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Theory of Change in Digital Behavior Change Interventions (Dbcis) And Community-Based Change Initiatives – A General Framework

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Abstract. A theory of change is a purposeful model of how an initiative, such as a policy, a strategy, a program, a project or an intervention contributes through a chain of early and intermediate outcomes to the intended result. Theories of change help navigate the complexity of social change. Digital behavior change interventions (DBCIs) and Community-based change initiatives represent complex designable systems. The goal of the DCBI is to provide an effective theoretical framework for behavioral change to practitioners that offer different forms of psychological intervention based on scientifically validated practices. Applying theory of change when designing digital individual and community interventions for optimizing digital wellbeing helps practitioners to achieve results in practice, as this strategic approach is generally considered an evidence-based framework. Theory of change is useful to guide the strategic thinking and action, as most of DCBI/ Community-based change initiatives research endeavors are active in a complex situation, often unplanned events happening. Conclusions and implications are discussed.

Keywords. Theory of Change; Digital behavior change interventions (DBCIs); Community-based change initiatives; Digital Wellbeing

1. Digital behavior change interventions (DBCIs)

Based on previous research on digital wellbeing (Macovei et al., 2011; Bran, 2018; Rad et al., 2019; Rad et al., 2019; Rad et al., 2019; Rad, Demeter, 2019; Rad et al., 2020) this paper further emphasizes on the importance of integrating theories of change in the digital psychological interventions aiming to mitigate the negative effects over the general population wellbeing index.

The discovery and refining of hypotheses are a crucial role in research. A compilation of definitions and/or statements that determine how phenomena relate to one another, according to a cross disciplinary consensus description of theory (Davis et al., 2015). Theories serve as a basis for embodying prior knowledge of how changes in causal variables result in a desired effect in health behavior changes (Davis et al., 2015). Theories are important as they contain interpretations and forecasts needed to generalize results from previous research into new fields of study and application (Noar et al., 2005; Rothman, 2004).

The degree to which behavior change theories accomplish these aims has been extremely complex (Noar et al., 2005). There were 83 theories included in a study of behavioral change framework using the concepts of theory and behavior (Michie et al., 2014; Prestwich et al., 2014). Just three were found to be systematic within their objective, and there was a general lack of specification, both in construct meanings and their relationships. In addition, the majority of behavior-related theoretical frameworks emphasized group-level and basically linear generalizability, which means the theory supports hypotheses and conclusions for average variations in group results (Spruijt-Metz, et al., 2015). Theory has the ability to provide information for specific individuals, especially into what could happen for those persons in the long run (Nilsen, 2015). A solid theoretical framework can make generalizations at both the collective and individual levels (Shadish et al., 2002; Molenaar et al., 2009; Molenaar, 2004).

The Transtheoretical Model (TTM) is a biopsychosocial, integrative framework for understanding the mechanism of deliberate behavior change (Prochaska et al., 1992; Prochaska et al., 2002; Prochaska et al., 2008). Some designs of behavior change, such as those based solely on psychological or biological factors, aim to include and combine core constructs from other hypotheses into a holistic framework of change that can be generalized to a range of behaviors, cultures, and environments.

The TTM is built around stages of change. When it comes to changing behaviour, researchers have discovered that individuals go through a sequence of steps. Although the amount of time an individual can spend in each stage varies, the activities necessary to advance to the next stage do not. At each point, some concepts and change mechanisms work best to minimize opposition, promote growth, and avoid relapse. Decisional balance, self-efficacy, and transition mechanisms are among the criteria. Just a small percentage of a vulnerable population is ready to respond at any given time. As a result, action-oriented instruction overlooks people in their beginning phases. Since it applies to the whole community rather than just the minority willing to act, guidance focused on the TTM results in greater engagement in the change process.

A temporal dimension is represented by the stage concept. Change refers to events that occur across time. Interestingly, there was no central construct reflecting time in any of the leading therapy theories. Changing one's behavior was once thought to be a one-time occurrence, such as avoiding smoking, alcohol or substances consuming, or binge eating. TTM views change as a long-term phase that involves progression through a sequence of phases. Although development through the Stages of Change can be linear, it is more common for it to be nonlinear. Individuals also loop through the stages or regress.

