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Development of a technology-based behavioral vaccine to prevent adolescent depression: A health system integration model☆,☆☆

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ABSTRACT

Efforts to prevent depression have become a key health system priority. Currently, there is a high prevalence of depression among adolescents, and treatment has become costly due to the recurrence patterns of the illness, impairment among patients, and the complex factors needed for a treatment to be effective. Primary care may be the optimal location to identify those at risk by offering an Internet-based preventive intervention to reduce costs and improve outcomes. Few practical interventions have been developed. The models for Internet intervention development that have been put forward focus primarily on the Internet component rather than how the program fits within a broader context. This paper describes the conceptualization for developing technology based preventive models for primary care by integrating the components within a behavioral vaccine framework. CATCH-IT (Competent Adulthood Transition with Cognitive-behavioral, Humanistic and Interpersonal Training) has been developed and successfully implemented within various health systems over a period of 14 years among adolescents and young adults aged 13–24.

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1. Introduction

Healthcare organizations are increasingly being required to both improve outcomes and reduce costs (McClellan, 2011). Mental disorders in adolescence, which are the single greatest hospitalization cost and source of disability in this age group, will soon be a major target for intervention within child health systems (Bardach et al., 2014). Depression in particular is a common disorder with episodic and chronic courses, marked by considerable impairment that accounts for a substantial proportion of costs incurred. Adolescent depression also accounts for a substantial proportion of future psychiatric, social and medical morbidity (Gladstone et al., 2011).

Reducing the incidence of mental disorders, including depression, in children and adolescents could substantially improve social and developmental factors such as high school graduation rates, work force participation, and relationship functioning in the future (Weisz et al., 2005). Preventive interventions targeting depression have been described as an economically efficient way to effectively reduce the incidence of the disease (Van Zoonen et al., 2014). However, creating models that prevent youth depression proves daunting because of the need to both develop an effective model that improves outcomes and

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costs, as well as the challenge of implementing such a model within a specific context (Gillham et al., 2000; Hoek et al., 2009).

Internet-based behavior change strategies have been proposed as one method that may facilitate a resolution of the cost and outcomes paradox. Several models of Internet- and technology-based learning to prevent or treat psychiatric and medical disorders have been developed as "stand alone entities". Some emphasize the content and importance of taking into account the psychological factors that influence health outcomes (Ritterband et al., 2009), while others focus on the factors related directly to the websites, that impact the "user experience" (Crutzen et al., 2009). Researchers have proposed the need to evolve and test intervention versions using randomization designs to optimize performance (Mohr et al., 2011), as well as consider specific implementation factors that are necessary for treatment efficacy (Durlak and Dupre, 2008).

In this paper, we describe the research and development process of CATCH-IT (Competent Adulthood Transition with Cognitive-behavioral, Humanistic and Interpersonal Training), a web-based depression prevention program designed for adolescents. We outline the scientific and practical steps required to develop an Internet-based prevention for health systems, or an integrated development model. We have previously posited that "technology-based behavioral vaccines" provide the optimal framework necessary to implement an Internet-based prevention program within a healthcare setting (Van Voorhees et al., 2011). Similar to the steps involved in the development of biological vaccines, the development of CATCH-IT incorporated specific preventive components that began with exploratory research, moved through pre-clinical research, and involved 3 clinical trials over a period of 14 years. The goal for CATCH-IT is to become a universal public health strategy, or behavioral vaccine, for the prevention of major depression among adolescents.

The development of a technology-based behavioral vaccine requires an extensive process to ensure each component is thoroughly developed in order to create the appropriate implementation that can maximize outcomes (i.e. reduce symptoms or prevent depressive episodes) (Van Voorhees et al., 2011). Much like the development of biological vaccines, the development of behavioral vaccines requires time, effort, and scientific expertise. Vaccine development is a multi-step process that can take years and in some cases, several decades. The research and development process moves through defined stages that take a candidate, such as CATCH-IT, from a concept to a licensed product (Collins, 2005). These processes include exploratory and pre-clinical phases. In this paper, we describe the current intervention, CATCH-IT 3, which is being evaluated presently through a grant from the US National Institute of Mental Health (Van Voorhees et al., 2011). We describe the process of developing the intervention, from exploratory research (1998–2006), to pre-clinical research (2002–2011), and then through the development and delivery of the program with revisions based on clinical research (2004-present).

2. Material and methods

2.1. Behavioral vaccine framework

The behavioral vaccine concept (Embry, 2002) provides a framework to develop and understand the model for what we call a technology based behavioral vaccine (Van Voorhees et al., 2011). We have described four key components of a behavioral vaccine that take into account both therapeutic and contextual factors. The therapeutic elements (see Fig. 1 below) include (1) a *life course schedule* that is theory-driven and includes booster doses and (2) active *effective components* of information and training to encode responses to future threats that can then be deployed at some future point. The contextual elements involve (3) a *motivational framework* to boost response to behavior prescription and (4) a *structured implementation strategy* to optimize intervention effectiveness (Van Voorhees et al., 2011). Below we use the behavioral vaccine framework to describe the revision process for the CATCH-IT model. Specifically, for each therapeutic element of the behavioral vaccine model (i.e., life course schedule, effective components, motivational framework, structured implementation strategy), we provide details about intervention development, and about the use of that element within the CATCH-IT 3 program.

In addition, we present a discussion of regulatory and administrative issues involved in the development and implementation of the CATCH-IT intervention.

2.2. Life course schedule

2.2.1. Intervention development

Intervention development first began at Johns Hopkins University, continued at The University of Chicago, and moved to the University of Illinois at Chicago. Van Voorhees led an interdisciplinary team of investigators in a multi-step development process: (1) initial translation by a primary care physician of manuals for face-to-face preventive interventions; (2) Internet-site design using an informal focus group; (3) serial fidelity reviews by a health psychologist, manual authors, and a practicing psychotherapist; and (4) socio-cultural review by an adolescent editor. The prototype intervention included an initial motivational

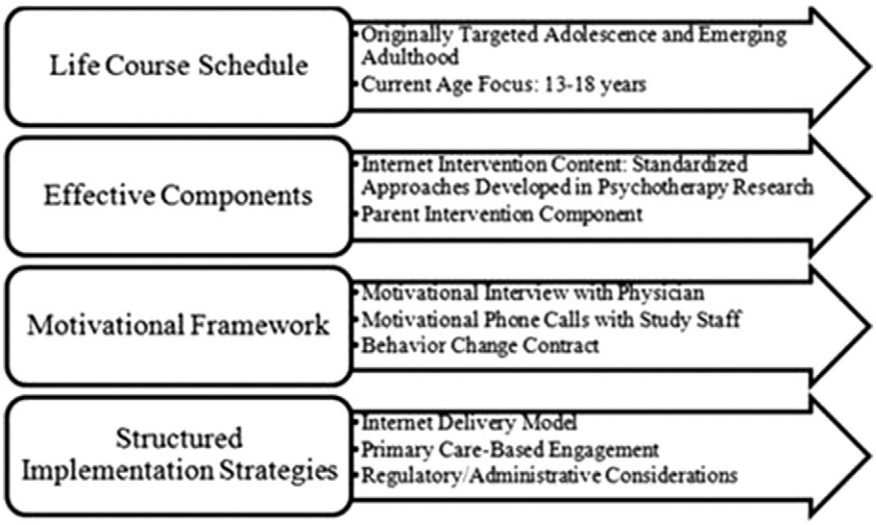

Fig. 1. Components of technology-based behavioral vaccine.

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