Taxonomy for strengthening the identification of core elements for evidence-based behavioral interventions for HIV/AIDS prevention

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Abstract

The concept of core elements was developed to denote characteristics of an intervention, such as activities or delivery methods, presumed to be responsible for the efficacy of evidence-based behavioral interventions (EBIs) for HIV/AIDS prevention. This paper describes the development of a taxonomy of core elements based on a literature review of theoretical approaches and characteristics of EBIs. Sixty-one categories of core elements were identified from the literature and grouped into three distinct domains: implementation, content and pedagogy. The taxonomy was tested by categorizing core elements from 20 HIV prevention EBIs disseminated by Centers for Disease Control and Prevention. Results indicated that core elements represented all three domains but several were difficult to operationalize due to vague language or the inclusion of numerous activities or constructs. A process is proposed to describe core elements in a method that overcomes some of these challenges. The taxonomy of core elements can be used to identify core elements of EBIs, strengthen the translation of EBIs from research to practice and guide future research seeking to identify essential core elements in prevention interventions.

Introduction

Evidence-based behavioral interventions (EBIs) are critical tools for reducing the HIV/AIDS epidemic in the United States [1]. EBIs have been shown to reduce HIV-related sex and drug risk behaviors in a variety of populations at high risk for HIV infection, including youth, injection drug users, African–American men and women, Hispanic men and women and men who have sex with men [2–7]. The Institute of Medicine [8] has recommended the use of HIV prevention interventions with proven efficacy, and the Centers for Disease Control and Prevention (CDC) includes EBIs as part of its national HIV prevention strategic plan [9]. Consequently, federal, state and local funding agencies promote the implementation of EBIs for HIV/AIDS prevention. In a report by the Kaiser Family Foundation and the National Alliance of State and Territorial AIDS Directors [10], 56 of the 65 federal health jurisdictions support the implementation of EBIs.

A major advance in the prevention of HIV/AIDS in the United States is the CDC’s research-to-practice framework of identifying, packaging and disseminating EBIs [11]. The first phase of the framework involves ongoing systematic reviews to identify EBIs for persons at high risk of acquiring or transmitting HIV [12, 13]. EBIs with proven efficacy are included in the online ‘Compendium of Evidence-Based HIV Prevention Interventions’ [14] and once listed in the CDC’s Compendium,
they are eligible to be translated into user-friendly packages of materials through the Replicating Effective Programs project [15–17]. The third phase of the CDC framework involves the national dissemination of EBIs, including the provision of training and technical assistance services, to community-based service providers and state and local health departments through the Diffusion of Effective Behavioral Interventions (DEBI) project [18].

The dissemination literature underscores the importance of maintaining a high degree of fidelity to EBI implementation to achieve programmatic objectives [19–23]. As innovations (i.e. EBIs) are transferred from research to practice, they are often adapted to meet the needs of disparate audiences, fit within a different setting or increase community ownership [24–26]. Adapted programs have an increased chance of becoming institutionalized by complementing the values and norms of the prevention agency and the local community [27–29].

The common struggle of balancing fidelity to the original intervention curriculum and the need for adaptation when implementing EBIs in real-world settings has resulted in the notion of intervention critical components or ‘core elements’ [30–33]. First introduced by Kelly et al. [34] and later refined by CDC [30], core elements are defined as elements that embody the theory and internal logic of the intervention and most likely produce interventions’ main effects. Core elements facilitate the selection of EBIs for a specific target population by highlighting important features such as skill sets required to deliver the intervention or necessary activities or cultural considerations addressed in the intervention session(s). Core elements also play an important role in adaptation by specifying boundaries between programmatic activities that should not be altered and activities that can be modified without sacrificing intervention fidelity. In addition, core elements provide the basis for quality assurance activities in that those elements critical to the intervention’s success should be monitored for fidelity during intervention implementation.

