An Exploration of the Effectiveness of the Fun For Wellness Online Intervention to Promote Health in Adults with Obesity: A Randomized Controlled Trial

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Abstract

Fun For Wellness (FFW) is an online behavioral intervention developed to promote well-being by enhancing the self-efficacy of participants. The objective of this study was to evaluate the effectiveness of FFW to promote health in adults with obesity in the United States of America in a relatively uncontrolled setting. The study design was a large-scale, prospective, double-blind, parallel group randomized controlled trial. Data collection occurred at three time points: baseline, 30 days, and 60 days after baseline. There was evidence for a positive direct effect of FFW on physical health status ($\hat{\beta} = 1.33$, $p = .005$, $d = 0.24$) at 60 days after baseline. In addition, there was evidence of a positive indirect effect of FFW on mental health status at 60 days after baseline through psychological well-being self-efficacy ($\hat{\beta} = 0.44$, [0.05, 0.94]).

Keywords: e-Health, m-Health, self-efficacy theory, well-being, health promotion, physical well-being self-efficacy, psychological well-being self-efficacy, mediation, physical health status, mental health status

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Approximately one-third of adults who are overweight can more precisely be classified as adults with obesity, and the size of this sub-group has tripled over the past few decades (World Health Organization, 2018). Globally, it is estimated that two billion adults are overweight (WHO, 2018). This trend is problematic because people with obesity may be at risk for major non-communicable chronic diseases such as cardiovascular disease, type II diabetes, musculoskeletal disorders, and some cancers (United States Department of Health and Human Services [USDHHS], 2013). To reduce the prevalence of adults with obesity, the WHO (2018) recommends that individuals engage in regular physical activity (e.g., 150 minutes at moderate intensity per week). Unfortunately, there is evidence that a very small percentage (e.g., < 5%) of adults with obesity meet public health guidelines for physical activity (Tudor-Locke et al., 2010). Fortunately, there is also evidence that cognitive-behavioral interventions can successfully promote physical activity in adults with obesity (Gourlan et al., 2011). To encourage sustained engagement in physical activity, the potential for experiencing health benefits across a broad array of health dimensions may be targeted and emphasized (Sullivan et al., 2001; USDHHS, 2013). Focused interventions for populations at risk are an established practice in prevention science (e.g., United States Preventive Services Task Force, 2018).

The objective of the current study was to evaluate the effectiveness of the Fun For Wellness (FFW) intervention to increase the physical and mental health of adults with obesity in the United States of America (USA), in a relatively uncontrolled setting. This is a population that could benefit from more resources, not just in improving physical health, but also in emotional well-being. The study described here was conceptualized as an effectiveness trial that built upon

a FFW efficacy trial completed in a relatively controlled setting (i.e., adult employees at a major research university in the USA) (Myers, Prilleltensky, Prilleltensky, et al., 2017). The present investigation is significant because the potential benefits of interventions should be evaluated under both ideal (e.g., more controlled) and real-world (e.g., less controlled) conditions (Singal et al., 2014). Prior to reporting the findings from the FFW efficacy trial and the hypotheses in the current study, we describe our theory of change, the promise of online interventions, and the rationale for the study.

Self-Efficacy

FFW is informed by self-efficacy theory (Myers, Prilleltensky, Hill, & Feltz, 2017). According to this theory, the beliefs held by individuals about their ability to perform certain actions can affect outcomes related to physical and mental health (Bandura, 1997). Self-efficacy beliefs rely upon four primary sources: enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological and/or emotional states. In FFW, enactive mastery experiences derive from playing and mastering interactive games. Participants are exposed to vicarious experiences of self-efficacy when they watch vignettes performed by professional actors. Verbal persuasion is experienced through exposures to mini-lectures by coaches. Finally, participants can derive a feeling of self-efficacy through physiological and emotional responses to self-reflection exercises. The scientific literature supporting each of these proposed sources of self-efficacy information in physical activity contexts is reviewed in Feltz et al. (2008). Furthermore, targeting self-efficacy as a potentially modifiable mediating variable via intervention is an established practice in prevention science (e.g., MacKinnon et al., 2001; Payton et al., 2000).

