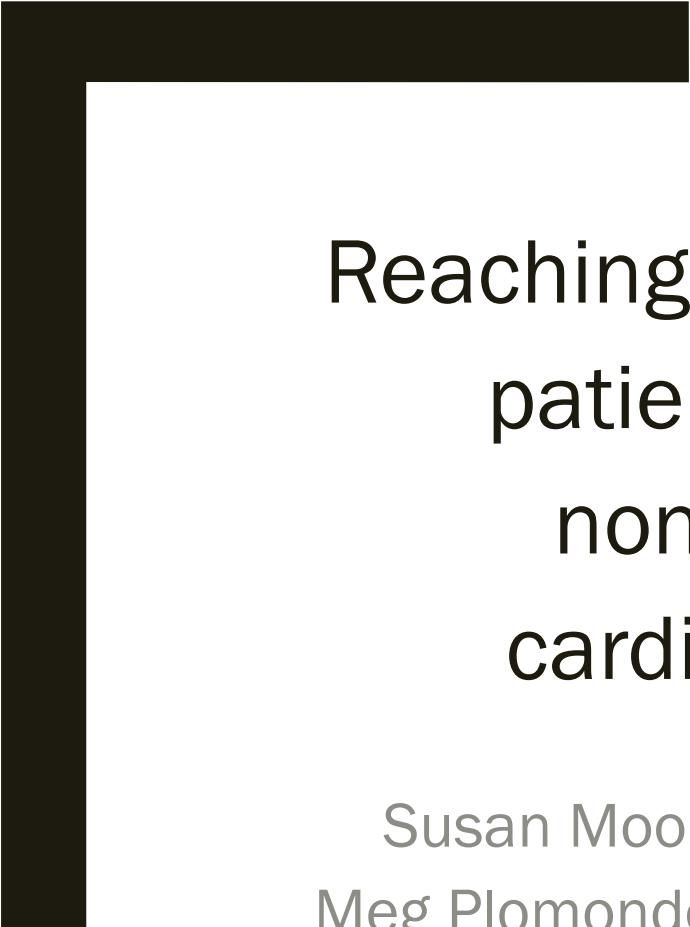
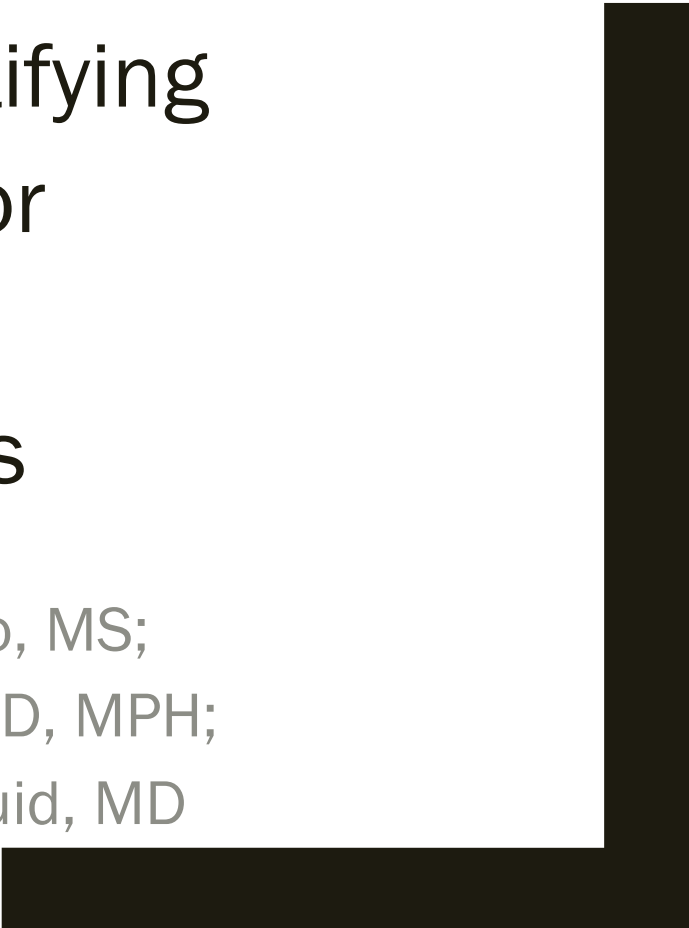




Reaching out in real time: Identifying patients at imminent risk for nonadherence to chronic cardiovascular medications

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Nudge: Study Overview

- Up to half (50%) of patients with cardiovascular conditions don't take their medications as prescribed.
- Medication non-adherence is a complicated problem that results in poor health outcomes, high health care costs, and preventable deaths.
- Previous adherence interventions have been resource intensive, high-burden, inconsistent, and with mixed results.



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Nudge: Study Overview

- Behavioral “nudges” are strategic reminders that show promise for supporting positive behavioral change.
- Digital technologies, particularly mobile phones, are more omnipresent now than ever before, offering opportunity to deliver behavioral nudges in a timely fashion.
- Year 1 pilot (UG3); Years 2-5 RCT (UH3).

Nudge Pilot: Year 1, Aim 1

- Develop and test tools, infrastructure, and procedures needed for a proposed large, multi-center, randomized trial.
 - *Develop and refine library of behavioral messages*

– *Establish patient identification, eligibility, and randomization procedures across the 3 sites*

Nudge Pilot: Year 1, Aim 2

- Pilot intervention delivery to demonstrate feasibility of and preliminary effects within 3 engaged healthcare systems.