Several studies have investigated fidelity of EBI implementation and illustrate the value of identifying core elements prior to large-scale dissemination. Harshbarger et al. [35] collected implementation data from 162 agencies trained to implement the ‘VOICES/VOCES’ EBI. They found that the vast majority (average 93.5%) of community-based organizations and health departments were able to implement with fidelity all four core elements of VOICES/VOCES. Kalichman et al. [36] found that 60% of the 93 agencies that implemented the ‘Healthy Relationships’ EBI maintained fidelity to all five core elements. In contrast, Galbraith et al. [26] found none of the 34 agencies trained to implement the ‘Focus on Youth’ EBI maintained complete fidelity to the eight core elements. The modest fidelity to core elements reported by Galbraith et al. [26] was partly due to not clearly describing the core elements prior to dissemination. Although these studies suggest that clearly identified core elements can enhance intervention implementation by community-based agencies, to date, there has been no rigorous evaluation of the relationship between core elements and intervention outcomes. Better methods of identifying and describing core elements can allow for empirical studies that explore the impact of core elements on outcomes.

Identification of core elements

According to Kelly et al. [34], core elements can be identified three ways—through program practice, behavioral theory and systematic research. The most common method involves program practice that consists of gathering information from people who possess extensive experience implementing the EBI, including original intervention developer, program staff and research participants [34]. Mowbray et al. [37] expanded upon this approach by suggesting that qualitative research can be conducted to glean opinions of what worked from end-users and to directly observe intervention implementation. Information gathered from these approaches can be combined with information from the published literature to identify components of effective programs [38, 39].

Another method involves the use of behavior change and health behavior theories to guide the identification of core elements. Kelly et al. [34]
emphasized that theoretical constructs such as self-efficacy, perceived norms and intentions are important determinants of positive behavior change. Much empirical evidence supports the relationship between social-cognitive constructs and positive behavior change [40–43] and suggests that activities to operationalize these theoretical constructs should be considered core elements [34].

Perhaps the most rigorous method for identifying core elements is through systematic research. Kelly et al. [44] suggest empirical component analysis, time-period randomization methods or iterative Phase-4 design models be used to determine the elements of interventions that are necessary and sufficient for behavior change. Other research methods to identify core elements can include multiple cell trials. For example, Jemmott et al. [45] evaluated the efficacy of the ‘Sister-to-Sister’ intervention for African–American women in primary care clinics by comparing the independent effects of two factors (i.e. delivery modality and skill-building activities). Women randomized to two skill-building interventions (i.e. either delivered as a small group session or a one-on-one session) had greater reductions in HIV-related risk behaviors and sexually transmitted diseases (STDs) morbidity than women randomized to two information-only interventions. These findings suggest that skill-building activities for condom use and safer sex negotiation are core elements of the EBI [46]. Another empirical approach to identify core elements involves mediation analysis. O’Leary et al. [47] examined mediators of the behavior change outcomes for Sister-to-Sister based on underlying theoretical constructs of the intervention (e.g. condom use knowledge and self-efficacy and expected sex partner reactions to condom requests). These analyses revealed that self-efficacy for condom use was significantly related to improved health outcomes, thereby supporting this construct as an additional core element of the EBI.

The HIV prevention field is not alone in grappling with how to identify core elements of EBIs. The field of substance abuse prevention was a forerunner in the dissemination of EBIs and tackled the issues of adaptation and fidelity. The Center for Substance Abuse Prevention has promoted multiple methods for the identification of core intervention activities, including components analysis, review of program materials (e.g. manuals), direct observation and rating of program implementation and secondary analysis of the published literature on the program [48]. In the field of violence prevention, a program that systematically reviews research on violence and drug abuse programs calls for program developers to operationally define core components of interventions that are necessary and sufficient to achieve desired outcomes [49]. In the field of after-school programming, Hammond and Reimer [50] note the requirement of established associations between program elements and outcomes is mostly lacking in their field and therefore, it cannot be known with certainty the core elements of after school programs. Similarly, Lee et al. [51] from the field of community psychology suggest that the strongest method to identify core elements is empirical studies but for programs that have not had that type of rigorous evaluation, they call for the use of program theory and logic models. Finally, a number of fields have taken a slightly different approach to core elements. Instead of identifying core elements of individual programs, synthesis activities have been used to develop one set of core elements for a range of similar programs [52].