Online Interventions

Although face-to-face preventive interventions are effective in addressing mental and physical health conditions (Conley et al., 2015; Nelson et al., 2015; Prilleltensky & Nelson, 2013), they are limited in reach and very labor intensive. Online interventions, in turn, offer many benefits in the promotion of healthy behaviors and the prevention of adverse conditions: scalability, interactivity, affordability, accessibility, and fidelity of implementation (Moessner et al., 2015; Portnoy et al., 2008; Proyer et al., 2014).

There is evidence that online preventive programs are effective. In a review of randomized controlled trials, researchers found that online programs improved knowledge, attitudes, intentions and behaviors associated with tobacco use, substance use, nutrition, eating disorders, and sexual behaviors (Portnoy et al., 2008). In an internet program aimed at reducing stress and promoting physical activity, meaningful improvements were found in overall well-being, emotional health, physical health, healthy behaviors, and life evaluations (Prochaska et al., 2012). Other studies have shown the efficacy of web-based and mobile interventions in areas such as drug abuse prevention (Schwinn et al., 2010), eating disorders (Moessner et al., 2015), and emotional well-being (Cobb & Poirier, 2014; Proyer et al., 2014).

Fun For Wellness

Depending both on readiness (Norcross, 2012) and individual differences in change strategies (Dolan, 2014; Klingemann & Sobell, 2007), some people relate better to certain strategies than to others. Therefore, we found it necessary to create an intervention that would incorporate a variety of strategies and modes of learning. With regard to the latter, FFW incorporates skill building and scenario-based learning, which are superior to didactic methods (Conley et al., 2015; Irvine et al., 2015). FFW utilizes several learning modalities, including case studies with real actors, video games, mini-coaching sessions, reflection exercises, and humor.

Each activity is called a challenge. In total, there are 152 challenges in FFW (for more details on the intervention, please see Myers, Prilleltensky, Lee, et al., 2019 and Myers, Prilleltensky, Prilleltensky, et al. 2017). The challenges derive from a model of change summarized in the acronym BET I CAN, which stands for Behaviors, Emotions, Thoughts, Interactions, Context, Awareness, and Next Steps. These are conceptualized as drivers of change because each one can be leveraged to modify a habit, thought, or emotion to exert a positive impact on well-being.

Each BET I CAN driver of change is taught to participants through two specific skills: *behaviors* (how to set a goal and how to create positive habits), *emotions* (how to cope with negative emotions and how to cultivate positive emotions), *thoughts* (how to challenge negative assumptions and how to create a new narrative about our lives), *interactions* (how to connect and how to communicate), *context* (how to read cues and how to change cues in the environment), *awareness* (how to know yourself and how to know the issue), and *next steps* (how to make a plan and how to make it stick). For example, under *emotions*, participants are taught how to cultivate positive emotions through savoring, gratitude, and mindfulness. Under *behaviors* participants are taught how to set an achievable goal such as exercising daily and eating more fruits and vegetables. Under *thoughts*, participants are taught how to develop a growth mindset and combat a fixed mindset. Under *interactions*, they are taught active listening. Each challenge or activity lasts approximately two to four minutes. Participants have access to FFW 24/7. The software keeps track of the user's progress and engagement with the program. A progress bar in the form of a thermometer shows participants how much they have accomplished already and how much is left in the program. All told, the program is about 12 hours long.

