Health Behavior Change: 
An Update on the State of the Science 
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Issue of Health Behavior

Dorothy, 62 years, clinic visit for a follow-up appointment.

Review of the EHR indicates weight gain with an increase of BMI to 29. She tells you that she can’t give up eating foods she likes. “There is no such thing as a diabetic diet nowadays.” “I walk sometimes at the park.”

What do you do when patients are less willing, ready, and able to change their health behavior?
Background

- Despite expanding treatment options and resources, <50% do not achieve the target of HbA1c <7.0% based on NHANES 2007-2010 cohort (Ali et al., 2013).

- Behavior-oriented education enhances empowerment, which enables responsibility for diabetes outcomes such as quality of life and lifestyle change (Norris, 2002).

- Tailored feedback messages more effective than generic feedback in changing behavior (Kazdin, 2012).

- Self-monitoring in combination with one self-regulation technique, such as goal review was related diet and physical activity intervention effectiveness (Mitchie et al., 2009).
Background

- Substantial evidence that structured Diabetes Self-Management Education (DSME), specific to diabetes population and chronic disease self management is effective
  - X-PERT patient program (Deakin 2006)
  - DESMOND program (Skinner 2006)

- Standards guide practice: American Diabetes Association (ADA) and the American Association of Clinical Endocrinologists (AACE) guidelines point to lifestyle modifications, including diet and exercise, as a foundation for T2DM management.
Background - Barriers

**Individual**
- Knowledge
- Health Literacy
- Health Beliefs
- Motivation
- Self-Efficacy
- Coping & Problem-Solving
- Locus of Control
- Depression
- Anxiety
- Forgetting
- Alcohol Use
- Other → Multiple Chronic Conditions

**Self-Management**

**Environment**
- Social Support
- Provider Factors
- Socio-economic Factors
- Distance to Health care
- Health Determinants
  - Nutrition
  - Physical Activity

Ahola & Groop (2012, p. 414)
Aims

Systematic Review → Scoping Review

- Provide an overview of barriers to diabetes self-management
- An overview of state of the science literature about health behavior change
Systematic review: Key questions

- To identify effective health education and behavior interventions of adult patients with type 2 diabetes.

- The **key questions** are:
  - What interventions are most effective in diabetes proximal outcomes glycemic control, weight, and other lifestyle outcomes?
  - What are the most effective behavioral change interventions?
  - What are the major gaps in the evidence base?
    - A look at now and future think
Search Strategy


- Data Bases- Cochrane Database of Systematic Reviews, OVID, and CINAHL
  - Search Terms
    - Health Behavior Intervention; Health Behaviors; Behavior Change
    - Diabetes, Type 2
  - Additional Limits: age ≥ 18 years, published in English, years 2005-2015
Records identified through Cochrane Library database searching (n= 956)

Limited to reviews (n=38)
Limited to 2005-2015 (n=38)

Records identified through OVID, CINAHL (n = 9102)

Limited to relevancy (n = 172)
Limited to 2005-2015 (n=89)

Records screened (n=38)

Records excluded (n= 32)
Did not address health education-behavior change interventions in adults with T2DM

Records excluded (n= 2)
Did not address health education-behavior change intervention in adults with T2DM

Full-text articles assessed for eligibility (n =10)

Excluded (n =3) Provider adherence n= 2 Adolescents only n =1

7 articles (4 reviews & 3 primary studies) included in Scoping review
Theoretical Foundation -

Focus on cognitive constructs such as attitudes, beliefs and expectations (related to outcomes, self-belief or what other people might think)

- Health Belief Model (Rosenstock, et al. 1988)
- Social Cognitive Theory (Bandura, 1986)
- Protection Motivation Theory (Rogers, 1975)
- Chronic Illness Trajectory Model (Corbin, 1998; Corbin & Strauss, 1998)
- Control Theory (Carver & Scheier, 1999)
A classification to support replication of behavioral change techniques

**Behavioral Change Taxonomy (BCT) Project, UK Medical Research Council (Michie et al., 2013).**

**Purpose:** Identify active ingredient(s) of interventions behaviors.

**Users:** Intervention designers, researchers, practitioners, systematic reviewers and all those wishing to communicate the content of behavior change interventions.

