Learning Health System

RCTs

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UCSF Health True North Pyramid

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The Learning Health System “Pillar”
What is a Learning Health System?

• “...a system that gains knowledge from every care delivery experience and is engineered to promote continuous improvement.”
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• Randomized controlled trials (RCTs) are the best way to gain knowledge...
  • A vision: every patient is randomized at least once during their encounter...

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• Can we “embed” RCTs in our healthcare system at UCSF?

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Embedded RCTs

• What does it mean to embed an RCT?
  • Embedded in EHR technology
  • Embedded in clinical workflow
Embedded RCTs

• Embedded in EHR technology
  • Eligible patients automatically identified by APEX
  • Randomization implemented by APEX (our Epic EHR)
  • Interventions (in each arm) are delivered by APEX
    • APEX is designed to support clinical decision-making and “nudge” clinicians to deliver better care
  • Outcomes are measured using APEX data
Embedded RCTs

• Embedded in clinical workflow

  • “Unsuspecting” clinicians will encounter the intervention
    • Whether they know it or not
    • No prior knowledge of the research required

  • Must not perturb clinical workflows too much
    • Extra time, unbillable services, etc
    • Patient consent? Extra data collection?

• Allow clinicians (and patients) to make clinical decisions
  • Pragmatic, non-protocolized interventions
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LHS Demonstration Projects

• CTSI-supported embedded RCTs at UCSF

• Calls for proposals
  • Identify a health outcome measurable by APEX query
  • Propose a scalable intervention to improve the outcome
  • Design an RCT to evaluate impact

• CTSI supports investigator time + in-kind support
  • APEX programming, study design, data work, etc
  • 8 projects total, 6 launched so far
RQI Example #1: Hypoglycemia

• Hypoglycemia events in the hospital
  • Lead – Rob Rushakoff

• Background
  • Uncommon, but should be predictable and preventable
  • Risk score exists

• Plan
  • Implement risk score, alert clinicians with advice
RQI Example #1: Hypoglycemia

Inpatients → Predict hypoglycemia

R

Alert via Carelink to Clinical Team, with advice
Usual care

= predictive analytics
= modification of workflow
= randomization
RQI Example #2: COPD orders

• Standardizing COPD orders
  • Lead – Ari Hoffman

• Background
  • Lots of standard COPD treatments that are not getting done at UCSF; and readmission rates are high

• Plan
  • Develop evidence-based orders, and insert into admission order sets for persons at high risk
RQI Example #2: COPD orders

ED patients → Predict COPD at discharge

R

Insert evidence-based orders into admission orders
Usual care

= predictive analytics
= modification of workflow
= randomization
RQI Example #3: Healthy Start

• Nomogram for expected weight loss in neonates
  • Lead – Valerie Flaherman

• Background
  • Well babies are expected to lose weight in first weeks
  • But losing too much weight is dangerous
  • Nomogram and web tool exists

• Plan
  • Autopopulate web-based nomogram and show to clinicians as guide to supplementation
RQI Example #3: Healthy Start

Well-baby nursery ➔ Predict weight loss ➔ Display nomogram + guidance on feeding

Usual care

= predictive analytics = modification of workflow = randomization
RQI Example #3: Healthy Start
Screenshot
RQI Example #3: Healthy Start

Screenshot

External website

SMART on FHIR
Lessons learned

• Embedded RCTs are feasible and useful
  • Allowed us to see unintended consequences

• Hard to design good decision support!

• Technology evolving
  • More shareable (SMART on FHIR)
  • Machine learning, etc