Digital behavior change interventions (DBCIs) are interventions that use digital technology to inspire and sustain behavior improvement in order to foster and sustain wellbeing through directly or indirectly prevention and maintenance of health issues, as defined (Yardley et al., 2016). Theoretical frameworks are important for effectively personalizing DBCIs. (Riley et al., 2011). Individuals use DBCIs to help with health awareness by delivering reinforcement in the society to modify particular habits in certain environments (Patrick et al., 2008). They are increasingly using knowledge about a client to tailor support to the individual's particular and often changing needs. "Just-in-time" adaptive action (JITAI) is one form of DBCI (Intille et al., 2003). Individuals who have the potential to partake in a positive behavior (or are vulnerable to a destructive behavior) and are open to help are supported by a JITAI. (Nahum-Shani et al., 2016). JITAIs and DBCIs in general require frameworks to account for differences in human traits and situations, as well as the fact that these differences can evolve over time (Hekler et al., 2016). Current behavioral models can only offer a finite amount of insight into

this form of action (Hekler et al., 2016), but they are necessary to deal with the underlying complexities of real-world behavior change.

There are four large domains that need additional research focus, according to (Hekler et al., 2016; Hekler et al., 2016). Firstly, there should be more emphasis on frameworks and designs that are as accurate, quantitative, and testable as possible when it comes to describing the complexities of behavior change. Model architectures, interaction directionality and magnitude, nuances, and multidimensional generalization frames will all be considered will all be used to make incremental progress toward accuracy.

Secondly, due to the intrinsic complexities of behavior change, no single study group is able to completely comprehend or model a phenomenon on its own, especially multifaceted generalization fields of an operation that require vast resources. This emphasizes the value and need of collective research consortia (Spruijt-Metz et al., 2016). It also emphasizes the importance of developing ontologies for interpreting behavior since they offer a consistent framework for organizing and communicating findings from various research projects. In a nutshell, an ontology is a well-organized definition of constructs and in-between interrelationships, as described by the informatics tradition (Art et al., 2015). One of the main goals of ontologic research is to make it easier to choose and define concepts like behavior change strategies (Michie et al., 2015) and mechanisms of action, as well as the emerging interactions. This form of procedure is necessary to make sure that researchers are investigating the very same ideas, and it will be especially important in the analysis of multidimensional generalization spaces because it will allow diverse research efforts to emerge into coherent frameworks and analytical designs.

Thirdly, it is critical to consider theoretical frameworks and analytical designs as a whole rather than separately, resulting in collaboratively created and tested theoretically based intervention packages (Hekler et al., 2016). The analysis of human actions necessitates a thorough understanding of the circumstances under which a mechanism of action can yield a result (Polizzi di Sorrentino et al., 2016). Behavioral models are very often regarded as universally applicable rather than being rigorously defined to assess whether or not they are helpful in explaining a series of observations (Rothman, 2013). It is critical for the advancement of behavioral science to concentrate not only on the creation of analytical designs, but also on the joint construction of these models and behavioral philosophies. Theorizing regarding multidimensional generalization spaces is an obvious aim for advancing this field (Martin, 2003).

Fourth, much further research is needed for creation of designs accounting for and forecasting modifications in idiographic characteristics over time (Molenaar, Campbell, 2009; Molenaar, 2004). Behavioral science predictive analyses, as previously stated, aim to rely on the data collection. Variations in variables that are unique to each person are inserted into the error terms of mixed model tests, rather than being the subject of modeling (Singer et al., 2003). Idiographic modeling focuses on the variants that are actually of the error term in mixed model studies.

Idiographic modeling, such as mechanism recognition (Ljung, 1999), aims to create highly defined models that explain how variables interact for a given person, allowing for more accurate estimation and subsequent monitoring of the specific phenomena over time. As a result, more careful simulation of behavior is needed, and device recognition, as well as computer science approaches collectively referred to as reinforcement learning (Sutton, Barto, 1998). Furthermore, as previously mentioned, these idiographic classification methods can be used to investigate multilayered generalization frames, demonstrating the effectiveness in making more personalized and precise DBCIs (Lyon et al., 2017).

