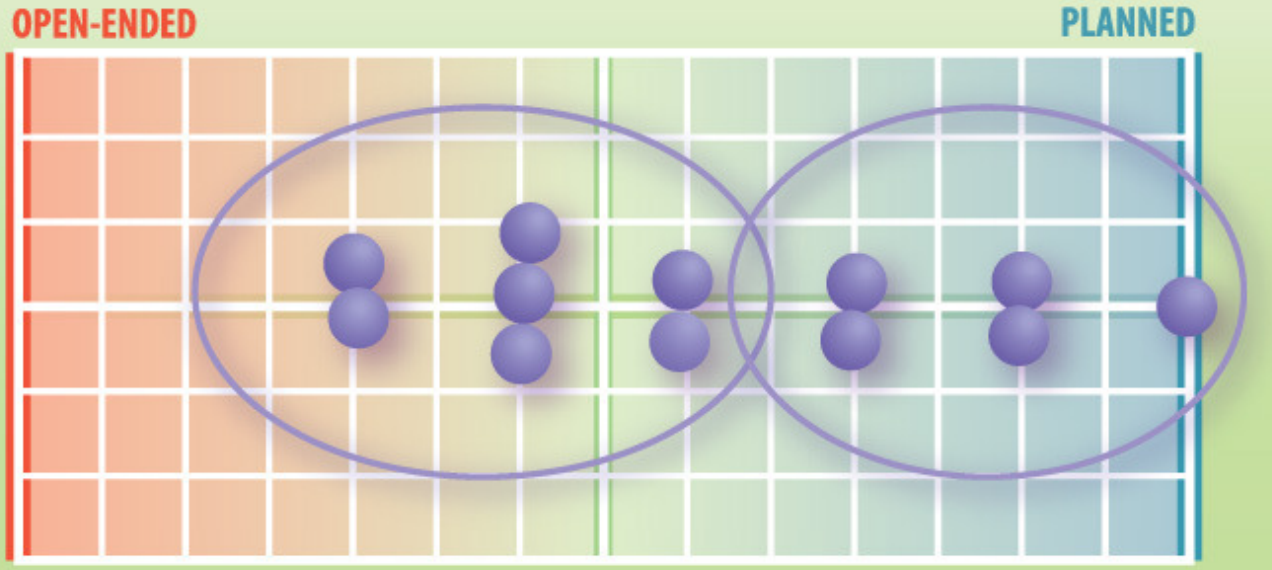
- Principles
- Analytical
- Questioning
- Impartial
- Decisions based on Logical Analysis

Life & Work Style



DESCRIPTORS		DESCRIPTORS
• Spontaneous		• Schedules
• Flexible		• Systemic
• Adaptable	**Structure with Flexibility**	• Structured
• Options		• Outcomes
• Life as Process		• Life as Order

Life & Work Style



DESCRIPTORS		DESCRIPTORS
• Spontaneous		• Schedules
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• Adaptable	**Structure with Flexibility**	• Structured
• Options		• Outcomes
• Life as Process		• Life as Order

Analysis

Focus of Energy
Participants lean toward a more inner-oriented focus

Taking in Information
Two groups:
A solid core needing concrete facts (***Doers)***
A significant number who also require the conceptual ‘big picture’ (***Theorists)***

Making Decisions
Logical and are powerfully influenced by values and beliefs

Life/Work Style
Two groups**:**
One needs more structure
One needs more flexibility

2. **Emotional Response Imagery**

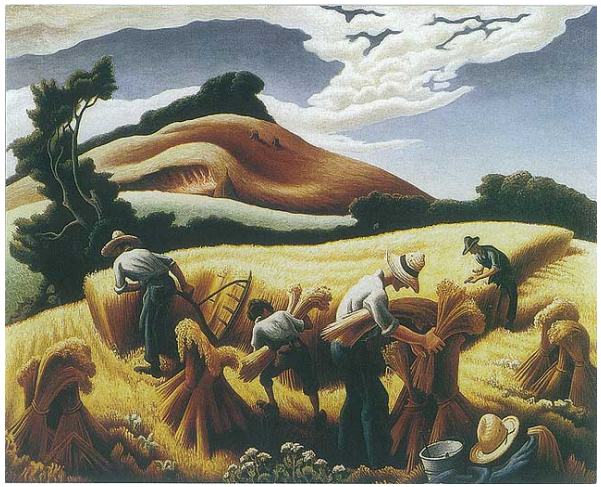
Images that reflect participants responses to 3 key questions:

1. Why did you go into nursing?
2. What are the difficulties of the work?
3. What supports do you need?

Why nursing?

