Long-Term Impact of an EHR-Enabled, Team-Based, and Scalable Population Health Strategy Based on the Chronic Care Model

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Disclosures

- In the past year, I have been a consultant or sponsored researcher on clinical decision support (CDS) for:
  - Office of the National Coordinator for Health IT*
  - McKesson InterQual
  - Hitachi

- I was formerly a consultant and co-owner of Clinica Software, which provided commercial services using a CDS technology (SEBASTIAN) used in the project
  - I no longer have a financial relationship with Clinica

*via ESAC, SRS, and Hausam Consulting

Background

- Effective and scalable population health strategies are needed for chronic illnesses such as diabetes
  - Half of all U.S. adults have at least 1 chronic illness
  - Chronic diseases are the leading cause of death
  - Shift from "volume-based" to "value-based" payment
- Chronic Care Model (CCM) is promising approach:
  - Delivery system redesign and organizational support
  - Clinical information systems
  - Clinical decision support (CDS)
  - Self-management support and community interaction

Challenges

- CCM is generally effective for improving process measures but impact on clinical outcomes vary

- CCM often requires resources not generally available in primary care
  - E.g., chart auditors, on-site diabetes educators
  - Makes programs difficult to scale

- Limited literature on long-term clinical impact of CCM-based population health programs

Need

- Evaluations of long-term impact of CCM-based, pragmatic, and scalable population health strategies

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Study Overview

- <u>Setting:</u> 18 Duke Primary Care clinics
- <u>Population:</u> 6,768 patients with diabetes seen at least once at clinics every study year as well as year prior
- <u>Intervention:</u> CCM-based, technology-facilitated population health program for multiple chronic illnesses
  - Technical interventions powered by standards-based decision support Web service to enable scalability[1]
- <u>Historical control:</u> labor-intensive, disease-registry based population health program
- <u>Timeframes:</u> 2007-2008 (pre), 2009-2010 (post)

Ref 1: Lobach DF, Kawamoto K, et al. Development, deployment and usability of a point-of-care decision support system for chronic disease management using the recently-approved HL7 Decision Support Service standard. *Stud Health Technol Inform.* 2007;129:861-5.

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Point-of-Care Decision Support System

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Feedback Report – Clinic Comparison

Feedback Report – Provider Comparison

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Feedback Report – Patient Panel

Typical Point-of-Care Workflow

- Clinic staff prints care reminders for provider

- Clinic staff performs required interventions per standing orders

- Providers engage patients in care through discussion of care reminder summary

Key characteristics:

- No new clinical staff required

- Leveraged existing EHR data (biggest difference with prior workflow, which required extensive data entry)

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Analysis Approach

- Focus on diabetes *a priori*
  - Inclusion in program from the start
  - Good disease control measure: hemoglobin A1c (A1C)
- Primary outcome measure: A1C levels
  - Monthly interpolated estimates to account for biased sampling (poor control leads to more frequent testing)
- Primary analysis: difference in A1C slopes between pre and post periods
- Estimate of expected A1C progression
  - U.K. Prospective Diabetes Study (UKPDS) Outcomes Model

Statistical Analysis Details

- Interrupted time series analysis
- Mixed linear model using PROC MIXED procedure with maximum likelihood estimation
- Indicator variables for months of year to adjust for seasonal A1C variation

