Application of system dynamics to inform a model of adolescent SBIRT implementation in primary care settings

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Study Design

- Multi-site cluster randomized trial
  - 7 adolescent primary care clinics in Baltimore City
  - Serving 3,600 patients ages 12-17 years

- Implementation Strategies for delivery of BI
  - Generalist
    - Primary Care Provider (PCP) conducts BI
  - Specialist
    - PCP does “warm handoff” to Behavioral Heath Counselor (BHC), who then conducts BI
Generalist vs. Specialist

**Generalist service delivery approach \( (n = 4) \)**
- Medical Assistant (MA) screens adolescent patients at all appointments
- Enters info into Electronic Medical Record (EMR) and opens PCP response screen
- PCP conducts BA or BI
  - Schedules follow-up or referral for assessment or treatment, if needed

**Specialist service delivery approach \( (n = 3) \)**
- MA screens adolescent patients at all appointments
- Enters info into EMR and opens PCP response screen
- PCP conducts BA and does “warm handoff” to on-site BHC
- BHC conducts BI
  - Schedules follow-up or referral for assessment or treatment, if needed
SBIRT Training

- All clinical staff received training on SBIRT principles and screening process for adolescent alcohol, drug, and tobacco use, and associated HIV sexual risk behaviors
  - Conducted within each site, based on assignment to Generalist or Specialist Conditions

- PCPs and BHCs received additional BI training based on motivational interviewing
Supportive Elements

- Bi-monthly feedback on screening rates, intervention processes and model adherence
  - Email feedback through clinic managers
  - Hard copy feedback delivered to providers

- Quarterly booster trainings
  - In-person 30 minute refresher trainings
  - Walk-through numbers and trouble-shoot process
System dynamics (SD) modeling was applied to help inform organizational strategies to support our understanding of effective adolescent SBIRT implementation strategies.

While both Generalist and Specialist service delivery models showed promise, SD modeling was presented as a means to foster deeper understanding about implementation outcomes.
Sources of Implementation Data for SD Model

- Patient visit and screening data
  - Longitudinal (implementation period)
- Training data
  - Initial and booster training sessions; longitudinal
- Staffing levels and staffing turnover
  - Longitudinal (implementation period)
- Qualitative provider interviews about knowledge of barriers and facilitators
  - Baseline and follow-up (implementation and sustainability period)
- Organizational impact data
  - E.g., catastrophic breakdown of a clinic’s electronic EMR
System Dynamics Modeling

- Vensim® software was used to develop the model and simulated outcomes

- Face-to-face and on-line meetings with key stakeholders were conducted to vet model’s purpose and scope

- Model structure utilized first-order smooth to simulate effect of key implementation constructs:
  - Performance Feedback Reporting (PFR) rates
  - Quality of Technical Assistance (TA)
Stock-and-Flow of aSBIRT implementation model

IMPLEMENTATION STRATEGY

Legend:
- red font = exogenous parameter
- Implementation driver
- Primary Care Provider BA | BI driver
- Behavior Health Counselor BI driver
- Simulated outcome of interest
Simulated Output

- SD model structure effectively represented the SBIRT intervention

- For the 20-month implementation time horizon, basecase scenario settings were calibrated to reflect actual monthly volume of:
  - adolescent primary care visits (N=9,639)
  - screenings (N=5,937)
  - positive screenings (N=246), and
  - brief interventions (BIs; N=50) over the 20-month implementation period
Modifying Performance Feedback Reporting Rates

- Bi-monthly (basecase)
- Quarterly
- Semi-annually
- Annually
Decreasing Performance Feedback Reporting from bi-monthly to quarterly, semiannual, or annual intervals generated diminished screening patterns.

Figure 1 - Medical Assistants' Screening Performance
Modifying Availability of the Behavioral Health Counselor

- 25%,
- 50% (basecase)
- 75%
- 100%
Examination of BI delivery rates for the SPECIALIST condition, where availability of the Behavioral Health Counselor (BHC) varied from 25% to 100%, showed that, as expected, higher BHC availability generated higher BI delivery rates, although never exceeded 10% of positively screened adolescents.

Figure 2 - BI Delivery Rate - SPECIALIST Only
Modifying PCP Perceived Severity of Substance Use for Positive vs Negative Screens

- Somewhat more severe (basecase)
- Same severity
- Extremely more severe
Comparison of simulated differences in the PCP’s likelihood to respond to a positive vs. a low risk adolescent patient (i.e., perceived severity) revealed high sensitivity, with BI delivery rates increasing from 39% to 61% (GENERALIST) and from 5% to 8% (SPECIALIST) by the end of the implementation period.

Results for the GENERALIST condition were substantively higher than in the SPECIALIST condition for all simulated values of PCP’s perceived severity.
Discussion

- Implementation outcomes are sensitive to frequency of PFR, with bimonthly events generating the most rapid and sustained screening results.

- Simulated trends indicate that availability of the BHC directly impacts success of the SPECIALIST model, but only slightly.

- Similarly, understanding PCPs’ perception of severity of need for intervention is key to outcomes in either condition.

- Additional application of the SD model will explore post-implementation outcomes.
Conclusions

- SD modeling is a robust method for implementation and dissemination science
  - Informed planning
  - Problem-solving
  - Monitoring strategies

- SD modeling can serve to synthesize multiple sources of information/data

- Collaborative modeling processes that begin from project inception constitutes best practice
Thank you

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