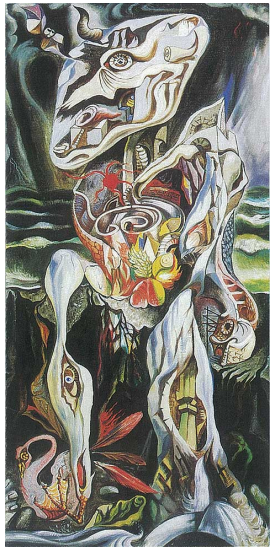
“It’s the satisfaction that comes from caring.”
“I need to feel I can make a difference.”
“To bring a sense of peace and well-being.”

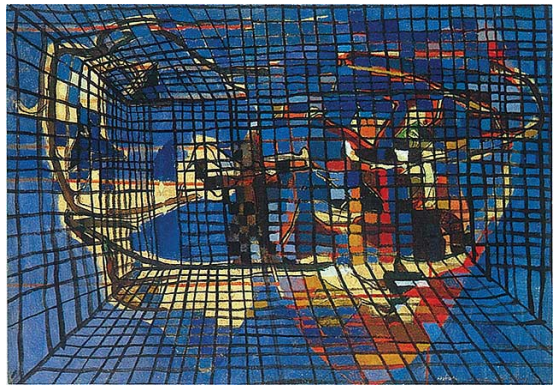
Why nursing?

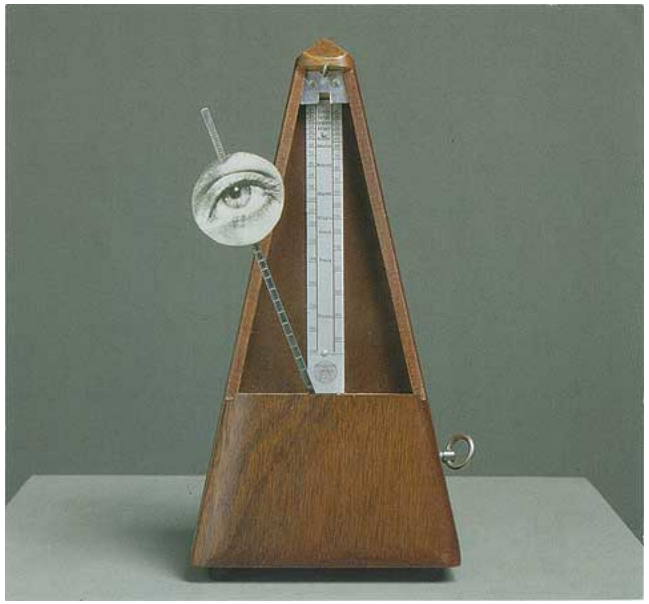


“Being part of a team.”

Why nursing?





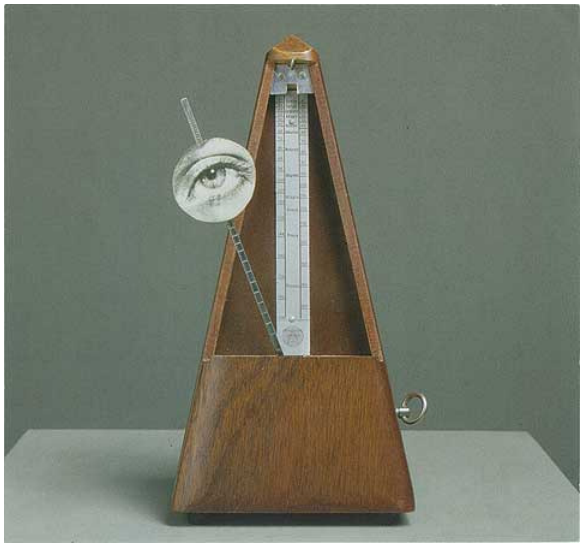


“Never know what’s going to happen next.”
“Fascinated by the complexity.”
“I’m learning all the time.”