As most DCBI research efforts are active in a dynamic situation, unplanned situations often occur, and theory of change will assist you in operating in the complex climate.

There are four key explanations why you would want to apply theory of transformation.

1. It will assist in developing a solid intervention planning design.
2. This will assist in tracking knowledge and learning framework so one will be able to review assumptions and be consistent about what is needed to do and what the indicators are.
3. Finally, some of us like to scale up what we're doing, but the principle of transition is assisting us in planning how we'll scale up later.
4. Finally, if you want to do the assessment at the end, the theory of change used at the beginning will help recreate what happened later, so one can make a different approach if it wasn't the theory of change used in the beginning.

A theory of change theory is essentially about what we want to do, how we believe we can accomplish it, and why we want to accomplish it (Serrat, 2017).

The majority of theory of change practitioners start with a visible and then move on to a narrative. In the visual, you'll have to separate the paths of transformation, which illustrate how you function backwards from your goal to articulate what changes are needed to achieve your ultimate vision. Finally, you will have a better understanding of what you as a team will do, as well as what you want other actors to do in the future to combine with your achievement outcome in the vision in the long-run (Breuer et al., 2015).

We all have ideas about transition, and in our previous planning frameworks based on the rational paradigm, we only considered assumptions, such as what will or will not happen around us. We think of new kinds of assumptions in theory of change, one of which is cause-effect assumptions, which is just our reasoning on how early effects can lead to later results, so we expound on that (Reinholz, Andrews, 2020). Another sort of inference that we look at is the perception assumption. When it comes to transition, some of us believe it will occur as a result of a conflict, while others believe it will occur as a result of science, and even others believe it will occur as a result of digitalization. It is important to align the team members' expectations on how progress can be implemented and to develop a shared philosophy of change in which those assumptions will be agreed upon.

As a result, digital behavior change interventions (DBCIs) are dynamic structures that can be designed (Hekler et al., 2016). Since this strategic approach is widely called an evidence-based methodology, using philosophy of change when planning digital interventions for maximizing digital health helps clinicians achieve outcomes in practice. The goal of the DCBI is to provide an effective theoretical framework for behavioral change to practitioners that offer different forms of psychological intervention based on scientifically validated practices. Motivation for change is often the best predictor of outcome (Center for Substance Abuse Treatment, 1999), and evidence shows that it directly affects the common factors present in all forms of psychological intervention from identifying the person's needs, interpreting clients' problems to the relationship with the clinician, the last being the building-blocks of the psychological intervention and which explains a significant part of its effectiveness. DCBI as an intervention technique can reach optimal parameters in short psychological interventions that, although they do not target the development and refining of complex psychological skills, they contribute efficiently to the targeted behavioral change. Applying theory of change when designing digital interventions for optimizing digital wellbeing helps practitioners to achieve results in practice, as this strategic approach is generally considered an evidence-based framework (Michie et al., 2017; Perski et al., 2017). Theory of change is useful to guide the

strategic thinking and action, as most of DCBI research endeavors are active in a complex situation, often unplanned events happening.

2. Community-based change initiatives

Theories of Change take into account a variety of core factors that aid program comprehension. Community-based change initiatives mostly have lofty objectives, making it impossible to devise concrete on-the-ground tactics to achieve them. Planning and carrying out assessment analysis that can guide practice and surface wider insights for the profession as a whole is often a challenging task.

For a variety of causes, theories of change (ToC) are critical to program progress. Theoretical foundations are needed for programs. Organizations will be more confident that their programs are implementing the best activities for the intended results by establishing a theory of change built on sound theory. And, since each phase, from the theories driving it to the results it aims to provide, to the resources required, is well identified with a theory of change, programs are easier to sustain, bring to scale, and assess.

