2016 Davies Award Case Study:
Glycemic Control in the Hospital

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Speaker Introduction

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Conflict of Interest

Melinda Ashton, M.D.
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Have no real or apparent conflicts of interest to report.
Agenda

• Our Motivation
• Utilization of Health IT: 3 Initiatives
  – Computer-Directed Insulin Dosing System (CDIDS)
  – Development of EHR Order Sets
  – Wireless Glucometer Integration
• Outcomes
• Current Status and Next Steps
• Questions
Learning Objectives

• Assess the value of reduced length of stay to an integrated hospital system preparing for value based payments
• Describe the components of an effective program to improve glycemic control in hospitalized patients
• Discuss the metrics used to evaluate clinical and nonclinical success in this program
• Discuss challenges and lessons learned during the implementation and maintenance of a glycemic control program for hospitalized patients
Treatment / Clinical
• Computer Directed Insulin Dosing System (CDIDS) was implemented & EHR order sets were modified to follow best practice. We demonstrate an improvement in the rate of normoglycemia.

Electronic Secure Data
• Clinical data from usual patient care was used to demonstrate a need for improvement. Data was provided back to the clinical teams to measure success.

Savings
• Savings are reported as improvements in length of stay (LOS)
Serving our community for more than a century

- 4 medical centers
- 33,877 admissions
- 70 locations
- 1903+ physicians

Kapiʻolani Medical Center for Women & Children

Pali Momi Medical Center

Straub Medical Center

Wilcox Medical Center
Our Motivation

• Change from Volume Based Payment to Value Based Payment
Journey to Accountable Care

In partnership with our largest commercial payer (BCBS)

2009
Ambulatory pilot.

2010-2013
P4Q contract signed with HPH hospitals & clinics.

2013
Hawai‘i Health Partners formed.

2014
Five year accountable care agreement signed.

2016
Network grown to 100,000 lives.
We did the math in 2013

• To hit our Medical Cost Trend targets we would drive down utilization and increase our costs

• We projected a >$160M loss over 5 years

We needed a plan to keep from going broke.
Two Key Parts of the Plan

• Expand primary care capacity by reducing waste and improving efficiency

• Reduce CMI adjusted average length of stay
  – 2% reduction every year
  – $156M in direct margin over 5 years

Patient Access
Treatment of Sepsis
Glycemic Control
Our Motivation: Why Glycemic Control?

• In 2013, Hawai‘i Pacific Health identified reduction in surgical complications and length of stay as major areas of focus
• Poorly managed blood glucose is a known contributing factor in both areas
• Multiple glucose algorithms were being used across the system with varying success
Diabetes Burden in HPH Hospitals

10,621 diabetics
32,750 total discharges
32.4% of all discharges

Discharged Patients with Diabetes
All Other Discharges
Local Problem

NSQIP post-op complications: patients with diabetes vs patients without diabetes

% of HPH patients with post-operative complications

<table>
<thead>
<tr>
<th>Year</th>
<th>DM</th>
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<tr>
<td>2013</td>
<td>10</td>
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<td>2015</td>
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Average Length of Stay Comparison 2013

Diabetics ALOS vs Non-Diabetics

~ 2 days
Glucose Values Across HPH: October 2013

Hyperglycemia rate: 31-40%

- **Pali Momi**: 2,239 (40%), 3,198 (57%), 155 (3%) readings below 70, 3,639 (67%), 92 (2%) readings between 70 and 180, 617 (35%), 46 (3%) readings above 180.

- **Straub**: 1,691 (31%), 3,639 (67%), 92 (2%) readings between 70 and 180, 617 (35%), 46 (3%) readings above 180.