- *Deliver Nudge messages at each site*

- *Solicit feedback from patient, provider, and health system stakeholders*
- *Develop final protocol for UH3 RCT*

Data Workgroup Objectives – Pilot

- Create a system to use health care delivery system pharmacy refill data to identify patients with a 7-day gap in cardiovascular medication refills, on a rolling basis.
 - Establish data infrastructure
 - Create and refine algorithms for population identification
 - Data collection and quality control (ongoing)
 - Monitor pharmacy data, identify patients with 7-day refill gaps



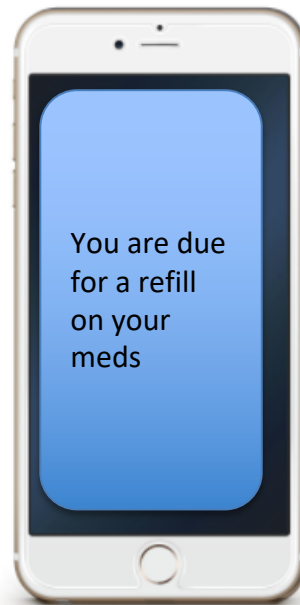
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Study Randomization

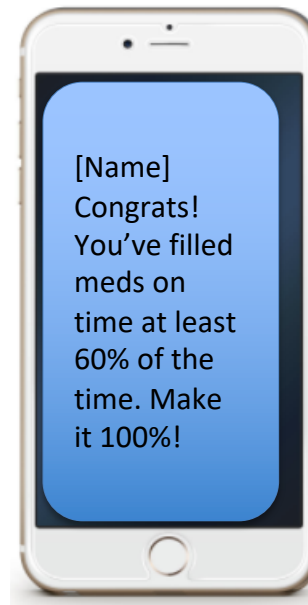
Usual Care

*No text
messages*

Generic Text



Optimized Text



Optimized Text +
AI Chatbot



Nudge

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Study Sites

- Denver Health and Hospital Authority
 - Integrated safety net system serving Denver, CO
 - Over 200,000 patients annually
 - Enrolled at 8 primary care clinics in Denver metro
- VA Eastern Colorado Health Care System
 - Tertiary care referral hospital and affiliated clinics
 - 38,000 veterans in CO, WY, MT, KS
 - Enrolled at 4 primary care clinics in Denver metro
- UCHealth – originally planned, deferred to phase II (RCT)



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Data Infrastructure - Systems

- Denver Health and Hospital Authority (DH)
 - Epic electronic health record
 - Comprehensive data warehouse (clinical and administrative data, including pharmacy)
 - Text message system infrastructure
- VA Eastern Colorado Health Care System (VA)
 - Single electronic health record (Computerized Patient Record System/CPRS)
 - Centralized data warehouse (clinical and pharmacy)
- Surescripts
 - Pharmacy data for external fills (DH, UCHealth)



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Data Infrastructure - Flow

- Daily reports from each participating system
 - Eligible participants
 - Refill data
- Secure transmission to study coordinating center
- Incorporation into centralized study database (REDCap)
- Patients with 7-day medication refill gaps receive messages from centralized message administration system (Upland)
 - Message type dependent on study arm



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Patient Inclusion

- Adult cardiovascular (CV) patients (18+ years)
- One or more condition(s) of interest
 - *Hypertension, hyperlipidemia, diabetes, coronary artery disease, atrial fibrillation*
- Prescribed one or more 1 medication of interest
 - *Beta-blockers, calcium channel blockers (CCB), angiotensin converting enzyme inhibitors and angiotensin receptor blockers (ACEi, ARB), thiazide diuretic, statins, alpha-glucosidase inhibitors, biguanides, DPP-4 inhibitors, sodium glucose transport inhibitors, meglitinides, sulfonylureas, thiazolidinediones, PGY-2 inhibitors, direct oral anticoagulants*
- Refill gap of at least 7 days



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Methods

- Health system internal pharmacy refill data
 - Surescripts integration initially explored, delayed to RCT
 - Approx. two-thirds of DH patients and 70% of VA patients
- CV patients identified through ICD-9 and ICD-10 codes
- Comprehensive medication list created using NDC codes, medication names/descriptions, medication classes
 - 10-digit NDC and 11-digit NDC crosswalk created
- Automated daily custom reports to generate patient lists
 - Prescription date, dosage, medication count, expected refill date

Results

- 400 patients included in pilot phases
 - 60 in message design and testing (phase I), 340 in pilot intervention (phase II)
 - 2 opted out of phase I; 54 opted out of phase II
- 286 patients enrolled in medication tracking
 - (134 VA – 43 days, 152 DH – 19 days)
- 207 patients experienced 7-day gaps and were successfully randomized and enrolled
 - 92 VA, 115 DH
 - 72% gapped on 1 or more medications; 26% gapped on all medications



Challenges

- Differential system refresh rates
 - Eg third-party data on external fills pulled for patient records just prior to their scheduled clinic visits as standard practice
 - Data warehouse vs. production system
- Cross-system data transformation and automated integration
- Monitoring for code changes and updates (eg new NDC codes)

Conclusions

- Real-time health system data can be used to support technology-based intervention at scale for at-risk patients.
- Addressing interoperability issues is essential for long-term sustainability.

Questions?

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