

UNC CENTER FOR THE BUSINESS OF HEALTH

*Assessing the Economic Value of Changing Various Health Behaviors
Using Mobile Health Interventions*

Katrina Donahue, MD, MPH

*Professor and Vice Chair of Research, Department of Family Medicine
Charles B. Wilkerson, Sr. Distinguished Professor
UNC School of Medicine*

George Kernodle, MHA, MTS

*Professor of the Practice
Kenan-Flagler Business School*

Patrick Le

*Howard Holderness Distinguished Medical Scholar
UNC School of Medicine*

Larissa M. Loufman, MPH, RD, CLC, CCRC

*Public Health Researcher, Department of Family Medicine
UNC School of Medicine*

Michael Rickles, Ph.D.

*Executive Director, Research Strategy
Sharecare*

Bradley Staats, MBA, DBA

*Associate Dean of M.B.A Programs
Faculty Director, UNC Center for the Business of Health
Kenan-Flagler Business School*

July/August 2020

Assessing the Economic Value of Changing Various Health Behaviors Using Mobile Health Interventions

In December 2019, the University of North Carolina at Chapel Hill (UNC) Center for the Business of Health (CBOH) began a research partnership with Sharecare, a leading digital health company founded by technology entrepreneur, Jeff Arnold, to assess the economic value of changing various health behaviors via mobile health (mHealth) interventions. The purpose of the research is to understand the efficacy and feasibility of mHealth interventions to change individual behaviors, promote health awareness and positive lifestyle choices, and lower direct medical costs through disease prevention and management. Both the CBOH and Sharecare identified a common interest in addressing the gaps in the current academic literature to support a better understanding of the economic impact(s) of targeted well-being interventions.

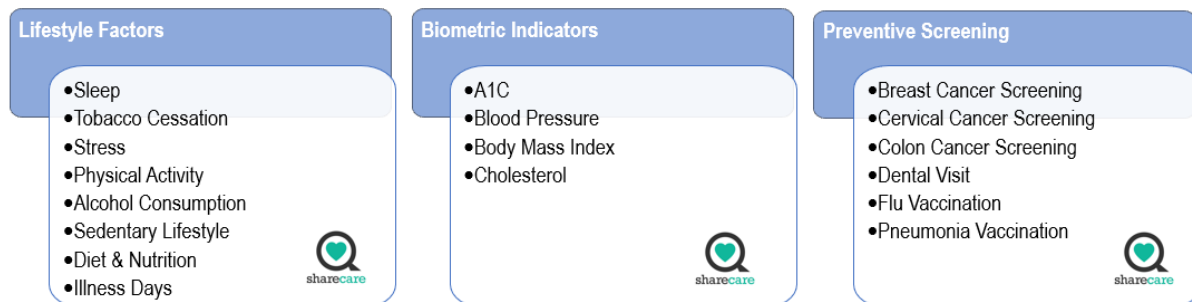
Sharecare and the CBOH bring unique and complementary skills and capabilities to this partnership. Sharecare is an innovative health IT company that seeks to promote health transformation by empowering individuals, communities, and organizations through engagement with a comprehensive technology platform which includes a mHealth application and online services as well as programs to assess specific health behaviors. They bring a wealth of experience and knowledge about digital health platform utilization, adoption, retention, and efficacy. Additionally, through various academic and private partnerships, Sharecare has incorporated its access to nationwide data on social determinants of health (SDOH) and community well-being to develop several proprietary indices for measuring these concepts. Since launching the CBOH in 2018, Professor Brad Staats, Associate Dean of M.B.A. Programs at the Kenan-Flagler Business School and Faculty Director for the CBOH, has worked to engage corporate partners and collaborate with health care experts across UNC Chapel Hill to drive insights around health, healthcare, and well-being in North Carolina. Aligning with the CBOH's mission to bring together expertise from across UNC to create new knowledge, build business capabilities for healthcare leaders, and convene important conversations on the business of healthcare, Professor Staats and Dr. Katrina Donahue, the Charles B. Wilkerson Senior Distinguished Professor and Vice Chair of Research at the UNC Department of Family Medicine, developed an interdisciplinary, multi-phased research plan to advance the current medical and economic knowledge.

