Implementation of a Diabetes Screening Instrument in the Pre-operative Setting for Total Joint Patients: A Doctor of Nursing Practice Project

Amber Smith MSN, RN, AGAC-CNS

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DNP Scholarly Project Team

- Dr. Beth Quatrara DNP, RN, CMSRN, ACNS-BC
  - AGCNS Program Coordinator, UVA School of Nursing
    - Faculty Advisor
- Kim Miller MSN, AGCNS-BC, CDCES
  - Inpatient Glycemic Management Program, UVA Health System
    - Practice Mentor
- Dr. Wendy Novicoff Ph.D
  - Professor, Departments of Orthopedic Surgery and Public Health Sciences, UVA School of Medicine
    - Practice Mentor and 2nd Reader
- Nicholas Calabrese MS, PA-C
  - UVA Health System, Department of Orthopedic Surgery

Background and Significance

- National CDC (2017) statistics
  - Prediabtes: 84.1 million
  - Diabetes: 23 million

- Estimated health expenditure prevention and treatment
  - $245 billion (Setji et al., 2017)

Background and Significance

- Obesity projections (Ward et al., 2019)
  - Prevalence to rise above 50% in 29 states by 2030
  - Will not be below 35% in any state
- Projections of total hip and knee arthroplasty revisions
  - Increase by 137% and 601% respectively by 2030 (Vasarhelyi & MacDonald, 2012)
- Undiagnosed diabetes (ADA, 2020)
  - higher preoperative blood glucose levels
  - higher risk of perioperative mortality

EBP Framework: Iowa Model

- Systematic, 7-step guide for implementation of EBP
  - Identify Triggering Issues/Opportunities
  - State the Question or Purpose

    **Is this topic a priority?*
  - Form a Team
  - Assemble, Appraise and Synthesize Body of Evidence

    **Is there sufficient evidence?*
  - Design and Pilot the Practice Change

    **Is change appropriate for adoption in practice?*
  - Integrate and Sustain the Practice Change
  - Disseminate Results

(Iowa Model Collaborative, 2017)

Step 1: Identify Triggering Issues/Opportunities

- Issues
  - Evidence of patients exhibiting increased risk
    - Pilot Study: 36/47 (76.6 %) Total Joint Arthroplasty (TJA) patients screened at increased risk (no history of diabetes) (Smith, 2020)
  - Increased LOS due to labile blood glucose and renal dysfunction
- Opportunities
  - Active Orthopedic QI Committee
  - Institution and departmental interest in enhancing glycemic management
  - Joint Commission Total Joint Certification
  - Cost savings
  - Improved patient outcomes

Step 2: Clinical Question

In adult patients (19 years and older) receiving an elective orthopedic total joint surgery at an academic medical center (AMC), does the integration of a standardized diabetes screening instrument increase the identification of previously undiagnosed pre-diabetes or diabetes during the pre-operative assessment?

Step 3: Form a Team

- Setting:
  - Pre-anesthesia Evaluation and Testing Center (PETC) at a Central Virginia Academic Medical Center
    - 10-15 total joint patients/week
      - Majority 60 years or older
    - Nurse-run; walk-in basis
  - Orthopedic Clinic
  - Surgical Admission Suite (SAS)
- Interdisciplinary Team Collaboration
  - 3 orthopedic surgeons, 1 orthopedic physician assistant (PA)
  - SAS and PETC staff

Step 4: Assemble, Appraise, & Synthesize the Body of Evidence

- Comprehensive database search
  - PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science, Cochrane Library
- Similar search terms and limiters for each database review were used.
  - "*diabetes", "screening", and "pre-operative*"
- Filters applied
  - Publication in the last 10 years
  - English language
  - Age: "Adult 19+"

Step 4: Assemble, Appraise, & Synthesize the Body of Evidence

Major conclusions

- Formalized screening identifies at-risk patients
- Lack of consensus regarding testing choice; HgbA1c reflects accurate trends of long-term glucose control
- Consistency across literature regarding presence of undiagnosed diabetes in a variety of surgical populations
  - TJA patients are a high prevalence population for diabetes
- The pre-operative assessment is an opportune time for screening
- Risk factor screening and diagnostic testing resulted in increased detection of undiagnosed diabetes

Step 5: Design and Pilot the Practice Change

Project Purpose

In adult patients (19 years and older) receiving an elective orthopedic total joint surgery at an academic medical center, does the integration of a standardized diabetes screening instrument increase the identification of previously undiagnosed pre-diabetes or diabetes during the pre-operative assessment?