While the abovementioned methods of identifying core elements have been useful, the core elements that have been developed for EBIs to date differ considerably in terms of scope, explicitness and specificity [39]. Furthermore, most EBIs have identified core elements in the absence of empirical data to establish relationships between behavior change components and positive health outcomes [44, 53]. Nevertheless, core elements have been valuable to guide the balance between adaptation and fidelity [26, 35]. In order to further the science of core elements, we suggest three improvements to the identification, description and use of core elements for EBIs. Core elements should be (i) identified through a methodical process based on findings from the literature, (ii) described to implementers in a method that supports fidelity and (iii) tested empirically to understand their impact on
behavioral and health outcomes. This paper addresses the first two improvements. We propose a methodical process to identify core elements based on the creation of a taxonomy developed from a review of the literature. We evaluate the utility of the taxonomy by categorizing the core elements of 20 EBIs disseminated by the CDC’s DEBI Project. Further, we propose a novel approach for describing core elements so they are simple, measurable, achievable, results-based and tested.

Methods

Development of taxonomy of core elements

A three-step process was used to develop the taxonomy to classify core elements. First, we reviewed the literature on behavior change theories and characteristics of effective interventions and reputationally strong programs [6, 16, 38, 54–57]. As the concept of core elements is a relatively new field with limited literature, we were not able to do a more traditional systematic review. Alternatively, we began by reviewing key articles on core elements known by the authors. Experts in the field reviewed the results to identify additional important contributions from the literature. Further, we reviewed several meta-analyses and systematic reviews of HIV prevention interventions that discussed common characteristics or components of effective programs [3–7]. We also examined constructs derived from the final report of an HIV prevention meeting of leading behavior change theorists commissioned by the National Institute of Mental Health [58]. Each identified article was reviewed to discern features or characteristics of effective interventions.

Second, similar types of core elements identified from the literature review were combined into one category so each category represented a unique concept. For example, we created a category ‘Intervention content appropriate for target population (e.g. culturally, developmentally or gender appropriate)’ to address cultural, developmental and gender-appropriate intervention content mentioned in multiple articles [16, 38, 54]. Similarly, Kirby et al. [38] identified ‘selected educators with desired characteristics (whenever possible), trained them [educators] and provided monitoring, supervision and support’ (p. 41) as a characteristic of effective programs for youth. Eke et al. [16] found that reputationally strong HIV prevention programs provide adequate training and orientation for program delivery. The training aspects of both approaches were merged into a common category ‘Ensure providers, volunteers and key staff have appropriate training and supervision’.

The third step involved grouping the categories of core elements into one of three domains: implementation, content and pedagogy. This approach was inspired by adaptation guidance offered by Kirby et al. [38] for youth-based sexual risk reduction programs. The ‘implementation domain’ includes core elements describing practical features or logistics of intervention delivery that can enable the program to be put into operation. The ‘content domain’ refers to what is being taught by the intervention and most closely aligns with models and theories of behavior change. The ‘pedagogy domain’ refers to core elements describing how the intervention content is taught or delivered, or the engagement style used to convey content. A minimum of four behavioral scientists from the larger review team (i.e. all co-authors) independently classified each category into one of the three domains. Next, classifications were shared with other members of the review team, inconsistencies were resolved through group discussion and a consensus was reached. Several categories could fit within more than one domain; however, a decision was made that each category should only be placed into a single domain that seemed the best fit by consensus of the team.

Taxonomy of core elements

A total of 61 categories of core elements emerged from our review of the literature and each category was assigned to the implementation, content or pedagogy domain (see Fig. 1). The implementation domain consists of 19 core element categories and these categories involve facets of intervention delivery such as dose (i.e. number of sessions), group size and number and type of facilitator(s). Addi-
### Implementation (k=19)

- Create a safe (either emotional or physical) environment for individuals to participate
- Ensure necessary support from stakeholders/gatekeepers
- Select providers, volunteers, and key staff with desired characteristics e.g., passionate about serving the client, respect for clients, peer, ethnically matched, can build rapport
- Ensure providers, volunteers and key staff have appropriate supervision
- Implement needed activities to recruit and retain target population
- Have clearly defined target population for whom intervention is appropriate
- Ongoing monitoring of program activities
- Intervention location appropriate for target population
- Intervention dosage (amount) # of sessions
- Intervention dosage schedule (when or how often)
- Conduct formative assessment
- Group size
- Number of providers/staff
- Ensure providers, volunteers, and key staff have appropriate training
- Agency attribute (e.g., structural, policy, structure)
- Behavioral reinforcement
- Incentive
- Seek to impact necessary support for protective behavior from key individuals in participant’s life (e.g., partners, parents, children)
- Cover topics in the planned sequence