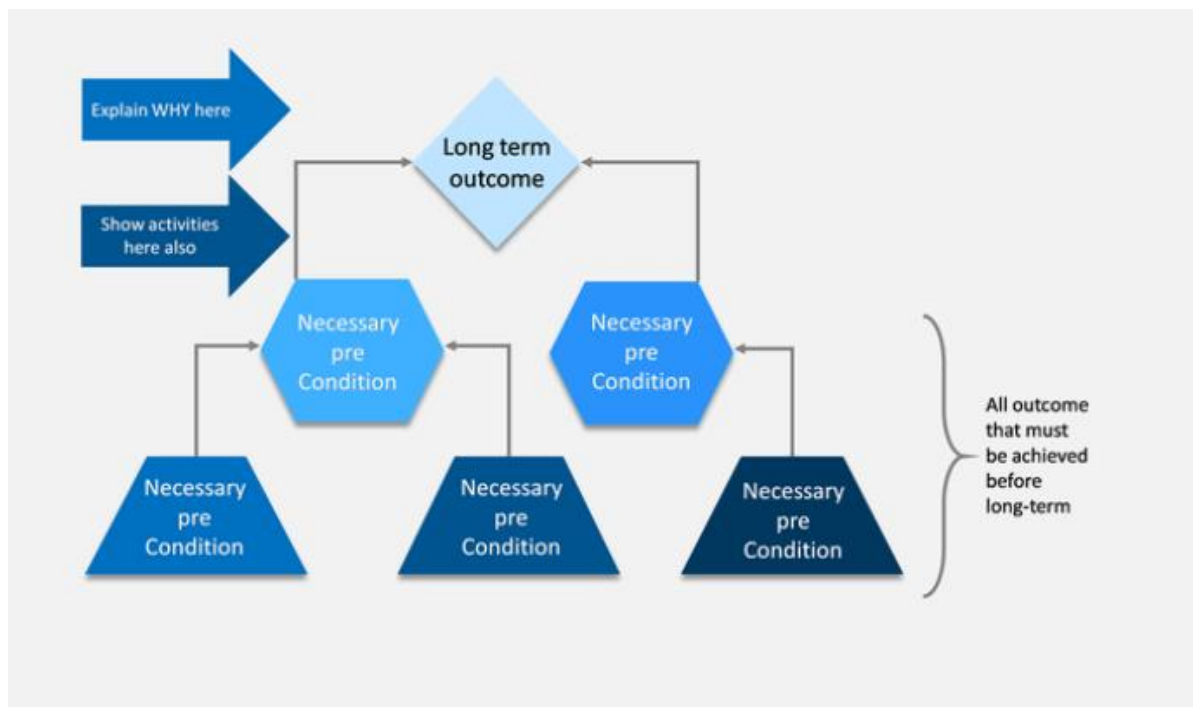


Figure 1 – Elements of a Theory of Change

Logic or outcomes models are strongly connected to this larger context, and are often used to consider a more strictly practical look at the interaction between inputs and outputs.