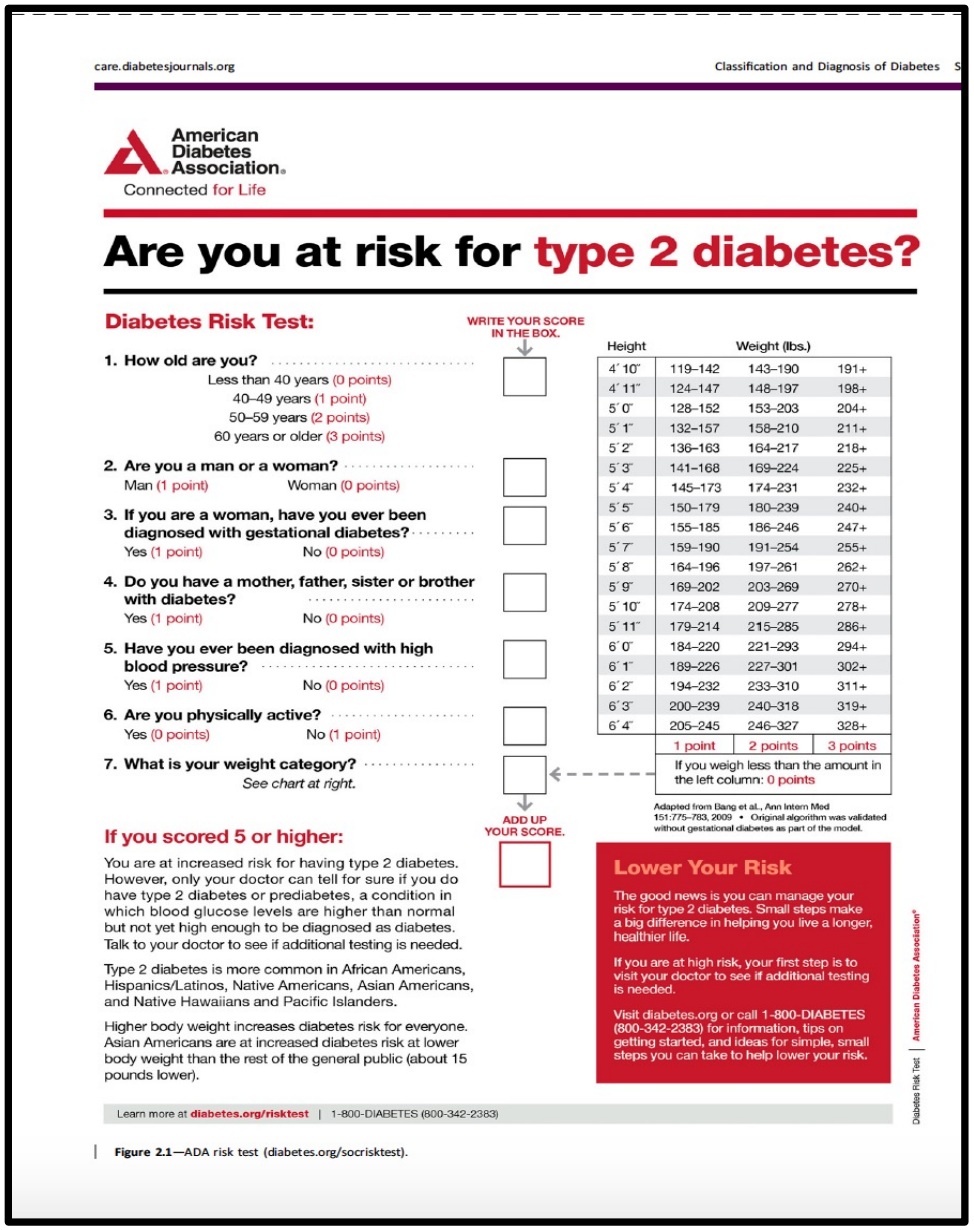
Design and Pilot the Practice Change (cont.)