### Content (k=25)

- Influence positive intentions to perform protective behavior
- Address feasible social/ecological/structural influences
- Influence skills necessary to perform the protective behavior (not otherwise specified)
- Influence expectancies (e.g., consequences or benefits) for protective behavior
- Address client’s multiple needs
- Influence social norms for protective behavior
- Influence cognitions for positive behaviors not otherwise specified (e.g., attitudes)
- Influence self-efficacy of protective behavior
- Specify behavioral objectives (e.g., personal goal setting)
- Intervention content that is appropriate for target population (e.g., culturally, developmentally, and gender appropriate)
- Influence emotional reaction for protective behavior
- Provide problem solving skills training (e.g., decision making)
- Goal setting skills
- Enhance self-control skills
- Discuss barriers to condom use, abstinence or other protective behaviors
- Address sexual risk triggers (e.g., sexual, drug using)
- Provide skills training for correct use of risk-reduction supplies or techniques
- Influence consistency between protective behaviors & personal standards/values
- Enhance coping skills
- Address gender norms
- Increase ethnic pride
- Enhance interpersonal communication skills (e.g., assertive, negotiation, disclosure)
- Provide HIV sexual health information including epidemiology information
- Enhance self-esteem/worth
- Provide risk reduction supplies, (e.g., condoms, lube, bleach kits)

### Pedagogy (k=17)

- Personalize information e.g., role model stories, personal risk, teachable moments, disclosure, assessment forms
- Deliver using multiple modalities/delivery strategies/levels
- Didactic lecture
- Counseling
- Testing for HIV or STDs
- Demonstration/modeling
- Interactive training (e.g., exercises, games, role plays, discussions)
- Use of electronic technology (e.g., video)
- Outreach
- Distribution of information (brochures, posters)
- Social marketing mass media, (e.g., TV, radio, billboards)
- Social event
- Provision of social support
- Empowerment/TA has ownership of intervention
- Engaging (e.g., entertaining, fun, interesting)
- Peer group discussion or peer interaction
- Provide appropriate referrals/facilitate integration of other services

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Fig. 1. Taxonomy of core element categories organized by implementation, content and pedagogy domains.
and demonstrations and provision of counseling services. Other categories include personalizing information through the use of role model stories, personal risk and teachable moments; the use of multiple delivery strategies and testing for HIV/STDs.

Classifying core elements of EBIs according to the taxonomy

After developing the initial taxonomy, we determined how well the published core elements of 20 EBIs supported by the CDC’s DEBI project could be classified using the taxonomy. The 20 EBIs included in the coding were: CLEAR, Focus on Youth with ImPACT, Healthy Relationships, Holistic Health Recovery Program, Mpowerment, Many Men Many Voices, Modelo de Intervención Psicosocial, Partnerships for Health, Popular Opinion Leader, Project START, PROMISE, RAPP, RESPECT, Safe in the City, Safety Counts, SIHLE, SISTA, Street Smart, Together Learning Choices and VOICES/VOCES. The published core elements of the 20 EBIs are provided on the DEBI website (http://www.effectiveinterventions.org). In general, the published core elements of these 20 EBIs were developed during the intervention packaging process. Original researchers worked in collaboration with CDC scientists to identify intervention core elements. The core elements were not identified based on a systematic process.

A minimum of four behavioral scientists from the larger review team (i.e. all co-authors) independently classified the core elements of each EBI into one or more of the 61 categories. As the focus on this activity was on the published core elements, these were the only materials used for classification (i.e. the original study facilitator guides and fact sheets were not used in the categorization process). Next, classifications were shared with other members of the review team, inconsistencies were resolved through group discussion and a consensus was reached. After completion of the classification for all 20 EBIs, all core elements grouped in each category were examined to confirm that the same concept was represented within that category (The full list of core elements and their classification in the taxonomy can be requested from the first author). This process allowed refinement of the categories if needed.

Results

The majority of 20 EBIs supported by the CDC’s DEBI project contained core elements in each of the implementation (80%), content (95%) and pedagogy (95%) domains. Further, 75% of the 20 EBIs had at least one core element in all three domains. Four EBIs (i.e. CLEAR, Healthy Relationships, Holistic Health Recovery Program and Many Men Many Voices) did not contain implementation core elements, one EBI (RESPECT) did not contain content core elements and one EBI (Holistic Health Recovery Program) did not contain pedagogy core elements.