Hitherto, FFW has shown positive results in certain domains of health with a population of healthy adults and with a population of people with obesity. With regard to the former, a

randomized controlled trial demonstrated that the program was instrumental in enhancing psychological, interpersonal, community, and economic subjective well-being (Myers, Prilleltensky, Prilleltensky, et al., 2017). These outcomes were measured using the I COPPE scale (Prilleltensky et al., 2015), which evaluates satisfaction with different life domains. In addition, FFW generated actions to promote well-being in the interpersonal and physical domains of health (Myers, Dietz, et al., 2018). Specifically, participants reported engaging in wellness-enhancing behaviors such as eating more fruits, vegetables and legumes; exercising more; and nurturing relationships. Finally, FFW increased well-being self-efficacy (Myers, Prilleltensky, Hill, & Feltz, 2017). This means that participants reported more confidence in their ability to undertake actions to promote their own wellness.

With regard to the population of people with obesity, a second RCT with FFW showed that participants increased their self-efficacy in terms of physical activity, and that, in turn, self-efficacy increased their actual physical activity (Myers, McMahon, et al., 2020). In addition, FFW improved community, occupational, physical, and psychological wellness (Myers, Prilleltensky, et al., 2020). This study measures the impact of FFW on the physical and mental well-being of participants.

Summary and Rationale for Present Study

In light of previous positive results using FFW with the general population and with people with obesity, and in light of the many health risks faced by the latter, this study sought to ascertain whether FFW can enhance physical and mental health within this population. In addition, given that previous studies have shown that self-efficacy is an important mediator in achieving positive health outcomes, we wanted to examine its role in fostering physical and mental health in people with obesity. Specifically, we wanted to study (a) whether FFW can have

a direct effect on the physical and mental health of people with obesity, and (b) whether self-efficacy can play a role in these outcomes as a mediating variable. Figure 1 displays our conceptual model. Whereas previous studies using FFW measured subjective well-being outcomes with the I COPPE scale (Prilleltensky et al., 2015), the present investigation uses as the main outcome the 36-item Optum™ SF-36v2 Health Survey (Ware, 2000; Ware & Kosinski, 1996). It was important for us to test in this study the effects of FFW using metrics that examine not just subjective well-being, as does the I COPPE scale, but also symptomatology related to physical and mental health status. This is why we chose to focus this study on the Optum™ SF-36v2 Health Survey.

Hypotheses

Four exploratory hypotheses were investigated in the current study based on the conceptual model depicted in Figure 1. Hypothesis 1 was that the FFW intervention would exert a positive direct effect on well-being self-efficacy. Hypothesis 2 was that well-being self-efficacy would exert a positive direct effect on health. Hypothesis 3 was that the FFW intervention would exert a positive direct effect on health. Hypothesis 4 was that the FFW intervention would exert a positive indirect effect on health through well-being self-efficacy. Dimension-specific hypotheses for physical and mental health status were not made due to a lack of previous research on the effectiveness of the FFW intervention with this particular population.

Method

All procedures in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The institutional review board at the University of Miami provided necessary permission (IRB# 20170541) to

conduct this study on July 11, 2017. The University of Miami and Michigan State University (STUDY00000979) established an Institutional Authorization Agreement on June 26, 2018 that provided permission for the University of Miami to serve as the designated IRB for this study.

Trial Registration

The data described in this manuscript were collected within a broader clinical trial, the Well-Being and Physical Activity Study (ClinicalTrials.gov, identifier: NCT03194854). Within this section we provide an overview of the relevant methods used in the Well-Being and Physical Activity Study to provide a context for the specific focus of this manuscript (American Psychological Association, 2010). Readers are referred to Myers et al. (2019) for a fuller description of the protocol for the Well-Being and Physical Activity Study. A populated CONSORT (Consolidated Standards of Reporting Trials)-EHEALTH checklist was provided for the Well-Being and Physical Activity Study by Myers, McMahon, Prilleltensky et al. (2020), who reported on the physical activity outcome data. The health outcome data that are the primary focus of this manuscript have not been considered in any previous report. The demographic covariates and compliance data briefly reported in subsequent sections of this manuscript, however, have also been reported by Myers, McMahon, Prilleltensky et al. (2020). See also Table 1.