- Sample
  - Adults aged ≥ 19 years presenting to PETC for preoperative assessment
- Inclusion Criteria
  - Adults aged 19 years and older
  - Receiving an elective total joint surgery (hip or knee)
  - Completing pre-operative screening visits at PETC
    - 10 SEP to 30 OCT
- Exclusion Criteria
  - Existing prediabetes/diabetes diagnosis
    - Self report or confirmed diagnosis in EHR
  - Pre-operative screening visits completed in other clinics

Design and Pilot the Practice Change (cont.)

- Primary Measure
  - Instrument Score
    - ADA (2020) Risk Screening Instrument
  - Categories assessed
    - Age
    - Sex
    - Gestational diabetes (if applicable)
    - Family history of diabetes
    - History of high BP
    - Activity
    - Weight
  - Total Score
    - ≤ 4: low risk
    - **≥ 5: increased risk**

(ADA, 2020)



care.diabetesjournals.org Classification and Diagnosis of Diabetes S

American Diabetes Association.
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Are you at risk for type 2 diabetes?

Diabetes Risk Test:

WRITE YOUR SCORE IN THE BOX.

1. **How old are you?**
   Less than 40 years (0 points)
   40–49 years (1 point)
   50–59 years (2 points)
   60 years or older (3 points)
2. **Are you a man or a woman?**
   Man (1 point) Woman (0 points)
3. **If you are a woman, have you ever been diagnosed with gestational diabetes?**
   Yes (1 point) No (0 points)
4. **Do you have a mother, father, sister or brother with diabetes?**
   Yes (1 point) No (0 points)
5. **Have you ever been diagnosed with high blood pressure?**
   Yes (1 point) No (0 points)
6. **Are you physically active?**
   Yes (0 points) No (1 point)
7. **What is your weight category?**
   See chart at right.

Height	Weight (lbs.)		
	1 point	2 points	3 points
4′ 10″	119–142	143–190	191+
4′ 11″	124–147	148–197	198+
5′ 0″	128–152	153–203	204+
5′ 1″	132–157	158–210	211+
5′ 2″	136–163	164–217	218+
5′ 3″	141–168	169–224	225+
5′ 4″	145–173	174–231	232+
5′ 5″	150–179	180–239	240+
5′ 6″	155–185	186–246	247+
5′ 7″	159–190	191–254	255+
5′ 8″	164–196	197–261	262+
5′ 9″	169–202	203–269	270+
5′ 10″	174–208	209–277	278+
5′ 11″	179–214	215–285	286+
6′ 0″	184–220	221–293	294+
6′ 1″	189–226	227–301	302+
6′ 2″	194–232	233–310	311+
6′ 3″	200–239	240–318	319+
6′ 4″	205–245	246–327	328+

If you weigh less than the amount in the left column: 0 points

Adapted from Bang et al., Ann Intern Med 151:775–783, 2009 • Original algorithm was validated without gestational diabetes as part of the model.

ADD UP YOUR SCORE.

If you scored 5 or higher:

You are at increased risk for having type 2 diabetes. However, only your doctor can tell for sure if you do have type 2 diabetes or prediabetes, a condition in which blood glucose levels are higher than normal but not yet high enough to be diagnosed as diabetes. Talk to your doctor to see if additional testing is needed.

Type 2 diabetes is more common in African Americans, Hispanics/Latinos, Native Americans, Asian Americans, and Native Hawaiians and Pacific Islanders.

Higher body weight increases diabetes risk for everyone. Asian Americans are at increased diabetes risk at lower body weight than the rest of the general public (about 15 pounds lower).

Lower Your Risk

The good news is you can manage your risk for type 2 diabetes. Small steps make a big difference in helping you live a longer, healthier life.

If you are at high risk, your first step is to visit your doctor to see if additional testing is needed.