Why nursing?

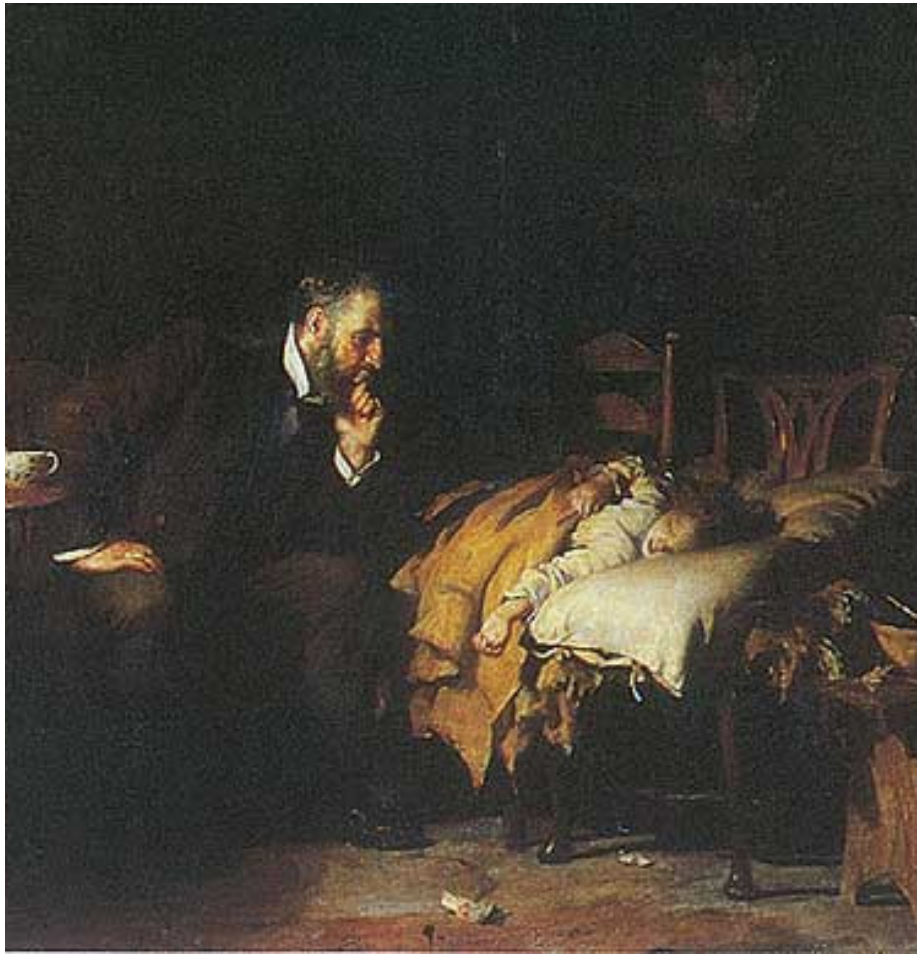
- Caring
- Companionship
- Complexity

Difficulties of Work

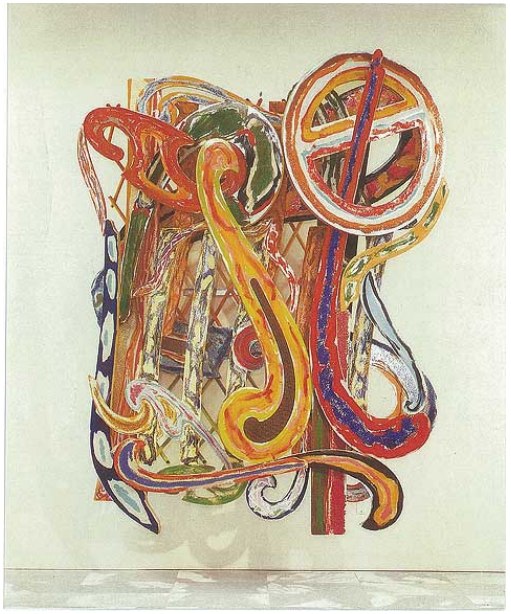


“The waiting is the hardest.”
“The work can be never-ending.”
“Relentless.”
“Boring.”