Study Design

The study design was a large-scale, prospective, double-blind, parallel group randomized controlled trial (RCT). Recruiting, screening, random assignment and collection of data were conducted online from August 2018 through November 2018. Data collection occurred at three time points: baseline (T1), 30 days (T2) and 60 days (T3) after baseline. The timeline for this

study was similar to timelines used in other well-being (Hendriks et al., 2019) and physical activity (de Vries et al., 2016) interventions.

Recruitment and Eligibility

A sample size of approximately nine hundred participants was targeted for enrollment in the study. Participants were recruited through the general population panel of the SurveyHealth (http://www.surveyhealthcare.com/) recruitment company. Partnering with a panel recruitment company is consistent with recruitment in preliminary research on FFW (e.g., Prilleltensky et al., 2015) and with a movement toward larger and smarter health promotion interventions (Bauer et al., 2014; Reis et al., 2016). Eligibility criteria were: (a) ability to access the online intervention, (b) living in the USA, (c) 18 years old $\leq$ age $\leq$ 64 years old, (d) body mass index $\geq$ 25.00 kg/m^2, and (e) absence of simultaneous enrollment in another intervention program promoting either well-being or physical activity. The BMI criterion included the overweight (i.e., 25.00-29.99 kg/m^2) category consistent with many physical activity-promoting interventions for adults with obesity (Gourlan et al., 2011).

Informed Consent

Informed consent was obtained from each participant included in the study. More specifically, immediately after being determined to be eligible for this study, each eligible individual was directed to a web-based, IRB-approved informed consent form. Each individual who clicked "Consent to Participate" was enrolled as a participant in the study. Each individual who clicked "Decline to Consent" was denied access to any further study-related activities. It is worth noting that participants were not required to engage in strenuous physical activity. The program was strictly psychoeducational and did not demand from participants to engage in any

physical activity. They were encouraged to do so, but it was not requested. Furthermore, participants read a medical disclaimer explaining that FFW does not replace medical care.

Random Assignment

Random assignment of each eligible participant occurred after (a) a unique and secure login credential was created, (b) informed consent was obtained, (c) a medical disclaimer was agreed to, and (d) the T1 survey battery was completed. Eligible participants were randomly assigned to the intervention (i.e., FFW) or the usual care (i.e., UC) group via software code that was written to accomplish equal allocations to the FFW and UC groups. Participants assigned to the FFW group were given immediate access to the intervention. Participants assigned to the UC group were put on a waitlist for access to the intervention. Please see Table 1 for further details on the demographic composition of our sample.

Usual Care. Participants assigned to the UC group were asked to conduct their lives as usual. The login credential for each UC participant provided access to a secure website to complete the survey battery at T1, T2, and T3. Usual care participants had the opportunity to earn up to $30 worth of Amazon electronic gift cards. Specifically, UC participants could earn $5 for completing the T1 survey battery, $10 for completing the T2 survey battery, and $15 for completing the T3 survey battery. Usual care participants were given one month of 24-hour access to the FFW intervention after data collection for this study was closed.

Fun For Wellness. Participants assigned to the FFW group were asked to engage with the FFW intervention. The login credential for each FFW participant provided 30 days (i.e., from T1 to T2) of 24-hour access to the 152 BET I CAN challenges, as well as access to a secure website to complete the survey battery at T1, T2, and T3. Fun for Wellness participants had the opportunity to earn a total of $45 worth of Amazon electronic gift cards. Specifically, FFW participants

could earn $5 for completing the T1 survey battery, $10 for completing both the T2 survey battery and at least 15 BET I CAN post-introductory challenges (plus an additional $15 for completing at least 30 BET I CAN post-introductory challenges), and $15 for completing the T3 survey battery.