Research Scope

The overall goal of the research is to understand the value of implementing mHealth interventions to improve and manage health. The current academic literature identifies positive correlations between mHealth interventions and behavior change. However, the actual economic value of these individual and/or collective interventions across diverse populations is unclear due to the proprietary nature of this data and economic evaluation techniques such as Return on Investment (ROI) analysis failing to capture the fullness of application-based lifestyle intervention programs by focusing exclusively on medical claims data. As a result, the CBOH and Sharecare decided to use a Value on Investment (VOI) evaluation model to understand the financial and non-financial impacts of mHealth interventions through the full lifecycle of a direct-to-consumer application-based product which includes onboarding, messaging, engagement, and activation. VOI models have grown in popularity as evaluation tools, particularly in the well-being space, due to their ability to assess and quantify the value of investments beyond traditional financial instruments to capture intangible assets or benefits of a product.

Through multiple conversations with Dr. Michael Rickles, Sharecare's Executive Director of Research Strategy, and Elizabeth Colyer, Senior Vice President of the Community Well-Being Index, the research team began by focusing on common lifestyle, biometric, and screening indicators (Figure 1).

Figure 1. CBOH's Initial Research Categories and Metrics for Evaluation



The team identified definitions for each of the metrics using the latest medical guidance and developed an innovative research design that incorporated skills and knowledge from across various academic disciplines. The UNC Department of Family Medicine research team began by examining the existing literature to understand the value and impact of mHealth interventions, while the UNC Kenan-Flagler researchers used micro-simulation techniques to model the impact of intervening on these metrics.

Our Innovative Research Design

The CBOH launched the research partnership by leveraging the skills and talents of a UNC Kenan-Flagler Student Teams Achieving Results (STAR) team. The Kenan-Flagler STAR program matches teams of the brightest M.B.A., undergraduate business, and other UNC graduate students with corporate partners to solve complex business challenges. Faculty Advisor George Kernodle, Dr. Rickles, and Daniel Morgan, M.B.A. Class of 2021, led a multidisciplinary team of UNC students through a proven consulting framework to develop a two-year research strategy and workplan that outlined clear workstreams across UNC departments, opportunities for collaboration and engagement with Sharecare, key milestones for research outputs, and a model framework for assessing the economic impact of interventions.

The research plan outlined by UNC and Sharecare, and further developed by the STAR team, includes two primary workstreams:



Scoping Reviews of mHealth Interventions on Prevention and Screenings: Dr. Donahue and Larissa M. Loufman, M.P.H., R.D., C.L.C., C.C.R.C., a UNC Department of Family Medicine public health researcher, are conducting scoping reviews of the existing medical literature to assess the effect of mHealth interventions on improving health behaviors. This work stream seeks to determine the impact, composition, delivery methods, and outcomes measured in mHealth interventions to impact the health metrics outlined in Figure 1 and summarize the overall findings from these studies. The goal of this work also includes identifying the prevalence of short- and long-term conditions that can develop in the absence of healthy behaviors.



Economic Analysis of Health Metrics: Leveraging the data and inputs from the first research workstream with additional primary and secondary research, Professor Staats leads the CBOH staff and Patrick Le, a fourth-year medical student and Howard Holderness Distinguished Medical Scholar, through the development of a micro-simulation model to identify the direct medical costs associated with each wellness condition. The research team incorporates analyses from multiple national and regional data sets to identify intermediate outcomes, prevalence rates, care treatment pathways, and direct medical costs for each condition. These data are input into a flexible Excel model that allows the end-user to adjust the population size, risk profile, and financial reimbursement amount to align with specific population characteristics.

These complementary workstreams, which will continue throughout the research collaboration, inform the team's understanding of the overall effectiveness and economic impact of mHealth interventions to improve health and reduce costs. Together, they provide an evidence-based lens for understanding mHealth management options and reviewing health technology company claims regarding product efficacy and financial feasibility.