“It can go either way…”

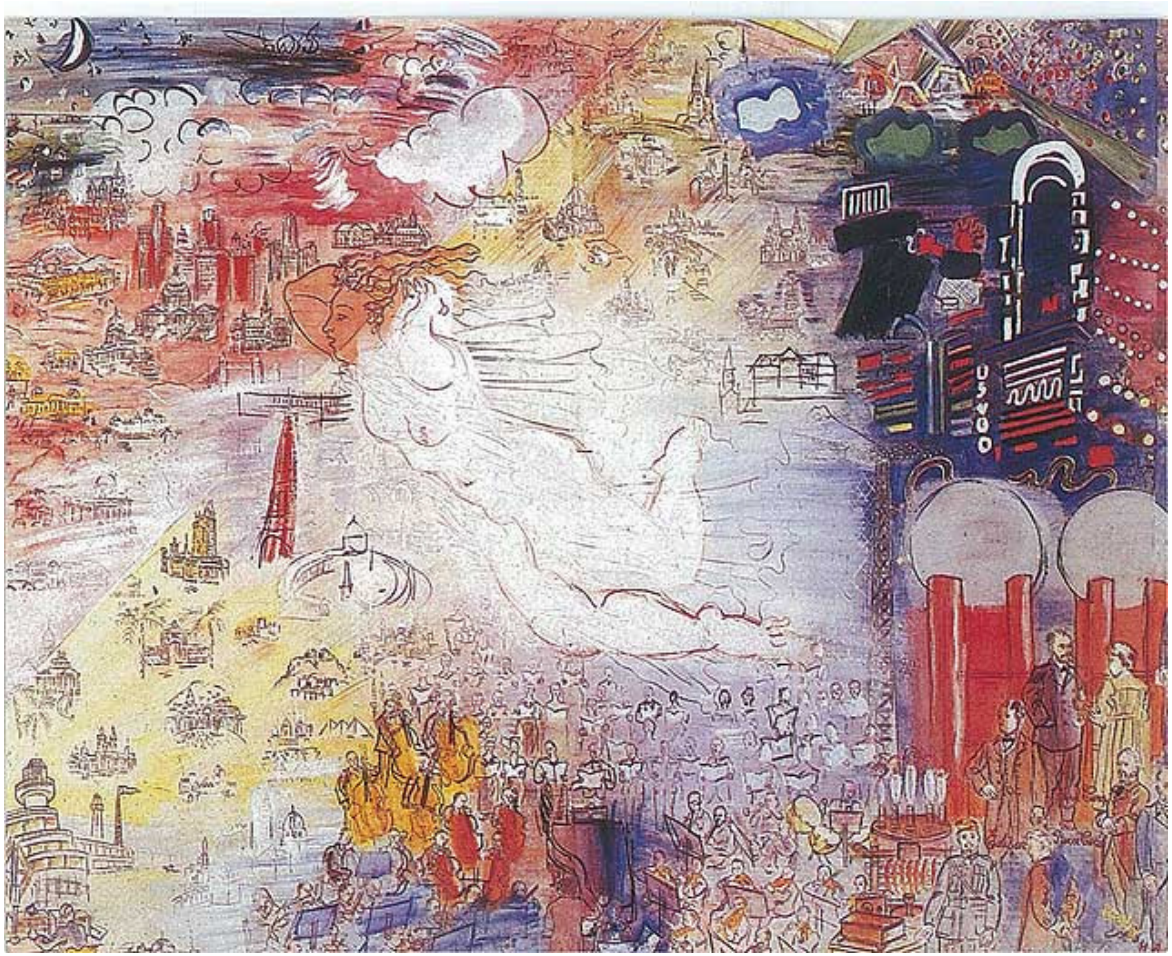


Difficulties of Work



“Every situation is different.”
“Definitely no cookie-cutter solutions.”
“Waiting for things to come into focus.”
“Sometimes it can be very confusing.”