Usage of Point-of-Care CDS System
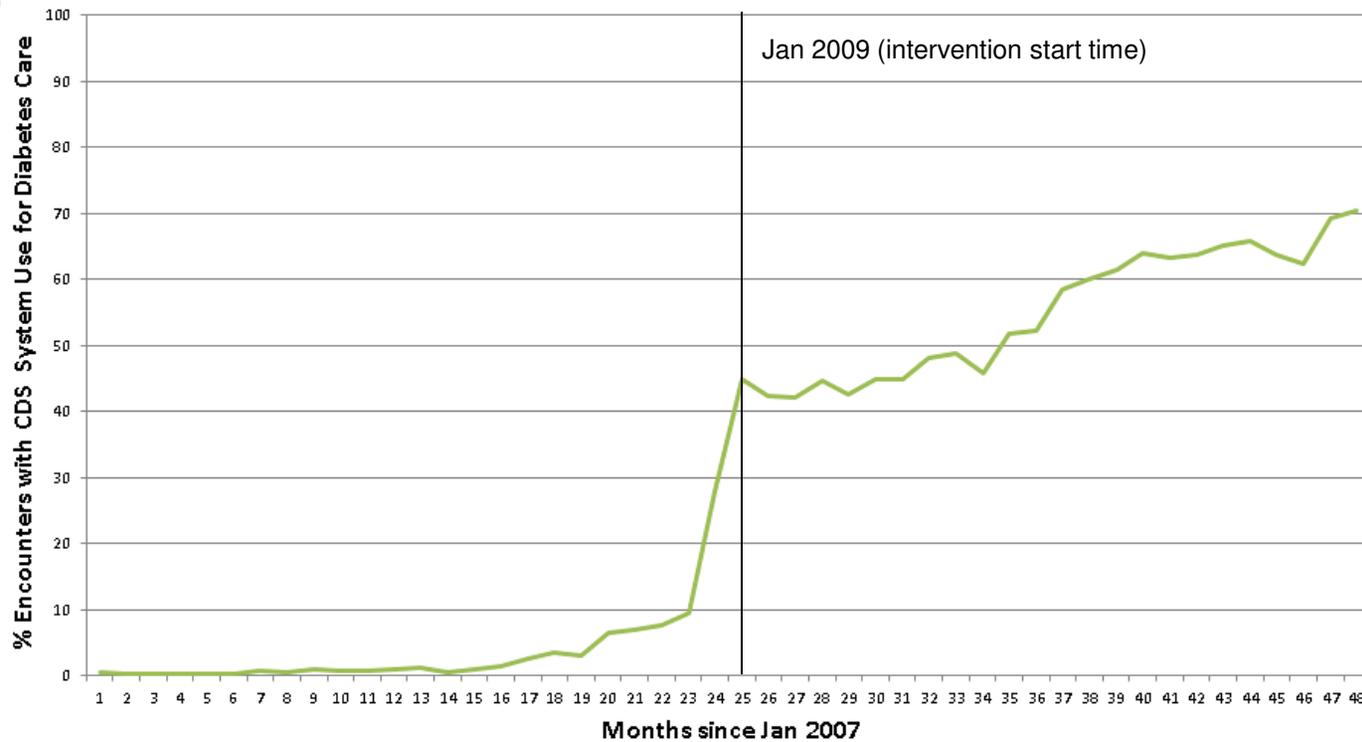
Average A1C Levels Over Time

Statistical Analysis Results

- A1C slope, historical control: 0.01%/year
- A1C slope, intervention period: -0.02%/year
- Difference in slope: statistically significant (p = 0.01) but clinically insignificant

- Overall A1C trend essentially flat throughout
  - Jan 2007: 7.17% (beginning of historical control)
  - Jan 2009: 7.24% (beginning of intervention period)
  - Dec 2010: 7.24% (end of intervention period)

Summary of Findings

- Pragmatic CCM-based population health strategy evaluated in 18 primary care clinics for diabetes

- Key intervention component (point-of-care decision support system) well accepted
  - Use in 70% of primary care encounters by end of study

- A1C levels were essentially flat through 4 study years (increase of 0.07%), compared to 0.42% increase expected from UKPDS Outcomes Model
  - Indicates effective disease control in both pre and post periods

- Main benefit of intervention was to replace labor-intensive processes with more efficient, automated processes (time savings estimate from CMO: at least 1 hr/day per clinic)

Limitations and Strengths

- Limitations

  - Lack of concurrent control group

  - Inability to distinguish impact of intervention components

  - Estimate of times savings based on expert opinion

  - Did not evaluate process measures

- Strengths

  - Large sample size (increased precision)

  - Long-term assessment (4 years)

  - Historical control (some protection against confounding)

  - Population-based (vs. only poorly controlled patients)

  - Pragmatic and scalable

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Implications and Future Directions

- Team-based, EHR-enabled population health programs based on CCM can effectively manage a population of patients with diabetes

- Automated approach to population health management can be just as effective as a highly labor-intensive approach

- Anticipate continuing research on how best to leverage the EHR to improve population health and achieve high-value care[1]

Ref 1: Lee VS, Kawamoto K, et al. Implementation of a value-driven outcomes program to identify high variability in clinical costs and outcomes and association with reduced cost and improved quality. *JAMA*. 2016;316:1061-72.

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Thank You!

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