Preliminary Outcomes

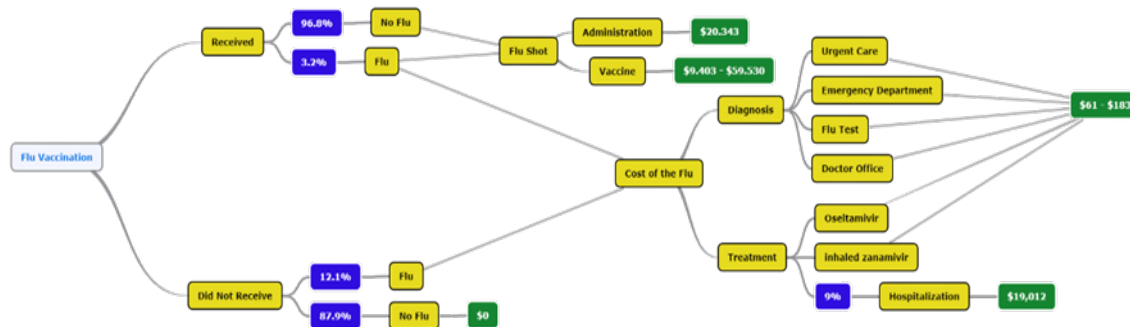
Since January 2020, the research team has evaluated the economic impact of 12 metrics and assessed the efficacy of various types of mHealth interventions. Preliminary results indicate that, although some interventions slightly increase per person healthcare costs in the immediate year following intervention (i.e., preventive screenings), the majority still lead to longer-term improvements in the health of the population being addressed. These benefits reduce annual per person health care costs by a wide range such as approximately \$88 (i.e., flu vaccination) to well over \$2,000 (i.e., sleep, sedentary lifestyle, Hemoglobin A1c). As hypothesized, the research team identified the most significant per person economic impacts for interventions that promote lasting behavior change.

Preliminary results of the scoping reviews reveal a range of effectiveness of mHealth interventions to promote behavior change that results in positive outcomes. Some interventions are effective over short periods of time, but fail to assess or influence long-term behavior change. However, the research consistently indicates positive, sustained outcomes for mHealth products/applications that are paired with real-time feedback or support mechanisms (i.e., behavior coaching, personalized messaging, program accountability). For example, the UNC Department of Family Medicine team reviewed the efficacy of smoking cessation interventions by assessing the impact and outcomes of telephone hotlines, text messaging programs, and web-based applications. They concluded that application and text message-based mHealth interventions can improve engagement with cessation programs by expanding communication through tailored, asynchronous, and real-time messaging with support networks and by reducing barriers to access such as cost, location, and timing/schedule conflicts. This example highlights the effectiveness of mHealth interventions to supplement and enhance traditional interventions to create lasting behavior change and improve individual and community well-being.

In addition to evaluating the effectiveness of various mHealth interventions, the UNC Kenan-Flagler team modeled the impact of interventions to assess their economic value. As demonstrated in Figure 2, they

developed flowcharts of each intervention to depict an average healthy working adult’s potential health outcomes, medical treatment pathways, and associated costs of care.

Figure 2. Flowchart Detailing the Economic Impact of Receiving a Flu Vaccination



The team determined a weighted average dollar value for each intervention by identifying the probabilities (blue boxes) and direct medical costs (green boxes) of certain diseases and treatment pathways (yellow boxes) in the immediate year following intervention among populations that received or did not receive the intervention. For example, the team determined the weighted average per person value of the flu vaccination to be \$88.70 using the inputs provided in Figure 2. Among the population that received the flu shot, only ~3% became ill compared to nearly 12% of the population that did not receive the shot. Direct health care costs for flu-infected patients without hospitalization ranged from \$61 - \$183. However, for the 9% of infected individuals that required hospitalization, direct medical costs increased severely to over \$19,000. By reducing the number of potential hospitalizations, the flu vaccine can lower direct medical costs by nearly \$90 per person.

Future Phases

The next phases of this research collaboration will expand on the current work to continue refining the economic analysis and extend the model to other phases of health management including medication adherence, medical consumption habits, and drivers of high-cost/high-touch programs (i.e., chronic disease management). As the CBOH team considers opportunities to submit portions of this research to peer-reviewed journals, the research continues to reveal new and interesting insights. In the words of Professor Staats, “The CBOH is thrilled to be working with Sharecare on this important work. We see great potential in this particular research effort, as well as our larger strategic partnership. By bringing together some of the brightest minds from UNC and Sharecare, we can advance the health care industry’s understanding of the drivers of health, lower the costs to the consumer and health care system, and improve individual and community well-being across the state of North Carolina.”