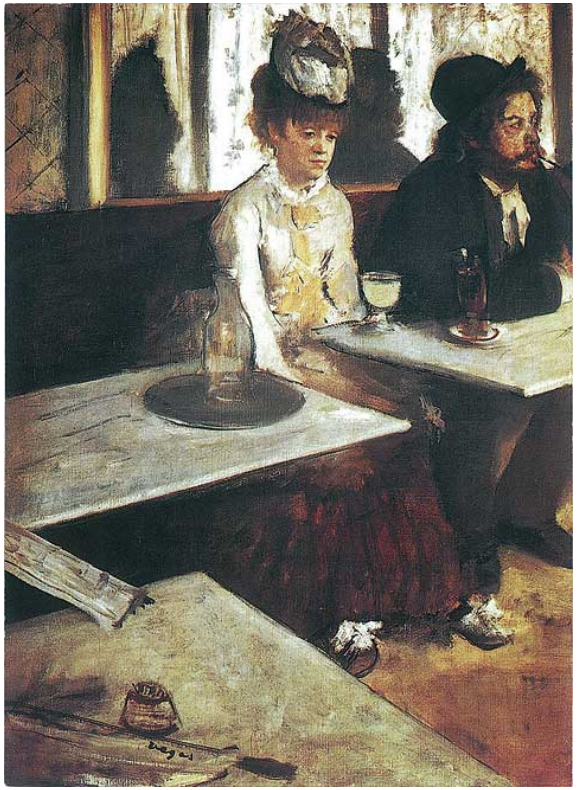
“All things to all people.”

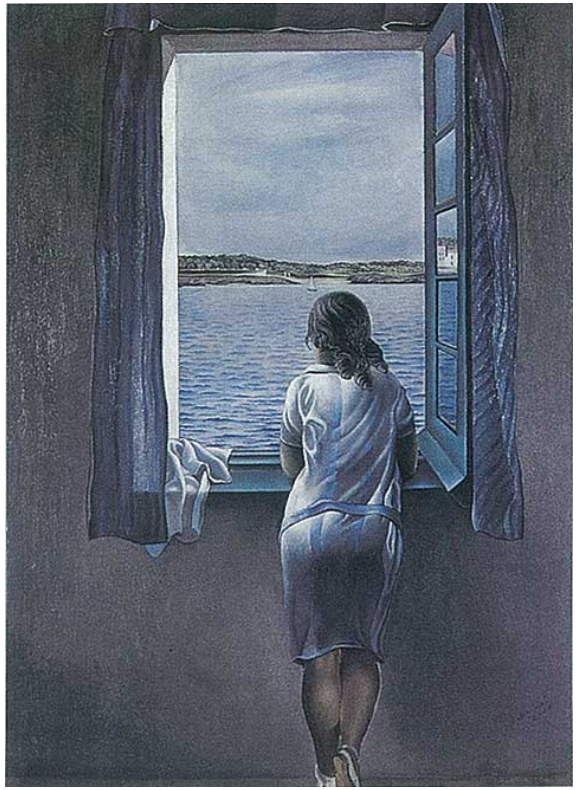


Difficulties of Work

“Watching the disease tearing away at the child.”
“Dealing with parents’ anxiety which can turn aggressive.”
“That feeling when you know that a child is going to die.”

Difficulties of Work





“The futility of knowing there is nothing you can do.”
“Outside of here, no-one has a clue about what we do.”
“Sometimes I feel so alone.”