- 93 clustered techniques (BCT Taxonomy version ➔ BCTTv1)
- Online training available at [www.bct-taxonomy.com](http://www.bct-taxonomy.com)

**Appraisal:**
- Work is underway to link BCTs to Theory
- Developing a framework for designing behavior change interventions
Systematic Reviews
<table>
<thead>
<tr>
<th>Author</th>
<th>Review Type</th>
<th>Topic Population</th>
<th>No. of Studies</th>
<th>Total No. Subjects</th>
<th>Variable Key Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Duke et al. (2009)</td>
<td>Systematic Review Meta-analysis</td>
<td>Individual Patient Education (IPE) defined as Face-to Face on wide range of SM issues</td>
<td>N= 9 RCTs n= 6 IPE to usual care n =3 IPE to group ed.</td>
<td>N = 1359</td>
<td><strong>Glycemic Control (GC)</strong>&lt;br&gt;n=6 did not significantly improve GC&lt;br&gt;HbA1c-&gt; WMD -0.1%(95% CI -0.3-0.1, p =0.33) over 12-18 month period. (Subgroup analysis, n=3 significant benefit of IPE with higher HbA1c at baseline&gt;8%; HbA1c-&gt; WMD -0.3(95% CI -0.5 to -0.1, p =0.007) over 12-18 month period).&lt;br&gt;n =3 of IPE compared to Group Ed did not significantly improve GC&lt;br&gt;HbA1c-&gt; WMD 0.03%(95% CI -0.02-0.1, p =0.22) over 12-18 month period&lt;br&gt;<strong>BMI and BP</strong>- No significant difference IPE to usual care or IPE to grp ed.&lt;br&gt;<strong>Main Findings</strong>- IPE Benefit on glycemic control when compared with usual care in a subgroup of those with a baseline HbA1c greater than 8%. Overall no significant difference between IPE and usual care. In the small number of studies comparing group and individual education, there was an equal impact on HbA1c at 12 to 18 months.</td>
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| Vodopivec et al. (2012) | Systematic Review Meta-Analysis | Mobile Phone Messaging Application for Preventive health Other preventable disease | N=4 RCTs Quasi-RCTs Control Before-After; Time Series only studies to assess effects of mobile message | N=1933 | Health Behavior

N=1705. **Mobile phone messaging support for smoking cessation** resulted in a significant increase of quit rates at 6 weeks (RR 2.20, 95% CI 1.79 to 2.70) and 12 weeks follow-up (RR 1.55, 95% CI 1.30 to 1.84). The effect persisted at 26 weeks if last values were carried forward (RR 1.28, 95% CI 1.11 to 1.48). Continuous abstinence at 26 weeks, allowing <3 ‘lapses’ of ≤ 2 cigarettes per lapse, was higher in the intervention grp (RR 1.64, 95% CI 1.12 to 2.42), whereas there was no impact on continuous complete abstinence (RR 1.4, 95% CI 0.92 to 2.44).

N =99. **Mobile phone messaging reminders** to take vitamin C tabs showed significantly higher self-reported adherence, and a marginal reduction in the number of missed tabs in the last 7 days compared to those who did not receive any reminders (MD -0.80, 95% CI -1.55 to-0.05).