- **Wilcox**: 1,086 (62%), 617 (35%), 46 (3%) readings above 180.
### Design and Implementation Timeline

<table>
<thead>
<tr>
<th>Task</th>
<th>Duration</th>
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<tr>
<td>Problem identification</td>
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<td>Project charter development</td>
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<td>Product Selection</td>
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<td>Internal IT work:</td>
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<td>- Design</td>
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<td>- Build ordersets</td>
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<td>- Test</td>
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<tr>
<td>Go-live at 2 sites</td>
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<tr>
<td>Time Out!</td>
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<td>IV protocol continues</td>
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<td>Go-live # 2 Pilot: SQ on 1 Med / Surg unit</td>
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<td>Re-do infrastructure and design</td>
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<td>Integrate glucometers</td>
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<td>Re-education</td>
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<td>Spread</td>
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Utilization of Health IT – 3 Main Initiatives

Initiative #1: Implementation of Computer-Directed Insulin Dosing System (CDIDS)

• Factors involved in CDIDS selection
  – At the time of product selection, it was the only product that met our needs for IV, subcutaneous, and pediatric insulin dosing
  – It met almost all of the best practices for inpatient glycemic management set forth by the Society for Hospital Medicine (SHM)
  – It also offered integration with our EHR
HPH CDIDS Implementation

• Collaborative project rollout with IT and Clinicians
• HPH glycemic case rounds
  – Included IT, Pharmacy, nurses, physicians (informatics and hospitalists)
• Escalation process for clinical and technical questions
Initiative # 2: Development of EHR order sets to support basal-bolus subcutaneous insulin dosing

• We needed to ensure that it would be easy to order insulin correctly if there was a downtime
• We also wanted to remove the sliding scale orders so that it was difficult to continue old (bad) habits
Order Set Build

• Principles applied:
  – Built upon SHM best practices
  – Comprehensive
  – Order panel-based
  – Pre-check as much as possible
SHM Best Practices Implemented with CDIDS & Order Sets

Table 1.

Key concepts to emphasize in protocols and order sets for subcutaneous insulin use in non critically-ill inpatients.

1. Establish a target range for blood glucose levels
2. Standardize monitoring of glucose levels and assessment of long-term control (HbA1c)
3. Incorporate nutritional management
4. Prompt clinicians to consider discontinuing oral anti-hyperglycemic medications

5. Prescribe physiologic (basal-nutrition-correction) insulin regimens
   a. Choose a total daily dose (TDD)
   b. Divide the TDD into physiologic components of insulin therapy and provide basal and nutritional/correction separately
   c. Choose and dose a basal insulin
   d. Choose and dose a nutritional (prandial) insulin:
      i. Match exactly to nutritional intake (see Table 2)
      ii. Include standing orders to allow nurses to hold nutritional insulin for nutritional interruptions and to modify nutritional insulin depending on the actual nutritional intake
   e. Add correction insulin
      i. Match to an estimate of the patient’s insulin sensitivity using pre-fabricated scales
      ii. Use the same insulin as nutritional insulin

6. Miscellaneous

★ a. Manage hypoglycemia in a standardized fashion and adjust regimen to prevent recurrences
★ b. Provide diabetes education and appropriate consultation
★ c. Coordinate glucose testing, nutrition delivery and insulin administration
★ d. Tailor discharge treatment regimens to the patient’s individual circumstances and arrange for proper follow-up

= SHM best practices implemented with CDIDS & Order Sets

Internally developed basal-bolus insulin order sets

Physician selects order panel of his/her choice
Basal / Bolus / Correction order panel with 0.5 multiplier selected:

Basal, bolus, and correctional doses are prechecked with doses and frequencies prepopulated. Physician is only required to select the appropriate order panel (1 click), then sign the orders. Nursing, diet, consult, and hypoglycemia orders are included.
Hypoglycemia treatment orders included in the order set:

☑ Glucomander Hypoglycemia Treatment

UNTIL DISCONTINUED First occurrence Today at 1400, First option: If patient has IV access, follow Glucomander D50 recommendation. Second option: If patient is alert and does not have IV access, give 4oz. apple or cranberry juice. Third option: If patient is not alert and does not have IV access, give Glucagon 1mg IM x 1 and start D5W at 100 ml/hr. Select Alternate (Oral) Hypoglycemia Treatment option in Glucomander. Following treatment: If close to meal time, give patient meal. If outside of meal time, give patient snack of 1-2 carb exchanges plus 1 protein exchange.