Table I lists the core element categories in the implementation domain in order of most common to least common. The most common categories in this domain include: ‘Select providers, volunteers and key staff with desired characteristics’ (eight EBIs) and ‘Have a clearly defined target population from whom intervention is appropriate’ (seven EBIs). The implementation categories addressed by only one EBI include ‘ensure providers, volunteers and key staff have appropriate supervision’, ‘agency attribute (e.g. structural, policy)’ and ‘behavioral reinforcement’. None of the EBIs included the core element category that addresses the use of ‘incentives’.

The content categories are listed in Table II. The most common content categories include: ‘enhance interpersonal communication skills e.g. assertiveness, negotiation, disclosure’ (12 EBIs) and ‘influence cognitions for positive behaviors (e.g. attitudes)’ (10 EBIs). Only one EBI contained core elements for each of the following content categories: ‘address feasible social/ecological/structural influences’, ‘address client’s multiple needs’ and ‘enhancing self-control skills’.

The most common pedagogy category addressed by 13 of the 20 EBIs (see Table III) is ‘personalize
information (e.g. role model stories, personal risk, teachable moments, disclosure and assessment forms). Only one EBI addressed each of the following pedagogy categories: ‘testing for HIV/STD’, ‘social marketing/mass media’ and ‘empowerment or having ownership of the intervention’.

The median number of categories addressed in the implementation domain across all 20 EBIs was 2.5 (range, 0–10). We also examined the core elements according to unit of delivery [i.e. individual and small group interventions versus community-level interventions]. Community-level interventions’ core elements were more likely to address the implementation categories than individual and small group interventions’ core elements (median scores of 6 versus 1).

For the content domain, the median number of categories addressed across all 20 EBIs was 5.5 (range, 0–10). Individual and small group interventions were more likely than community-level interventions to address content categories (median scores of 7 versus 2). With regard to the pedagogy domain, the median number of categories of core elements addressed by the 20 EBIs was 3.5 (range, 0–7). Community-level interventions and individual and small group interventions addressed similar numbers of pedagogical categories (median scores of 5 and 3, respectively).

The review of the published core elements from 20 EBIs revealed several weaknesses in the current method of developing and writing core elements. First, there were several instances when a single core element tapped multiple categories within the taxonomy and as a result, these core elements were difficult to interpret. For example, one core element of the ‘Popular Opinion Leader’ intervention addressed a total of 10 categories according to the new taxonomy (see Fig. 2). Second, there were instances when EBIs had more than one published core element addressing the same category. For example, ‘Safety Counts’ contains four separate core elements describing the provision of referrals and the integration of medical and other social services (see Fig. 2). There were also instances when the description of core elements was theoretical or academic and not readily understood by lay providers.

**Table I. Number and percent of EBIs that address 19 implementation categories of core elements**

<table>
<thead>
<tr>
<th>Category</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select providers, volunteers and key staff with desired characteristics e.g. passionate about serving the client, respect for clients, peer, ethnically matched, can build rapport</td>
<td>8 (40)</td>
</tr>
<tr>
<td>Group size</td>
<td>7 (35)</td>
</tr>
<tr>
<td>Have clearly defined target population for whom intervention is appropriate</td>
<td>7 (35)</td>
</tr>
<tr>
<td>Intervention dosage (amount), number of sessions</td>
<td>6 (30)</td>
</tr>
<tr>
<td>Intervention location appropriate for target population</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Ongoing monitoring of program activities</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Ensure necessary support from stakeholders/gatekeepers</td>
<td>4 (20)</td>
</tr>
<tr>
<td>Seek to impact necessary support for protective behavior from key individuals in participant’s life (e.g. partners, parents, children)</td>
<td>4 (20)</td>
</tr>
<tr>
<td>Amount of providers/staff</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Conduct formative assessment</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Create a safe (either emotional or physical) environment for individuals to participate</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Ensure providers, volunteers and key staff have appropriate training</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Intervention dosage schedule (when or how often)</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Cover topics the planned sequence</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Implemented needed activities to recruit and retain target population</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Agency attribute e.g. structural, policy, structure</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Behavioral reinforcement</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Ensure providers, volunteers and key staff have appropriate supervision</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Incentives</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