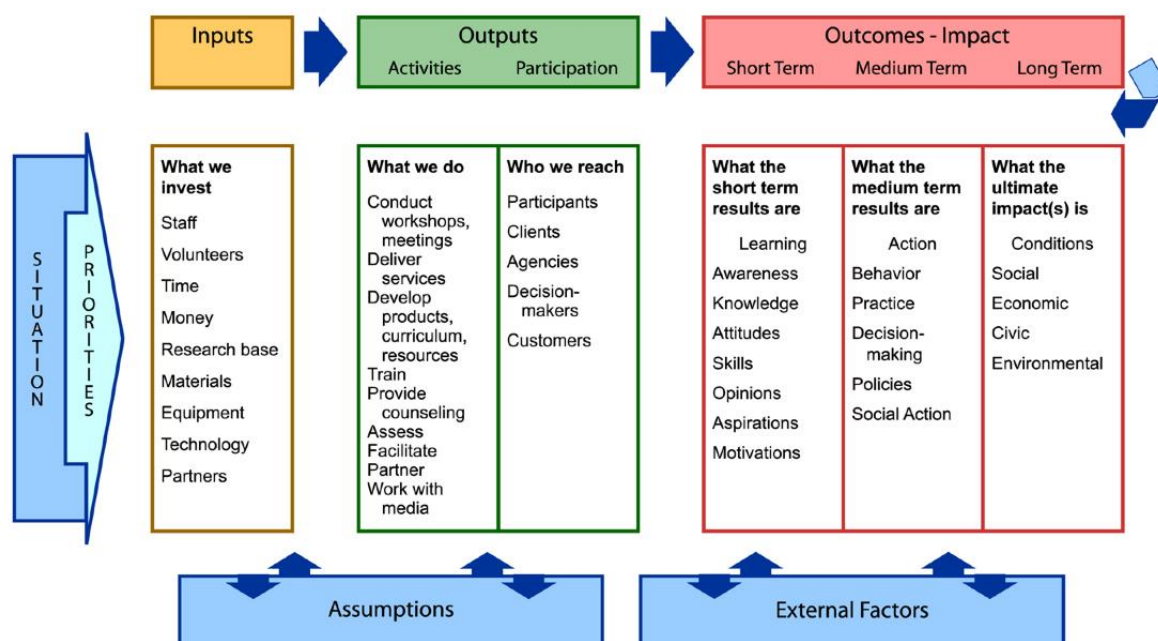


Figure 2 – Logic models *Source: University of Wisconsin*

Logic models communicate the path to a desired outcome and allow for the identification of key success indicators. Finding strategies to express and direct planned project efforts, particularly those designed to deliver dissemination and utilization results, is the starting point for implementing daunting programs that extend through multiple work groups and departments. Many administrators lack the resources necessary to clearly define, catalog, and convey dynamic program objectives, task plans, and expected outcomes. Logic models can help achieve these objectives by enabling project managers to prepare for outcomes by imagining a big picture perspective of a project's scope of work and future impact on different target programs. Logic models are also known as "outcomes models," "causal strings," or "intervention logic models" (ILMs). Logic models are often used as part of a broader theory of change (TOC)-based approach to program development and assessment.

Logic models are narrative or graphical representations of real-world systems that convey the underlying expectations that an action is supposed to produce. They usually depict a series of cause-and-effect interactions, or a systems approach to communicating the pathway to a desired outcome. The model illustrates different orders of outcomes relevant to a particular problem or situation by describing conceptual linkages among program capital, operations, outputs, and audiences. Importantly, critical performance metrics can be defined after a program has been represented in terms of the logic model. Logic models can thus be seen as aiding both preparation and assessment.

Brown (2020) begins *Unpacking the Theory of Change* by stating that the phrase theory of change is both familiar and puzzling. Practitioners in the social field can more easily execute and evaluate their strategies if they have a clearer understanding of the different meanings. The author offers a grid to remind us of the various meanings funders or peers may have in mind as they inquire for your theory of change are they asking for a glamorous mission statement, or a reasoning model, or are they looking for consistency with data on results, or are they looking for an analysis of successful methods?

Reinholz and Andrews (2020) discuss the relationship between a theory of change and change theory, as well as how change theory should be used to guide a project's theory of

change. A project-specific theory of change is linked to assessment. It keeps the project's basic logic clear, and helps with preparation, execution, and evaluation. Change theories, on the other hand, reflect scientific and empirically based insight of how change happens that is independent of any particular initiative. A theory of change is updated by change theories.

ToCs, according to Oberlack et al. (2019), are resources that can and should be used more widely to improve the validity, reflexivity, learning capacity, and efficacy of sustainability research. The authors begin by outlining a framework for understanding ToCs in sustainability science and demonstrating their diversity.

In 2019, O'Cathain et al. aimed to provide researchers with advice on steps to follow during the implementation of interventions. When designing strategies to promote wellbeing or other diverse environments, the authors propose core actions to consider. Seeing intervention implementation as a complex iterative method, engaging stakeholders, analyzing published empirical findings, building on emerging ideas, formulating program theory, collecting primary data, and acknowledging context are only a few of them, along with considering future deployment in the real world, as well as planning and optimizing an intervention through iterative iteration processes of stakeholder feedback. According to Koleros and Mayne (2019), as therapies have become more complicated, developing ToCs that effectively unpack this complexity has become more difficult. The creation of evaluable ToCs, which are required for performing rigorous theory-based assessment approaches such as contribution analysis, is also critical (CA). The use of nested actor-based ToCs is explored in this article as one method of addressing these issues.