**Main Findings**- Low number of participants in combined with limitations of risk of bias and lack of demonstrated causality, the evidence for support of behavioral health is of low to moderate quality. The evidence is of high quality only for interventions aimed at smoking cessation.
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<td>Pal et al. (2013)</td>
<td>Systematic Meta-analysis</td>
<td>Computer-based self-management (CBSM) interventions Type 2 Diabetes Clinic based; home based; mobile phone based</td>
<td>N=16 RCTs Compared to standard diabetes care, non-interactive CBSM, paper education, face-to-face diabetes SM</td>
<td>N =3578</td>
<td><strong>Glycemic Control (GC)</strong> Small benefit of CBSM. Pooled effect HbA1c-&gt; WMD -0.2% (95% CI -0.4 to -0.1, p =0.009; 2637 participants; 11 trials). (Subgroup analysis of mobile phone best effect size, WMD -0.5% (95% CI -0.7 to -0.3, p =0.0001; 280 participants; 3 trials). <strong>Depression, HRQOL, Weight, Lipids</strong> Current interventions do not show adequate evidence for improving depression, HRQOL, or weight. 4 out of the 5 interventions showed benefits on lipid profile.</td>
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**Main Findings**- CBSM have a small beneficial effect on GC with a larger effect on the mobile phone subgroup. No benefits on cognitive, behavioral or emotional outcomes.
### Main Findings

CAHE has short- to medium-term effects on GC and on knowledge of diabetes and triglycerides. None of these studies were long-term trials, and so clinically important long-term outcomes could not be studied. No studies included an economic analysis. The heterogeneity of the studies made subgroup comparisons difficult to interpret with confidence.
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<td>Lawler et al. (2010)</td>
<td>Cluster RCT</td>
<td>N= 434 Type 2 Diabetes</td>
<td>Primary Care Australia</td>
<td>10 clinics randomly assigned to Telephone Counseling vs. Usual Care</td>
<td>Measurement points- Baseline, 4 months, &amp; 12 months. N= 426</td>
<td>Inquiry about changes in underlying health behaviors as opposed to markers of disease management or progression</td>
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<td>Theory-Social Cognitive Theory (Bandura)</td>
<td>↑BP</td>
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<td>Telephone counseling- 18 phone called over 12 months from masters level graduates (training in motivational interviewing, physical activity promotion</td>
<td>Majority had ↑BP; 3 or more chronic conditions; female; Caucasian; married, non-smokers; and aged 58 years.</td>
<td>Provides evidence of health behaviors change and co-vary in the context of multiple health behavior interventions.</td>
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<td>Primary Care Australia</td>
<td>Workbook-Physical Activity &amp; Healthy eating</td>
<td>Impact on Multiple Health Behaviors-Physical Activity (moderate), Healthy Dietary Changes.</td>
<td>This study agrees with literature supporting medium to high intensity interventions.</td>
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**Main Outcomes**

Telephone Counseling group were more than twice as likely than those in the Usual Care group to make greater reductions in multiple behaviors over the intervention course (OR 2.42; 95%CI 1.43 to 4.11) p <.01