Difficulties of Work

- Waiting
- Not knowing (complexity, uncertainty)
- Distress
- Aloneness

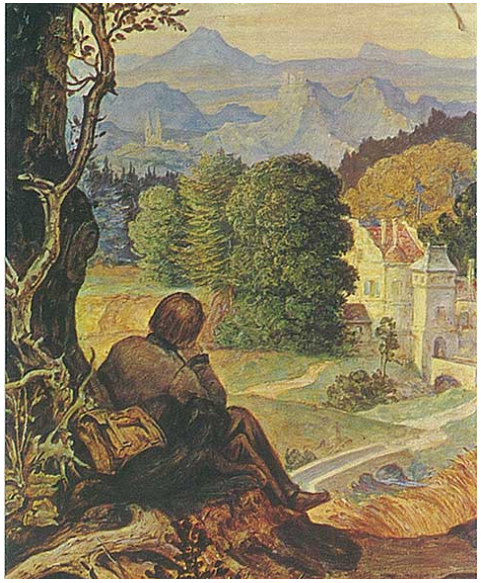
Supports Needed

“ Colleagues with a sense of belonging.”
“Confident I have management’s support.”
“Knowing I’m part of a team.”

Supports Needed

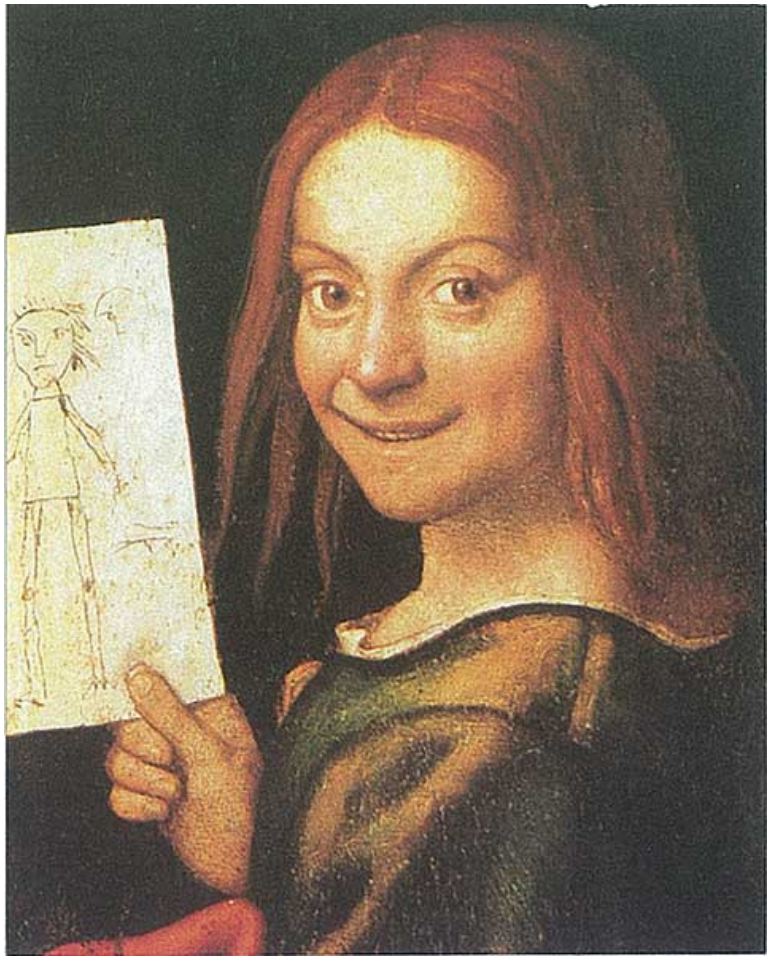
“My husband.”
“My family and friends.”
“My husband doesn’t ‘get it’, but he listens and can make me laugh.”

Supports Needed



“Time out to be by myself.”
“The tradition, history and science of medicine."
“Worry-free time for myself.”

“Laugh when you can!”