Participants were required to complete four introductory challenges in order to gain access to the remaining 148 post-introductory BET I CAN challenges. These introductory challenges provided an orientation to the website and to the characters that appear in the vignettes. Participants self-selected which post-introductory BET I CAN challenges to complete. Challenges completed by each participant were tracked by computer software to provide data (i.e., participation points) for the FFW engagement scoring system (Myers, Prilleltensky, Prilleltensky, et al., 2017). Earning at least 21 participation points was the operational definition for being engaged with the FFW intervention (Myers et al., 2019).

Survey Battery

Instruments designed to measure demographic information, well-being self-efficacy, and health were included in the survey battery. Proposed demographic covariates of well-being were collected via self-report at T1 and included participant gender, race/ethnicity, highest level of education completed, marital status, employment status, age, and household annual income (Rubenstein et al., 2016). This set of demographic variables is collectively referred to as the demographic covariates from this point forward.

Health. Health was measured at T1 through T3 with the well-established 36-item Optum™ SF-36v2 Health Survey (Ware, 2000; Ware & Kosinski, 1996). Summary measures comprising two components, physical health status ($\alpha = .89$) and mental health status ($\alpha = .82$), were derived from previous psychometric reports (Ware et al., 1994; Ware et al., 1995; Ware et

al., 1998; Ware et al., 2007). From an empirical perspective, the two-component scoring approach (physical and mental health) offered more precision than the eight-health-domain scoring approach (Maruish, 2011). From a conceptual perspective, the two-component scoring approach better aligned with the focus of the FFW intervention because the intervention targets both physical and mental health and not necessarily some of the other domains such as bodily pain and social functioning. The physical health status component asks participants about their ability to engage in physical activities such as carrying groceries, climbing stairs, and walking a mile. In addition, it asks about feeling sick and changes in their health. The mental health status component, among other things, asks about feeling nervous, depressed, happy, and peaceful.

Well-Being Self-Efficacy. Instead of using a general self-efficacy measure, our team developed a specific *well-being self-efficacy* measure, which is, according to various authors, the preferred mode of assessing self-efficacy (Bandura, 2006; Myers, Prilleltensky, Hill, & Feltz, 2017; Myers, McMahon, Prilleltensky, et al., 2020). Our measure, as we shall explain below, measures *physical well-being self-efficacy* and *psychological well-being self-efficacy* separately.

Well-being self-efficacy was measured at T1 through T3 with two subscales, the physical well-being self-efficacy ($\alpha = .77$) and the psychological well-being self-efficacy ($\alpha = .78$) of the Well-Being Self-Efficacy (WBSE) Scale (Myers, Prilleltensky, Hill, & Feltz, 2017; Myers et al., 2019). Physical well-being self-efficacy was defined as the degree to which individuals perceive that they have the capability to attain well-being in their physical health and wellness. Psychological well-being self-efficacy was defined as the degree to which individuals perceive that they have the capability to attain well-being in their psychological and emotional experiences. Each of the two subscales has a unique item stem asking participants about their perceived capability in each domain in three different time periods: past (30 days ago), present

(right now), and future (30 days from now). This 6-item version of the WBSE Scale was concordant with health as conceptualized in the FFW context (i.e., physical health status and mental health status) based on guidelines for the construction of self-efficacy scales (Bandura, 2006). Both of these dimensions of well-being self-efficacy had an exclusive item stem that referenced three unique periods of time: past (i.e., 30 days ago), present (i.e., right now), and future (i.e., 30 days from now). The exclusive item stem for physical well-being self-efficacy was "your physical health and wellness." The exclusive item stem for psychological well-being self-efficacy was "your psychological and emotional well-being." Responses to each item were organized within a five-category rating scale structure, where 0 = no, 1 = low, 2 = moderate, 3 = high, and 4 = complete confidence, based on previous psychometric research on effective self-efficacy rating scale structures (Myers et al., 2008).