One behavior change was associated with changes in other behaviors with high co-variation across most behaviors. eg. Physical activity changes associated with dietary changes.
Single Primary Studies
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<td>Gabbay et al. (2013)</td>
<td>Pragmatic RCT Diabetes Nurse Case Management and Motivational Interviewing for Change (DYNAMIC)</td>
<td>N =545 18-75 years with T2D</td>
<td>Primary care United States</td>
<td>12 primary care clinics in 2 health care systems</td>
<td>Clinical Measures  &lt;br&gt;Systolic blood pressure (SBP) was better in the intervention than usual care group (131 ± 15 vs. 135 ± 18 mmHg, respectively; P &lt; 0.05).  &lt;br&gt;HbA1c, LDL, Diastolic BP</td>
<td>MI for improvement of patient outcomes has shown mixed reviews in patients with diabetes. This study using MI also included diabetes handouts, telephone, email, and video conferencing. Unclear if MI was a major ingredient or some other dynamic.</td>
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<td>Untreated usual care control vs Intervention nurse case management motivational interviewing guided behavior change counseling (Eight, 1 hour visits with BSN nurses)</td>
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<td>Attended to MI fidelity</td>
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<td>NCMs trained in MI led to significant improvements in selected clinical measures and depression</td>
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**Main Outcomes**  
The NCMs and MI improved SBP. The large decrease in HbA1c and LDL in the control group may have obscured any intervention effect.
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<td>Ambeba et al. (2014)</td>
<td>Secondary analysis of the Self-Monitoring and Recording using technology (SMART) trial</td>
<td>N=210 Random allocation to 3 groups • Paper diary, • Personal Digital Assistant (PDA) • PDA +Daily Feedback (DF) messages</td>
<td>Academic Research Center US</td>
<td>Effect of tailored daily feedback message on dietary intake Intervention- 3 components of standard behavioral intervention • Group sessions • Dietary and Exercise goals • Self-monitoring</td>
<td>Measurement points- 6-mo., 12-mo., 18 mo., 24 mo. <strong>Percentage Change in Dietary Measures</strong> by time and feedback group, mixed-model analysis→ <strong>Significant within-group decreases in energy</strong> (DFB,-22.8%, P&lt;.0001; no-DFB,-14.0%,P,.0001) and <strong>total fat</strong> (DFB,-10.4%,P=.0002;no-DFB,- 4.7%,P=.02) for both the DFB and no-DFB groups over time. In addition, the DFB group had a significant within-group decrease in saturated fat intake (-11.3%, P=.005) over time. <strong>Discussion</strong>- Findings suggest delivery of more frequent tailored messages Provide a change out of library of messages to limit desensitization</td>
<td>DFB messages delivered in real time using mobile devices can play an important role in the reduction of energy and fat intake.</td>
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**Main Outcome**-
Daily feedback messages tailored to diary entries and delivered in real time can enhance motivation
Hankonen et al. (2015)

**Behavior Change Techniques Questionnaire** assessed use of 8 BCTs relating to physical activity and 8 BCTs related to lower fat diet in the past 11 months.

- **Number of BCTs used**
  - Number of BCTs used was significantly associated with a ↓ in BMI over 1 year.
  - Using all BCTs lost more wt than those using 0-10 BCTs

- **Specific BCTs associated with behavior change and wt loss**
  - Main effects were significant for goal setting, goal review, and social support
    - Those who used goal setting lower-fat diet and increased physical activity lost significantly more weight (M change in BMI = −.88 kg/m², SD = 2.13) than those who used goal setting for dietary change only (M = .08 kg/m², SD = 1.50, p = .029, N = 21) or for neither behavior (M = .49 kg/m², SD = .98, p = .023, N = 13).
    - When used social support to change both behaviors lost more weight.
    - Those who used goal review for both behaviors lost more weight.

**Main Outcomes**

Higher number of BCTs used was associated with weight loss
Gaps In the Literature

- Barriers to self-management
- Tailored to the illness experience
- Examine the active ingredients of BCTs
- Study of culturally appropriate self-management
- Engage in studies about technology delivery of information and BCTs
Recommendations- Practice

- Culturally Appropriate Health Education (CAHE) results in significant improvements in HbA1c, triglycerides and diabetes knowledge. The potential is reduction in diabetes-related complications.
  - Recommend CAHE be an integral aspect of EB treatment
  - Delivered by trained/certified personnel
  - Culturally appropriate- National Standards for Diabetes Self-Management Education "the diabetes educational needs of the target population...such as ethnic background" as an essential standard (Funnell, 2009).
Recommendations- Research

- Bio-physiological Proximal Outcomes are central in diabetes population RCTs. Worthy to consider other self-management outcomes.
- Selection of more than one theoretical foundation may be indicated. For instance, human-technology interface.
- Systematic approach to selection of integrated theories for the research study
- Provide cost effectiveness of the intervention
- Measure for multiple chronic conditions
- Long term, multi-center RCTs are needed to study if effects are sustained.
Future Think is Now

Increased use of technology support for supporting behavioral change is now and evolving with changing technology

New foci-

- Technology and behavioral change
  - Mobile Phone Messaging tailored to and learning condition concordant
- Targeted and precision health
  - Tailor the intervention
  - Multi-modal approaches for BCTs
References


References