Supports Needed

- Teamwork/collegiality
- Family and friends
- Time on my own
- Humour

When Support Is Not Available

Participants were asked to describe what happens when the support they need is not available:

- They all describe a loss of morale and say they get more easily overwhelmed and over-tired.
- Depending on their psychology:
  - They will either withdraw and become less likely to consult with others – i.e., they lose connection

  OR

  - Take on more and more in an attempt to “become all things to all people” –i.e., they lose focus

3. **Interviews**

Findings of one-to-one discussions

One-to-One Discussions

- Overall, participants have a positive and enthusiastic outlook and attitude, even though the majority estimate that their stress levels on an average day, “are 7 out of 10.”
- An appealing aspect of the work is that it is “never the same,” and that they “are learning all the time.”
- As a group, participants welcome change: “I’m always looking for new ways to be more effective.”
- Being part of a team is very important to these individuals: “I feel I have a voice in the treatment process.”
- The greatest challenge is the sense of aloneness outside of the team, outside of work: “Other people just don’t get it.”

One-to-One Discussions

- Almost all participants said that from the outset, they chose to work in pediatrics, i.e., they chose to work with children, not adults.
- They are clear that they also work with the child's parents, but their allegiance is to the child.
- They find that the children are inspiring and upbeat – "They don't complain about the small things."
- It's difficult when a child dies, but when a child gets better, "You hope it's for a whole lifetime."

How To Communicate To…

When it comes to taking in information, participants fall into two distinct groups: ***Doers*** and ***Theorists:***

To be effective, communications messages and materials must incorporate the needs of both groups:

- Facts and details should be presented with symbolic language– metaphors, analogies, etc.
- Structured, sequential information should be in the context of the ‘big picture’ and move between ideas and tasks
- Immediate ‘how-to’ information should include possibilities for future patterns, trends, adaptations.

Key Findings

- ICU nurses are a distinct group among nurses
- They are both team players and independent thinkers (professionals working with other professionals)
- They respect the traditional ways of doing things, but are able to ‘think outside the box’ and are open to change and innovation
- Communicating to the different ‘types’ among these individuals is key to success of the intervention
- Humour is essential.

Communications

Communications Goal

To achieve high level, widespread ‘buy-in’ and implementation of the intervention

Objectives

- Raise awareness about opioid risks
- Provide accessible, available intervention information to segmented audiences
- Integrate psychological research findings into all materials for maximum engagement

Audiences

- Frontline practitioners
  - Theorists (Inner-oriented)
  - Doers (Outer-oriented)
- Frontline team leaders/directors
- Pharmacists
- Physicians
- Administrators
- Educators/Trainers

Key Messages

Well-crafted key messages begin a dialogue with the intended audiences.

Key messages are:

1. Clear, concise, ‘bite-sized chunks’ of information that *may* stand alone, but more likely are used to develop other communications materials
2. Easy to say and more important, easy to understand and remember
3. Unequivocal
4. Specific, and written in an active voice.

Take the Morphine Challenge!

CAPHC, ISMP Canada, and CPSI in collaboration with Researchers at Saint Mary's University invite all conference attendees to take part in a paediatric medication challenge.

Study results will inform practice improvement for morphine infusions in paediatric patients.

With prescriptions and formulas provided, we challenge you to calculate the morphine dosage for a paediatric patient.

Visit us at the CAPHC booth during the conference for more information and to take the challenge!

The quickest person to calculate the correct concentration will win a $50 gift voucher.

CAPHC ACCSP

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One University. One World. Yours.

cpsi icsp

ismp CANADA

A protective psychological space for the safe delivery of **Opioids**

Enter The OZone

Where you want to be when you

PRESCRIBE

PREPARE

DELIVER

In The OZone you are alert, engaged and focused

Opioid medications

Own your OZone

A protective psychological space for the safe delivery of **Opioids**

STEP into The OZone

STRESS CHECK

Stretch your upper body.
Take a few deep breaths.

Talk to a colleague.

Envision a peaceful place.

Pause between tasks.
Pace yourself.

You already know this space - step into it when you work with Opioids!

Own your OZone