Data Analytic Approach

A path model was fitted in Mplus 8.4 with maximum-likelihood (ML) estimation with robust standard errors (Muthén & Muthén, 1998-2017). Type I error rate was set equal to .05. Missing data were addressed with full information ML estimation using the observed information matrix under the assumption of missing at random (MAR; Schafer & Graham, 2002). Indexes of model-data fit considered were: the exact fit test $\left(\chi^2_R\right)$, root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), and the Tucker-Lewis index (TLI) consistent with relevant recommendations (e.g., Kline, 2016). Latent variable reliability was measured with coefficient *H* (Hancock & Mueller, 2001). Component score reliability was assessed with Cronbach's alpha (Cronbach, 1951; Raykov & Marcoulides, 2019). Indexes of effect size for direct effects on component score variables were Cohen's *d* (1988) and percentage of observed variance explained. Indexes of

effect size for direct effects on latent variables were latent mean difference (Hancock, 2001) and percentage of latent variance explained. The latent mean difference coefficient is an analog to Cohen's *d* (1988) and also is denoted as *d* from this point forward. Commonly used heuristics were used to assist in the interpretation of an absolute value of Cohen's *d*: .20 (small), .50 (medium), and .80 (large). For each indirect effect a bias-corrected bootstrapped estimate of the 95% confidence interval (CI) was obtained with the number of draws set equal to 2000 (MacKinnon, 2008). An index of effect size was not considered for indirect effects because an effect size index for complex mediation models with latent variables has not yet been established (Lachowicz et al., 2018).

Path Model. An over-identified (*df* = 212) path model was fitted to the data consistent with the conceptual model depicted in Figure 1 under an intent-to-treat approach (Hollis & Campbell, 1999). Latent physical well-being self-efficacy at T2 was regressed on FFW (i.e., a dummy coded variable, where 0 = UC, 1 = FFW), latent physical well-being self-efficacy at T1, physical health status at T1, and demographic covariates. Latent psychological well-being self-efficacy at T2 was regressed on FFW, latent psychological well-being self-efficacy at T1, mental health status at T1, and demographic covariates. Physical health status at T3 was regressed on FFW, latent physical well-being self-efficacy at T2, physical health status at T1, and demographic covariates. Mental health status at T3 was regressed on FFW, latent psychological well-being self-efficacy at T2, mental health status at T1, and demographic covariates. The expression "adjusted (latent) mean difference," is used from this point forward to acknowledge the statistical adjustment made by including covariates in the model. Each of the four latent variables had three unique indicators.

There were four sets of focal parameters in the path model. The first set of focal parameters was the direct effects of FFW on the two domains of latent well-being self-efficacy at T2 (i.e., β_1). Each of these two parameters was interpreted as the adjusted mean difference on latent well-being self-efficacy (i.e., physical or psychological) at T2 for the FFW group as compared to the UC group. The second set of focal parameters was the direct effects of the two domains of latent well-being self-efficacy at T2 on the corresponding health status at T3 (i.e., β_2). Each of these two parameters was interpreted as the path coefficient from a particular domain of latent well-being self-efficacy (e.g., physical) at T2 to the corresponding health status (e.g., physical) at T3. The third set of focal parameters was the direct effects of FFW on the two health statuses at T3 (i.e., β_3). Each of these parameters was interpreted as the adjusted mean difference on health status (i.e., physical or mental) at T3 for the FFW group as compared to the UC group. The fourth set of focal parameters was the indirect effects of FFW on the two health statuses at T3 through the corresponding domain of latent well-being self-efficacy at T2 (i.e., β_4, where $\beta_4 = \beta_1 * \beta_2'$). Each of these two parameters was interpreted as the product of path coefficients from FFW to a particular health status (e.g., mental) at T3 through the corresponding domain of latent well-being self-efficacy (e.g., psychological) at T2. Each set of focal parameters tested the numerically corresponding hypothesis (e.g., β_1 tested hypothesis 1).