*Number (n) and percent (%) of 20 EBIs disseminated by the CDC’s DEBI project.
## Table II. Number and percent of EBIs that address 25 content categories of core elements

<table>
<thead>
<tr>
<th>Category</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhance interpersonal communication skills e.g. assertiveness, negotiation, disclosure</td>
<td>12 (60)</td>
</tr>
<tr>
<td>Influence cognitions for positive behaviors (not otherwise specified e.g. attitudes)</td>
<td>10 (50)</td>
</tr>
<tr>
<td>Provide skills training for correct use of risk-reduction supplies or techniques</td>
<td>7 (35)</td>
</tr>
<tr>
<td>Influence skills necessary to perform the protective behavior (not otherwise specified)</td>
<td>6 (30)</td>
</tr>
<tr>
<td>Provide HIV sexual health information including epidemiology</td>
<td>6 (30)</td>
</tr>
<tr>
<td>Provide problem solving skills training (e.g. decision making)</td>
<td>6 (30)</td>
</tr>
<tr>
<td>Influence self-efficacy of protective behavior</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Influence social norms for protective behavior</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Intervention content that is appropriate for target population (e.g. culturally, developmentally, gender appropriate)</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Specify behavioral objectives (e.g. personal goal setting)</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Enhance coping skills</td>
<td>4 (20)</td>
</tr>
<tr>
<td>Goal setting skills</td>
<td>4 (20)</td>
</tr>
<tr>
<td>Discuss barriers to condom use, abstinence or other protective behaviors</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Increase ethnic pride</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Provide risk reduction supplies, e.g. condoms, lube, bleach kits</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Address gender norms</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Address sexual risk triggers (e.g. sexual, drug using)</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Enhance self-esteem/worth</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Influence consistency between protective behaviors &amp; personal standards/values</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Influence emotional reaction for protective behavior</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Influence expectancies (e.g. consequences or benefits) for protective behavior</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Influence positive intentions to perform protective behavior</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Address client’s multiple needs</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Address feasible social/ecological/structural influences</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Enhance self-control skills</td>
<td>1 (5)</td>
</tr>
</tbody>
</table>

*Number (n) and percent (%) of 20 EBIs disseminated by the CDC’s DEBI project.

## Table III. Number and percent of EBIs that address 17 pedagogy categories of core elements

<table>
<thead>
<tr>
<th>Category</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personalize information e.g. role model stories, personal risk, teachable moments, disclosure, assessment forms</td>
<td>13 (65)</td>
</tr>
<tr>
<td>Interactive training e.g. exercises, games, role plays, discussions</td>
<td>7 (35)</td>
</tr>
<tr>
<td>Peer group discussion or peer interaction</td>
<td>7 (35)</td>
</tr>
<tr>
<td>Delivered using multiple modalities/delivery strategies/levels</td>
<td>6 (30)</td>
</tr>
<tr>
<td>Demonstration/modeling</td>
<td>6 (30)</td>
</tr>
<tr>
<td>Counseling</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Outreach</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Didactic lecture</td>
<td>4 (20)</td>
</tr>
<tr>
<td>Distribution of information (brochures, posters)</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Provide appropriate referrals/facilitate integration of other services</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Social event</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Use of electronic technology (e.g. video)</td>
<td>3 (15)</td>
</tr>
<tr>
<td>Engaging (e.g. entertaining, fun, interesting)</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Provision of social support</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Empowerment/target audience has ownership of intervention</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Social marketing/mass media, e.g. TV, radio, billboards</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Testing for HIV or STDs</td>
<td>1 (5)</td>
</tr>
</tbody>
</table>