Visit diabetes.org or call 1-800-DIABETES (800-342-2383) for information, tips on getting started, and ideas for simple, small steps you can take to help lower your risk.

Learn more at diabetes.org/risktest | 1-800-DIABETES (800-342-2383)

Diabetes Risk Test | American Diabetes Association®

Figure 2.1—ADA risk test (diabetes.org/socrisktest).

(ADA, 2020)

Sensitivity/Specificity (Bang, 2009)

- Sensitivity: 80%
- Specificity: 63%.

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Determination for Diabetes Screening Questionnaire

Do you have a current pre-diabetes or diabetes diagnosis or ever been told so by your physician? Check the appropriate box below.

***Diabetes is also known as: 'sugar', 'high blood sugar', 'high blood glucose'

☐ YES ☐ NO

*If you answered NO to the above question, please continue with the questionnaire on the following page, keep the educational handout attached to the back of the questionnaire, and return this sheet and the completed questionnaire to the front desk staff. Please clarify any questions regarding the items on questionnaire with the front desk clinic staff to ensure accurate scoring.

*If you answered YES to the above question, please disregard the questionnaire on the following page and return this paperwork to the front desk clinic staff.

Race: Select the appropriate box

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Pacific Islander
- ☐ White

Ethnicity: Select the appropriate box

- ☐ Hispanic or Latino
- ☐ Not Hispanic or Latino

Determination of screening and testing

(Medical News, 2019)

Design and Pilot the Practice Change (cont.)

Secondary Measure

- FBG
  - Drawn for patients:
    - Risk score ≥ 5
    - No documented HgbA1c within past 90 days
    - No diagnosis in EHR
  - 100-125 mg/dL = prediabetes
  - ≥ 126 mg/dL = diabetes
- HgbA1c
  - 5.7-6.4% = prediabetes
  - ≥6.5% = diabetes

Table 2.5—Criteria defining prediabetes*

FPG 100 mg/dL (5.6 mmol/L) to 125 mg/dL (6.9 mmol/L) (IFG)
OR
2-h PG during 75-g OGTT 140 mg/dL (7.8 mmol/L) to 199 mg/dL (11.0 mmol/L) (IGT)
OR
A1C 5.7–6.4% (39–47 mmol/mol)

FPG, fasting plasma glucose; IFG, impaired fasting glucose; IGT, impaired glucose tolerance; OGTT, oral glucose tolerance test; 2-h PG, 2-h plasma glucose. *For all three tests, risk is continuous, extending below the lower limit of the range and becoming disproportionately greater at the higher end of the range.

Table 2.2—Criteria for the diagnosis of diabetes

FPG ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.*
OR
2-h PG ≥200 mg/dL (11.1 mmol/L) during OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.*
OR
A1C ≥6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.*
OR
In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dL (11.1 mmol/L).