Necessary Sample Size. Necessary sample size was determined for a fixed level of power for rejecting the null hypothesis that the population model-data fit of the path model was at or exceeded a particular value for poor model-data fit (MacCallum et al., 1996) using an online utility (Preacher & Coffman, 2006) consistent with relevant recommendations (Myers, Ntoumanis, et al., 2018). Population model-data fit (i.e., ε) in the RMSEA metric was set equal to .05 in the null condition (i.e., ε_0), which defined the boundary for poor model-data fit. Two

values of population model-data fit were specified, .02 and .04, in the alternative condition (i.e., ε_1). Type I error was set equal to .05. Degrees of freedom were set equal to 212. Power was set equal to .80. When $\varepsilon_1 = .02$ necessary sample size was equal to 137. When $\varepsilon_1 = .04$ necessary sample size was equal to 455.

Results

Participant Characteristics

Figure 2 depicts participant flow from eligibility screening to randomization to retention over the three measurement occasions for the health outcome data. A total of 821 consented participants were randomly assigned to FFW (n = 410) or UC (n = 411). Forensic analysis by a computer scientist done prior to data analysis identified 154 cases as fraudulent and these cases were excluded from analysis leaving 667 analyzed cases (i.e., participants), FFW (n = 331) or UC (n = 336). The researchers initiated the forensic analysis and then consulted with the designated IRB, legal counsel, and the office of research compliance and quality assurance about the computer scientist's report of suspicious activity on the website (e.g., participants logging in very close temporal proximity and sending identical e-mails to the computer scientist in inadequate English). The forensic analysis revealed that all of these 154 accounts were made by one user and/or group through two virtual private server services. The analysis was reported as a Reportable New Information (RNI#00003760) incident to the designated IRB in December 2018.

An exploratory logistic regression model with the demographic covariates specified as predictors provided evidence that the Hispanic variable (i.e., b = 1.00, p = .030) and the age variable (i.e., b = 0.05, p = .002) were significant predictors of missing data (i.e., 0 = not missing, 1 = missing) at T2, while the Hispanic variable (i.e., b = 1.00, p = .030), the age variable (i.e., b = 0.05, p = .002), and the married variable (i.e., b = -0.76, p = .047) were

significant predictors of missing data at T3, within the FFW group. In summary, the odds of observing missing data within the FFW group at T2 and T3 increased with age and were higher for participants who identified as Hispanic, while the odds of observing missing data at T3 were lower for participants who were married. This exploratory analysis was done for descriptive purposes and did not test MAR assumptions about the missing data (Schafer & Graham, 2002).

As may be seen in Table 1, the majority of the participants identified as female (67.2%); White, non-Hispanic (74.1%); having completed at least a 4-year college degree (60.1%); married (65.2%); a full-time employee (62.6%); at least 40 years old (55.6%); and as residing in a household with an annual income of at least $70,000 (51.6%). Table 1 provides a comparison of demographic characteristics, well-being self-efficacy scores, and health scores at T1 for participants by randomization group. There were no statistically significant differences on the proportions of demographic characteristics by randomization group. Similarly, there were no statistically significant differences on the mean well-being self-efficacy scores or the mean health scores at T1 (i.e., baseline) by randomization group. A majority (81.9%) of the participants who were assigned to the FFW group were engaged with the FFW intervention.

Path Model

There was evidence for close to approximate fit of the path model to the observed data: $\chi^2_R(212) = 399$, $p < .001$, RMSEA = .036 (.031, .042), SRMR = .031, CFI = .956, and TLI = .929. There was evidence of acceptable levels of reliability for latent physical well-being self-efficacy at T1 (i.e., coefficient $H = .78$) and T2 (i.e., coefficient $H = .77$). Similarly, there was evidence of acceptable levels of reliability for latent psychological well-being self-efficacy at T1 (i.e., coefficient $H = .80$) and T2 (i.e., coefficient $H = .78$). Percentage of variance accounted for in latent well-being self-efficacy at T2 was 48.3% for latent physical well-being self-efficacy and