*Number (n) and percent (%) of 20 EBIs disseminated by the CDC’s DEBI project.
<table>
<thead>
<tr>
<th>Weakness</th>
<th>Example</th>
<th>How SMART addresses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core elements are too complex addressing many different categories simultaneously</td>
<td>EBI: POL Core element: Groups of POLs meeting together weekly in sessions that use instruction, facilitator modeling, and extensive role play exercises to help POLs refine their skills and gain confidence in delivering effective HIV prevention messages to others. Groups are small enough to provide extensive practice opportunities for all POLs to shape their communication skills and create comfort in delivering conversational messages.</td>
<td>S-simple; core elements should be simplified and not address too many categories.</td>
</tr>
<tr>
<td>Multiple core elements addressing the same issue</td>
<td>EBI: Safety Counts Core element: Provide appropriate referrals/facilitate integration of other services. 1. Group Session One and Group Session Two (identify client’s HIV risks and current stage of change, hear risk-reduction success stories, set personal goal, identify first step to reduce HIV risk, and make referrals to C&amp;T and medical/social services) 2. One (or more) Individual Counseling Session (discuss/refine risk-reduction goal, assess client’s needs, and provide needed referrals to C&amp;T and medical/social services) 3. Two (or more) Follow-up Contacts (review client’s progress in achieving risk-reduction goal, discuss barriers encountered, identify concrete next step and discuss possible barriers/solution, and make referrals to C&amp;T and medical/social services) 4. HIV/HCV Counseling and Testing (offer the client this service either through referrals or at the implementing agency)</td>
<td>S-simple; limit number of core elements for each critical component.</td>
</tr>
<tr>
<td>Language is complex and theoretical</td>
<td>EBI: Holistic Health Core element: Teaches skills to increase awareness of how different senses of self can affect self-efficacy and hopelessness.</td>
<td>S-Simple; written in simple, straightforward language.</td>
</tr>
<tr>
<td>Core elements are not linked to results</td>
<td>EBI: Project Smart Core Element: Use assessment and documentation tools to provide a structured program.</td>
<td>M-measurable; precise and include specific details when needed.</td>
</tr>
<tr>
<td>Core elements are not empirically tested</td>
<td>Many</td>
<td>A-Achievable; Assessed for implementation feasibility by agencies who might adopt the intervention.</td>
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**Fig. 2.** Examples of weakness with core elements and SMART solution.

For example, ‘Holistic Health Recovery Program’ includes the core element ‘teaches skills to increase awareness of how different senses of self can affect self-efficacy and hopelessness’. There were also instances when the core element was ambiguous and therefore challenging to implement and mea-
sure. For example, ‘Project START’ contains a core element guiding facilitators to ‘use assessment and documentation tools to provide a structured program’. This core element does not specify which tools should be used nor does it provide a rationale on how the program is provided in a structured manner. Finally, many core elements were not linked to the desired outcomes.

**Discussion**

Based on a systematic review of the literature, a taxonomy was developed for describing and identifying core elements of EBIs for HIV prevention. The taxonomy categorizes core elements in terms of implementation, content, and pedagogy domains. Further, the utility of the taxonomy was tested based on the published core elements of 20 EBIs that are nationally disseminated through the CDC’s DEBI project [18]. The new taxonomy revealed several ways in which the current process of developing core elements can be strengthened. While the majority of EBIs contained core elements in all three domains, there were a few noticeable gaps and several EBIs contained only core elements in a single category.

We encourage intervention developers to consider the implementation, content, and pedagogy domains when developing core elements. According to our categorization of the 20 EBIs, community-level interventions contained more core elements in the implementation domain while individual and small group interventions contained more core elements in the content domain. This is consistent with the intent of community-level interventions to change complex community-wide norms and practices to support individual-level behavior change efforts. Similarly, the emphasis of individual and small-group interventions on one-on-one counseling and skill-building activities, respectively, is often based on specific behavior change theories. Developers of community-level interventions may put an additional focus on implementation categories and developers of individual and small-group interventions may put additional emphasis on content categories. Consideration of all three domains for all interventions can improve EBI delivery. It is also noteworthy that none of the EBIs contained a core element addressing incentives, and only two EBIs contained core elements addressing the recruitment and retention of clients. Recruitment and retention, often aided by incentives, are challenges frequently cited by HIV prevention providers that implement EBIs [10]. Successful recruitment and retention procedures used in the original research trial should be translated into core elements to assist service providers.

We noted several weaknesses in the published core elements of the 20 EBIs disseminated by the
CDC’s DEBI project. There were several instances when core elements contained multiple categories, thereby making them complex and difficult to interpret. In addition, several EBIs had multiple core elements within one category in our taxonomy. While there may be circumstances warranting multiple core elements to address the same category (e.g. when each addresses a different component of the intervention), redundant core elements is impractical and may overlook critical facets of intervention delivery. Several core elements were not specific enough to effectively guide intervention delivery or the assessment of intervention fidelity. Finally, many core elements were not linked to the desired results.