Contribution analysis begins with a method for depicting an expected transition mechanism as a series of events, taking into account contextual factors (Ton et al., 2019). An assessment that uses contribution analysis to analyze and validate this hypothesis of progress (ToC) assesses whether an action is a contributory factor, as well as how and why the intervention made a difference. Contribution analysis is a general framework rather than a specific approach, consisting of six stages in an iterative loop of ToC reflection and refining. Allen et al. (2017) shows how an outcomes-based method, Theory of Change (ToC), can be used in combination with DSS production to help both broad problem framing and outcomes-based measurement and assessment.

Davies' report from 2018 examines the technological problems around the representation of Theories of Change, as well as the ramifications of design decisions regarding their evaluability. Six systemic issues are identified, along with their assessment implications, using examples and data from the Internet. Following that, the paper discusses a variety of approaches that software creators, implementers, and evaluators may use to solve these issues.

Most research and development projects have untested and unjustified conclusions as their vulnerable point. Archibald et al. (2016) explain a ToC approach in this paper that aims to help community engagement professionals interact more consistently with assumptions by incorporating evaluative thinking into policy preparation, reporting, and assessment. The authors demonstrate how ToC models can promote more reflective and proactive program creation by encouraging individual and organizational learning and adaptive management.

In recent evaluation on theory of change the most representative and feasible models are: the Behavior Change Wheel (Michie, 2014), and the Behavior Change Ball (Hendriks, 2013). Under a more general framework, we can also find pathways to behavior change (Petraglia et al., 2007; Critchley et al., 2012; Zongrone et al., 2018; Cole-Lewis et al., 2019).

In terms of understanding essential thinking mechanisms and motivational triggers that cause behavior change in low-income environments, behavioral science-based approaches to planning and evaluating development programs have come a long way. These methods,

however, fail to account for the uncertainty and interdependence of social-ecological environments, as well as the fact that transition processes, once triggered, play out over time and are interpreted differently by different individuals or narratives within a system (Lambe et al., 2020).

Beyond articulating assumptions, using a theory of change has added importance, according to previous studies. It is the ability to build on, or criticize, 'mid-level' or generic ideas arising from empirical analysis and conceptualization that this approach provides. Any well-known ideas of individual and organizational behavior change can help direct behaviors and explain related outcomes. Similarly, implementation science identifies principles for intervention that are most likely to guarantee a strategy or program's effectiveness. As a result, a theory of change does not need to start from scratch, nor should it. It should preferably build from what we know or believe to be more probable in broad terms (from practice, systematic analysis, and theorizing), but still taking into consideration the particular context, which necessitates some nuance in local intervention in order to achieve desired outcomes. There are also theories at the mid-level on what constitutes meaningful consequences in the context of intent.

Social change (Serrat, 2017), which is characterized as the mechanism by which individuals and societies adapt or abandon customs and associated leading concepts, beliefs, and motives to behave differently in response to spontaneous (unique) or structural causes, is not a simple process. It is fueled by a slew of cultural, demographic, economic, environmental, political, religious, science, and technical movements, which act singularly but more often than not in co - evolutionary tandem, and almost always in the face of entrenched interests who want to keep things the way they are. Furthermore, there are various forms, intensity levels of it, regardless of developmental, dispute, or practical explanations:

- Discursive—a shift in an actor's narrative(s) about a concern, challenge, or issue.
- Procedural—a transition in how a company's management procedures are carried out.
- Content-based—a change in a concern's essence.
- Attitudinal—a shift in how people think about an issue.
- Behavioral—a difference in how actors perform or interact with others in relation to a problem as a result of formal and informal shifts in discourse, practice, content, or mindset (Serrat, 2017).

The Theory of Change method is an outcomes-based, participatory technique that extends critical thought to the creation, execution, and assessment of an intervention, such as a proposal, strategy, program, or project, with the goal of fostering emergent, projectable, or disruptive change. It combines visioning, preparation, and evaluation viewpoints, as well as reasoning model principles.

A theory of change describes how and why a series of logically related events, known as change pathways, can lead to a certain outcome. It does so by articulating assumptions on how short-, medium-, and long-term transition occurs in a given external sense, as well as the biases and theories that underpin them; and stipulating how early and intermediate outcomes (preconditions) for long-term progress can be achieved and reported with metrics that indicate how much of each result is to be realized, by whom, and when.