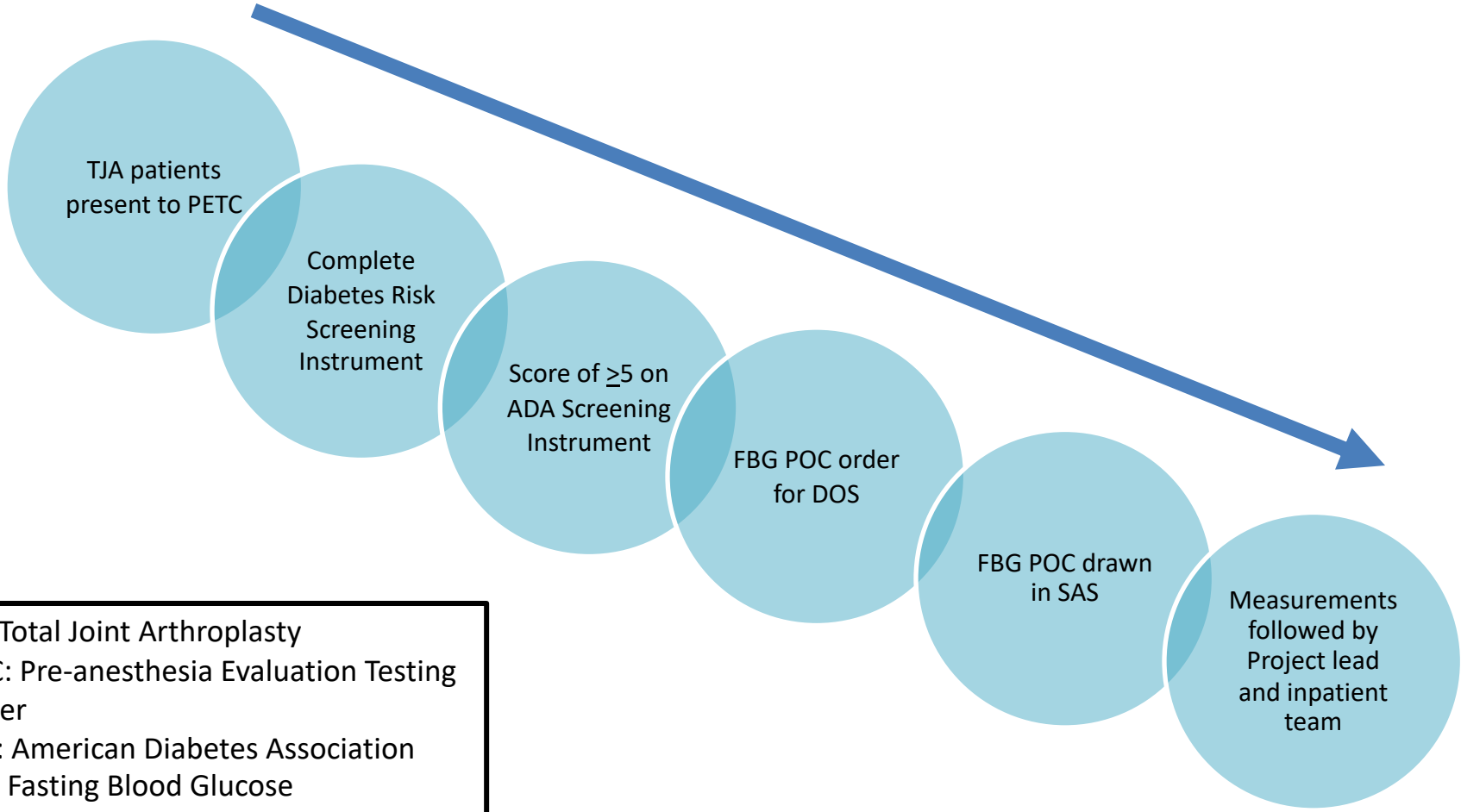
DCCT, Diabetes Control and Complications Trial; FPG, fasting plasma glucose; OGTT, oral glucose tolerance test; WHO, World Health Organization; 2-h PG, 2-h plasma glucose. *In the absence of unequivocal hyperglycemia, diagnosis requires two abnormal test results from the same sample or in two separate test samples.

(ADA, 2020)

Design and Pilot the Practice Change (cont.)

- Institutional Review Board (IRB) approval obtained
  - EBP confirmed
- Staff Education
  - Expectations of staff, process flow
  - In-person education
    - Pre-anesthesia Evaluation Testing Center (PETC)
    - Surgical Admission Suite (SAS)

Design and Pilot the Practice Change (cont.)



TJA: Total Joint Arthroplasty
PETC: Pre-anesthesia Evaluation Testing Center
ADA: American Diabetes Association
FBG: Fasting Blood Glucose
POC: Point of Care
DOS: Day of Surgery
SAS: Surgical Admission Suite

Design and Pilot the Practice Change (cont.)

- Data Collection
  - 10 SEP – 30 Oct
  - Deidentified data
    - Linking document utilized
  - Screening forms maintained at front desk; Stored in secured file
  - Data Analysis
    - Descriptive Statistics
    - EBP: continuous analysis of process

Design and Pilot the Practice Change (cont.)