To address these weaknesses and help ensure that interpretable and useful core elements are developed prior to dissemination of EBIs, we propose that core elements be ‘SMART’—that is simple, measurable, achievable, results-based and tested (see Fig. 3). As the end-users of core elements include front-line prevention providers with diverse experience and education, the description of core elements should be ‘simple’ and not overly complex. Core elements that are ‘measurable’ and explicit allow monitoring of implementation fidelity and quality assurance. Core elements should also be ‘achievable’ or feasible for organizations to implement. Researchers are encouraged to work collaboratively with implementing agencies when developing core elements to ensure ease of implementation [37]. Core elements that are ‘results-based’ or connected to desired behavioral or biologic outcomes will help implementers understand the importance of keeping fidelity to core elements. Finally, empirically ‘testing’ core elements to demonstrate their connection to desired outcomes is a goal the field should strive toward.

Another weakness involves core elements not capturing critical aspects of the intervention. To address this weakness, a diverse team of individuals involved in developing the intervention (i.e. researchers, trainers, facilitators and even members of the target population) could use the taxonomy to isolate implementation, content and pedagogical aspects of the intervention they believe are critical for intervention success. The taxonomy can also assist intervention developers to identify core elements during the original research trial to help guide mediation analyses [59] or replication studies [60]. In both of these scenarios, it is critical to craft practical, clear and understandable core elements for use in future research and program implementation efforts.

This review is not without limitations. Although best efforts were made to find all relevant articles pertaining to behavioral theories and characteristics of effective interventions, some may have been overlooked. The taxonomy described in this paper is based in part on the findings of several meta-analyses of HIV prevention interventions for various at-risk populations and those meta-analyses were based on systematic literature reviews. Therefore, it is not surprising that our review of the published core elements from the 20 EBIs disseminated through the CDC’s DEBI project did not reveal many missing categories. However, it is possible that other important categories of core elements may be missing, and the taxonomy should be updated as the number of EBIs increase in the future. Another limitation involves testing the taxonomy based on the 20 EBIs disseminated by the DEBI project, of which only four were community-level interventions. This small number of EBIs may limit the generalizability of the taxonomy to all HIV prevention EBIs. It is also plausible that EBIs not disseminated by CDC may focus on additional categories of core elements not included in the taxonomy (e.g. environmental barriers and social structure change). Finally, there is a paucity of empirical data establishing relationships between core elements and positive health outcomes [44, 53]. Therefore, the taxonomy should undergo further testing as additional EBIs are identified and disseminated by CDC.

Implications for future research and practice

The taxonomy proposed in this paper can be used as a tool to help researchers identify core elements during intervention development. Similar to Rot-
eram-Borus et al. [39] proposed common factors of HIV prevention programs, researchers can use the taxonomy to identify categories of core elements that may impact behavior in the target audience and design or adapt intervention activities and implementation procedures using these categories to create new interventions. The taxonomy also allows for standardization of core elements across EBIs, which would allow further comparisons across EBIs. This standardization can facilitate other important future research areas including meta-analyses to identify specific intervention components influencing behavior change, and the number or combination of core elements needed to achieve greater efficacy. Other operational questions that can be explored based on the taxonomy include the determination of the ideal number or mix of core elements from various domains, whether EBIs with more core elements have greater impact on behavior change than EBIs with fewer core elements and whether certain categories of core elements are more crucial than others. Kelly et al. [44] call for Phase 4 HIV prevention effectiveness trials to provide answers about the effectiveness of EBIs when scaled up. In Phase 4 trials, core elements could be evaluated through various methods to determine if they are indeed the critical elements leading to behavior change. Based on the importance of effectiveness research, having well-written and operationalized core elements is critical and use of the taxonomy of SMART core elements could assist such empirical testing.

Core elements can serve an important role throughout the broad range of research, research translation and program implementation efforts. The taxonomy of core elements of HIV prevention interventions described herein can be used by intervention developers to systematically guide the identification of core elements of their interventions, strengthen the translation of interventions from research to practice and help guide future research seeking to identify essential intervention elements that must be delivered with fidelity. Furthermore, the taxonomy can strengthen the selection, delivery, adaptation and ultimately the effectiveness of EBIs delivered by HIV prevention providers in real-world settings.

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**Conflict of interest statement**

None declared.

**References**