A logic model (results framework) is a tactical explanation of the mechanism of producing an outcome: it emphasizes inputs and actions, the outcomes they produce, and the relations between the outputs and the intended outcome in a very mechanistic manner. Assumptions are loosely articulated, and partners are uncertain how the transition process will proceed across departments, which is a recurrent flaw. A theory of change, on the other hand, is a strategic picture of various strategies needed to achieve early and intermediate results that

are essential for long-term change. One advantage is that causal pathways define what is required to produce desired outcomes: predictions can be evaluated and calculated. As a result, the Theory of Change approach allows organizations to think more profoundly about their work. An outcome's structure can be drawn after a consequence has been determined to illustrate how it can be achieved; hence, a theory of change should be supported by many logic models. In short, when it comes to interpretation or discovery on the one hand, and transparency versus learning on the other, logic models and theories of change vary significantly in terms of the perspectives and interactions they possess.

Creation is a dynamic mechanism, as Reeler (2007) and Funnell (2011) convincingly argue; learning from experience is the foundation of self-determination; and not all crises are disasters. Making theories of change clearer from the start, without finding objective reality or a conclusive recipe to eradicate ambiguity, helps determine exactly what has to happen. Six overlapping questions should be answered by a philosophy of change: 1. What long-term question, its root causes, and implications do you and others want to address (external context)? 2. What are you hoping to help or influence (beneficiaries)? 3. What are the desired outcomes (benefits)? 4. When will the advantages be understood (duration)? 5. how can one and others (interventions) make it happen? and 6. why do you think the principle of theory of change hold up, and on what facts do you base your belief (assumptions)?

What interventions actors suggest are a reflection of the health of their theories of change and their ability to quantify what actually matters. Both are dependent on their respective stages of growth. In the end, the true advantage of the Theory of Change approach is that it helps to develop potential for purposeful theory and its successful application.

3. Conclusions and implications of Theory of Change

In both developed and developing countries, the use of Theory of Change in planning and assessment has increased among philanthropies, government institutions, development organizations, universities, multinational NGOs, and several other major organizations. (McLellan, 2020). As a result, new areas of research have emerged, such as the link between the Theory of Change strategy and systems thinking and uncertainty. Change cycles are no longer seen as linear, but rather as complex feedback loops that must be comprehended. As a result, Theory of Change helps to improve control, measurement, and understanding. They're also assisting in the understanding and assessment of effect in difficult-to-measure fields like policy, capacity building, and structural growth. New ideas continue to evolve (Jackson, 2013). Despite the growing popularity of Theory of Change, particularly in the development sector, there is a lack of uniform understanding of the strategy and the methods required to successfully enforce it. In fact, there is evidence of some confusion about what the term 'theory of change' actually means; in some cases, what some program developers describe as a Theory of Change is, in essence, simply log frame, strategic plan or another approach that does not encompass the complexity of the theory of change approach.

Logic structures and conceptual models have been developed by practitioners as techniques and methods for planning and evaluating social innovation process. Although these models effectively communicate an initiative's or organization's priorities and finances, they pay little attention to the diverse social, technological, political, and structural systems that underpin social and societal change. As a result, while logic models and log frames have established an Implementation Theory, they may lack an underlying Theory of Change (Funnell, Rogers, P., 2011). In addition, unlike logic models and log frames, Theory of Change starts with a participatory mechanism to explicitly identify desirable results and to express and discuss one another's assumptions. Rather than participating in traditional forward-oriented "so-

that” logic, Theory of Change starts by defining policy objectives or expected effects and focusing backwards on result pathways. The group starts with the long-term objective and results in Theory of Development, then moves backward (in time) to the earliest improvements that need to be made. It is only after the pathway has been created that it is time to think about which strategies can help deliver the pathway's outcomes.