☑ dextrose 50 % soln (D50)

5-50 mL PRN, Intravenous, Routine, Glucose less than 70mg/dl
Use when patient has IV access (dosing per Glucomander recommendation)

☑ glucagon 1 MG inj

1 mg PRN, Intramuscular, Routine, Glucose less than 70mg/dl
If patient is not alert and does not have IV access, give Glucagon 1mg IM x 1 and start D5W at 100 ml/hr. Select Alternate (Oral) Hypoglycemia Treatment option in Glucomander.

☑ dextrose (D5W) 5% 1000ml inj

at 100 ml/hr, Intravenous, PRN starting Today at 1347 until Wed 8/24 at 2359, Routine
If patient is not alert and does not have IV access, give Glucagon 1mg IM x 1, obtain IV access, and start D5W at 100 ml/hr. Consult physician on D5W duration. Select Alternate (Oral) Hypoglycemia Treatment option in Glucomander.
What we (quickly) learned

• Poor clinical practices
  – Routine use of sliding scale and continuation of oral hypoglycemics
  – Lack of attention to timing of blood glucose checks, meals, and insulin administration
  – Lack of understanding about implications of hyperglycemia

• Dietary issues
  – Lack of knowledge in assessing carbohydrate intake

• At the same time, the technical implementation for the subcutaneous product was not going well
We did keep the IV CDIDS product going due to popular demand!!
Utilization of Health IT – 3 Main Initiatives

Initiative #3: Wireless glucometer integration

Prior to integration:

- Nurse aide retrieves patient’s BG with glucometer
- Nurse aide *transcribes* BG value from glucometer into Epic
- Nurse *transcribes* BG value from Epic into CDIDS
- CDIDS recommends insulin dose based on *transcribed* BG value

After integration:

- Nurse aide retrieves patient’s BG with glucometer
- BG is wirelessly *transmitted* from glucometer into Epic, then from Epic into CDIDS
- CDIDS recommends insulin dose based on *transmitted* BG value

Advantages:
- ✓ Fewer steps
- ✓ Less people involved
- ✓ Risk of transcription error eliminated
- ✓ Less time consuming
IV CDIDS Workflow

• Step 1: Glucose value is wirelessly transmitted from the glucometer into Epic, then from Epic into CDIDS. Nurse is required to validate the current glucose value with a single mouse click.

Nurse clicks checkmark to validate current glucose level

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• **Step 2:** CDIDS displays recommended insulin infusion rate. Nurse is required to validate the rate change with a single mouse click.

• **Step 3:** Nurse adjusts insulin rate on the infusion pump and documents rate change on the Epic Medication Administration Record (MAR).
Outcomes

• IOM recommendation: Transition away from paper-based protocol to an IT solution
  – Paper protocols → CDIDS

• ISMP recommendation: Standardize ordering and administration of high risk drugs
  – Multiple paper protocols across system → single, standardized solution
CDIDS in the ICU
% CDIDS Utilization for Titratable Insulin Infusions
Dec 2014 - Nov 2016

Better performance
% of Glucose Readings <70 mg/dl
for ICU Patients Placed on CDIDS vs. Usual Care
at Hawai’i Pacific Health

Hypoglycemia

*No statistically significant difference between CDIDS and Usual Care groups (p=0.90).
Normoglycemia

% of Glucose Readings Normal (70 - 179 mg/dl) for ICU Patients Placed on CDIDS vs. Usual Care at Hawai‘i Pacific Health