- Results
  - Total screened: 121
    - Pre-existing diagnosis (self-report and/or noted in PMH/problem list): 27 (22.31%)
    - Low risk (<5): 17 (14.05%)
    - Undiagnosed at-risk (≥5): 77 (63.64%)
      - Documented A1C in EHR (within past 90 days): 23
        - » ***Elevated*: 3**
        - » Normal: 20
      - **DOS FBG *elevated*: 9**
      - DOS FBG normal: 23
      - **DOS FBG not completed/completed incorrectly: 22 (28.57%)**
        - » **Complete Sample: 55**

Design and Pilot the Practice Change

Table 2

At-risk (Undiagnosed) *Sample Demographics: Elevated Measurements*

Screening Item	N (%)
Elevated measurement (HgbA1c/FBG)	12/55 (21.82)
Age [a]	
<40 (0)	0 (0)
40-49 (1)	0 (0)
50-59 (2)	3 (25)
60 or older (3)	9 (75)
Gender [b]	
Male (1)	7 (58.33)
Female (0)	5 (41.67)
Family Hx (Yes)	3 (25)
Gest. DM (Yes)	0 (0)
HTN Dx (Yes)	9 (75)
Physically Active (No)	1 (9.09)
Weight Category [c]	
0	1 (8.33)
1	6 (50)
2	5 (41.67)
3	0 (0)

Note. Each ADA screening item and sub-category is based on analysis of the at-risk total joint population with elevated HgbA1c or FBG.

[a] Item one on the ADA risk-screening instrument includes four subcategories for age and scores for each (0-3) are noted in parenthesis.
[b] Similarly, item two distinguishes gender and assigns a score based on each as noted in parenthesis.
[c] The final item labels weight, denoted in four sub-categories and scores (0-3) are based on the ADA weight/height comparison table.

- Elevated FBG or HgbA1c measurements
  - **12/55 (21.82%)**
- Race
  - White, Non-Hispanic/Latino - 83.33%
  - Black, Non-Hispanic/Latino - 16.67%
- BMI
  - Mean - 28.95
  - Minimum - 24.25
  - Maximum - 34.45
- FBG (9)
  - Mean - 110
  - Minimum - 100
  - Maximum – 125
- HgbA1c (3)
  - 6.0, 6.0, 6.3

Design and Pilot the Practice Change (cont.)

- Discussion
  - Demographic findings
  - Change to standard work; missed opportunities
  - Health policy change; Insurance coverage of HgbA1c
  - Variability in screening pathway
  - Screening instrument bias
  - Diabetes screening importance

Step 6: Integrate and Sustain Practice Change

- Strengths
  - Implementation of the current ADA clinical practice recommendations
  - Minimal adjustment to current clinical and administrative flow
    - No delay in patient care
    - Minimal impact on resource or personnel requirements
  - Promotes early recognition of chronic disease
- Limitations
  - Insurance restrictions on ability to perform HgbA1c testing
  - Various screening pathways
  - System level process improvement

Integrate and Sustain Practice Change (cont.)

- Practice Implications
  - Health promotion and disease prevention
    - Opportunity to increase awareness
  - Focus toward health policy change
  - Application in other surgical populations
  - Process improvement at systems level
  - Streamline pre, intra and postoperative glucose management
  - Cost savings for patient and institution
  - Improved care outcomes

Integrate and Sustain Practice Change (cont.)

- Sustainability Plan
  - Screening conducted earlier in outpatient process
  - Changes to EHR
  - Change to standard work
  - Advocating for changes to health policy: HgbA1c
  - Follows ADA clinical recommendations for diabetes screening

Step 7: Disseminate Results

- Project findings shared with practice site and team
- Libra-Scholarly Repository
- *American Academy of Orthopedic Surgeons Journal* (AAOS)
- The Military Health System Research Symposium in Fall of 2021

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  - Surgical Admission Suite (SAS) Head Nurse

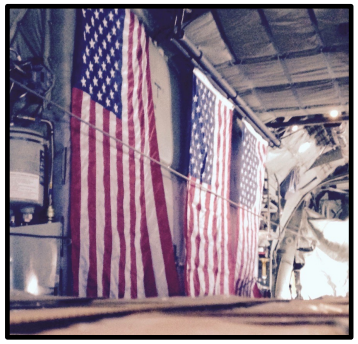
Thank you

- United States Army
- My family & friends









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Questions?

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