Until recently, Theory of Change has not differentiated between impact, influence, and leverage as types of outcomes, although this can be helpful in concentrating the Theory of Change on observable outcomes. When using Theory of Change to direct monitoring and assessment, the TOC (2004) helps center the group's emphasis on results that can be convincingly related to the Theory of Change if they are reached. The Theory will predict results in control and leverage, in addition to direct program-related outcomes (impact). This method could help prevent mapping results involving large changes in behavior and values across whole societies, which are easy to imagine but impossible to track and assign to any single program. Outcome mapping is another refinement that specifically tackles the attribution issue. Changes in state are distinguished from changes in behaviour in this process, with changes in state referring to large shifts in economic conditions, legislation, governance, institutional behavior, and so on, across whole societies. The capability of any one actor's tracking capabilities can be exceeded when measuring changes in state. Governments compile statistics on state transitions, but the data may not be optimized to calculate the types of transition predicted by any given Theory of Change. Changes in state are often impossible to trace to a single cause, as previously mentioned. Changes in behavior, on the other hand, are often easier to track and link to a group's own work. The Results Mapping emphasis on behavior changes will help to steer a Theory of Change toward outcomes like these, where the change agent is more concerned with and can effectively track and analyze.

Is Theory of Change an enemy or ally of strategic thinking? This is an ongoing and significant debate, particularly as the importance of and desire for strategy that is grounded, agile, and opportunity-driven grows. Some viewpoints regard the ToC as a rigid paradigm that obstructs efficient work and useful assessment. If the transition paradigm is viewed as one that can be tweaked as companies understand what functions from field practice, the principle should not be at odds with strategic action. The Theory of Change paradigm acts as a driving frame of reference if policy is about seizing resources and figuring out what works. A checklist is not a design; it does not compel practitioners to accept the targets as part of a comprehensive reform strategy or to think critically and strategically about how to better achieve the results along the course.

Considering that changes don't unfold in a linear fashion – that actions interact in a variety of, partially random ways, with a variety of feedback loops that aren't modeled in a top-down diagramming style, an important concern is whether the linear Theory of Change paradigm is sufficient as an explanation of what will happen. Theory of Change does not, in particular, model how things happen; rather, it models how we think things can happen, according to one response to the question. A theory of change is a prediction that indicates what conditions we assume must occur in order for other conditions to emerge. Theory of Change represents the way we thought logically (if a, then b) and chronologically (first this, then that) because it is forward-looking and rational. As a result, the linear format is sufficient. A method model that illustrates how Theory of Change blends into a broader, more cyclical scheme in which theory leads to intervention, which leads to monitoring and evaluation, which leads to theory revision, which leads to the next action, more monitoring and evaluation, and so on may be beneficial. The linear theory is depicted as a logical driver of transformation in this method

model, which must be followed not only by intervention but also by assessment and readjustment in order to remain valuable (Clark, 2004).

4. Discussion

If DBCIs want to fulfill their mission, they must look at behavior science as a source of static reality rather than a reservoir of information from which to borrow. Instead, DBCIs must add to the behavior science area by using their own skills (Sucala et al., 2020; Wang et al., 2019). DBCIs can provide a continuous stream of data about real-time user activity, meaning, and DBCI use, in addition to interactive interfaces and attractive user features. This data, along with the statistical capability to interpret it, will further advance the field of behavior change by allowing researchers to better understand how people behave in order to create more effective interventions.

Since no one group has the experience or capital to create successful, efficient behavioral health technology on its own, developing effective DBCIs requires deep interdisciplinary collaborations among behavior scientists, programmers, software developers, technology engineers, and data scientists.

Designing systems that enable machine learning and predictive analysis for just-in-time, agile DBCIs necessitates a significant investment of time and money that could outweigh traditional government funding opportunities and even multiple business R&D budgets. Furthermore, with existing computing capacities, real-time human personalization will not be possible to incorporate or maintain on a wide scale. Personalization at the individual level is not possible for existing computing resources for DBCIs that could theoretically affect millions of individuals. Alternatively, new personalization capabilities depend on the ability to identify people into subgroups that are individually receptive to a particular intervention feature or conceptual model of a component, similar to personalized medication.

To summarize, while more nuanced relationship structures and collaborative platforms are expected to develop as technologies and data analytics advance, the behavior science sector no longer needs to create, investigate, and execute its technical solutions in fragmented environments (Aljerf, AlMasri, 2018). The proposed conceptualization could influence academic and business activities, as well as demonstrate the need for collaborative platforms to ensure fruitful collaborations that contribute to more efficient DBCIs and improved health outcomes.

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