Better performance

CDIDS*

Usual Care*

*Statistically significant difference between CDIDS and Usual Care groups (p<0.0001).
% of Glucose Readings ≥ 180 mg/dl
for ICU Patients Placed on CDIDS vs. Usual Care

at Hawai‘i Pacific Health

Hyperglycemia

Better performance

Usual Care*

CDIDS*

*Statistically significant difference between CDIDS and Usual Care groups (p<0.0001)

*Statistically significant difference between CDIDS and Usual Care groups (p<0.0001)
IV CDIDS was going well but we had low adoption of SubQ CDIDS

...We needed data

- We use data to drive improvement
- Discussions with leadership about benefit of CDIDS were not possible without knowing our status
Data Collection

• There was a need to develop datamarts to help standardize reporting on glucose related metrics
• 2 datamarts were developed

Glucose Datamart

Glucose Metrics Datamart
Glucose Datamart

• This datamart stored all Lab and Point of Care results for all inpatient encounters
  – Data field examples: Glucose collection time, glucose results, data source, flags for all glycemic categories (e.g. hypoglycemic, hyperglycemic)

• Data collected in this datamart came from the following sources:

  Flowsheets ➔ Lab Results ➔ Glucometer
Glucose Metrics Datamart

• This datamart is the primary data source for all glucose related metrics

• Here are some of the included data fields:
  – Total glucose readings while on CDIDS for all glycemic categories
  – Patient days while on CDIDS for all glycemic categories
  – Total glucose readings while in the ICU for all glycemic categories

• Data collected in this datamart came from the following sources:
  ADT > MAR > Glucose Datamart > HIM
Glucometrics Dashboard

- We have developed a dashboard to review various glucose metrics.
Outcomes Improvement – Subcutaneous CDIDS

*Statistically significant difference between CDIDS and Usual Care groups (p<0.01).
Outcomes Improvement - LOS

Non-Adjusted ALOS | 2014FY – 2017FYTD

*Both populations show a statistically significant decrease (p <0.01).
CMI Adjusted ALOS | 2014FY – 2017FYTD

Desired Trend:
Reduced Variation Among Populations

*Both populations show a statistically significant decrease (p <0.01).
Observed vs. Expected LOS
Diabetes Dx Only | 2014FY – 2016FYTD

Desired Trend: Observed ≤ Expected

Better performance
Outcomes Improvement – Surgical Complications

NSQIP Post-Op Complications:
Patients with Diabetes vs. Patients without Diabetes

Better performance
What does our glycemic program look like today?

Implementation:

**HPH Planning Committee:**
- Executive Sponsor
- Project Manager
- IT Lead
- Physician Lead
- Pharmacy Lead
- Nursing Lead

**Site Implementation Committee (per site):**
- HPH Planning Committee
- Vendor Representation
- Physician Champion
- Pharmacy Lead
- Nursing Educator
- Dietary Lead
- Point of Care Lead

Maintenance:

**HPH Glycemic Control Committee:**
- Composed of members of both the Planning Committee & Site Implementation Committees
HPH Glycemic Control Committee

- Meets quarterly
- HPH team leading
- Facility teams continuing to promote
- Nurse educators, dietary and pharmacist continuing involvement
- Data dashboard (glucometrics) to evaluate ongoing results
Lessons Learned

• Concomitant rollout of glycemic management and CDIDS
• Timing of wireless glucometer integration
• Ownership and accountability
Next Steps

• Evaluation of benefits so far
  – Disappointing utilization of subcutaneous CDIDS tool
• Targeting specific areas where we are likely to have success
  – Perioperative protocol – IV & SubQ
  – Criteria for automatic IV CDIDS placement
• Continuation of HPH Glycemic Control Committee
Treatment / Clinical
• Computer Directed Insulin Dosing System (CDIDS) was implemented & EHR order sets were modified to follow best practice. We demonstrate an improvement in the rate of normoglycemia.

Electronic Secure Data
• Clinical data from usual patient care was used to demonstrate a need for improvement. Data was provided back to the clinical teams to measure success.

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Questions?

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