59.9% for latent psychological well-being self-efficacy. There was evidence of acceptable levels of reliability for physical health status ($\alpha = .91$) and for mental health status ($\alpha = .83$) at T3. Percentage of variance accounted for in health at T3 was 71.6% for physical health status and 60.5% for mental health status. The unstandardized estimates of the covariates (i.e., non-focal parameters) for both physical health status and mental health status are available in Table 2, but these estimates are not discussed further due to spatial limitations. The unstandardized estimate of each focal parameter from the path model by hypothesis is provided in Table 3 and these estimates are discussed below. Figure 3 visually depicts key focal unstandardized parameter estimates for Hypothesis 1 through Hypothesis 3.

Hypothesis 1. The first hypothesis was that FFW would exert a positive direct effect on well-being self-efficacy. The adjusted mean difference on latent physical well-being self-efficacy at T2 for the FFW group as compared to the UC group was both statistically non-significant and negligible in size, $\hat{\beta}_1 = -0.04$, $p = .549$, $d = -0.07$. Conversely, the adjusted mean difference on latent psychological well-being self-efficacy at T2 for the FFW group as compared to the UC group was both statistically significant and meaningful (though approximately small) in size, $\hat{\beta}_1 = 0.14$, $p = .036$, $d = 0.26$. In other words, FFW increased psychological well-being self-efficacy at T2, but failed to do so for physical well-being self-efficacy. Thus, only partial support was provided for hypothesis 1.

Hypothesis 2. The second hypothesis was that well-being self-efficacy would exert a positive direct effect on health. The path coefficient from latent physical well-being self-efficacy at T2 to physical health status at T3 was statistically significant, $\hat{\beta}_2 = 1.15$, $p = .004$. Similarly, the path coefficient from latent psychological well-being self-efficacy at T2 to mental health status at T3

also was statistically significant, $\hat{\beta}_2 = 3.13$, $p < .001$. In other words, both physical and psychological well-being self-efficacy at T2 predicted improved physical and mental health status at T3 respectively. Thus, full support was provided for hypothesis 2.

Hypothesis 3. Our third hypothesis was that FFW would exert a positive direct effect on health. The adjusted mean difference on physical health status at T3 for the FFW group as compared to the UC group was both statistically significant and meaningful (though approximately small) in size, $\hat{\beta}_3 = 1.33$, $p = .005$, $d = 0.24$. Conversely, the adjusted mean difference on mental health status at T3 for the FFW group as compared to the UC group was both statistically non-significant and negligible in size, $\hat{\beta}_3 = -0.22$, $p = .694$, $d = -0.04$. In other words, FFW was able to improve physical health status directly but not mental health status. Thus, only partial support was provided for hypothesis 3.

Hypothesis 4. The last hypothesis was FFW would exert a positive indirect effect on health through well-being self-efficacy. The 95% CI for the product of path coefficients from FFW to physical health status at T3 through latent physical well-being self-efficacy at T2 included 0.00, $\hat{\beta}_4 = -0.05$, [-0.26, 0.10]. Conversely, the 95% CI for the product of path coefficients from FFW to mental health status at T3 through latent psychological well-being self-efficacy at T2 did not include 0.00, $\hat{\beta}_4 = 0.44$, [0.05, 0.94]. In other words, there was no evidence of a positive indirect effect of FFW on physical health status through physical well-being self-efficacy. However, there was evidence supporting a positive indirect effect of FFW on mental health status at 60 days after baseline through psychological well-being self-efficacy. Thus, only partial support was provided for hypothesis 4.

Discussion

The objective of the current study was to evaluate the effectiveness of the FFW online intervention to increase physical and mental health status in adults with obesity in the USA. Unlike an earlier clinical trial of FFW, this one was conducted in a relatively uncontrolled setting. In general, results show that, compared to participants in the UC condition, those who took part in the FFW intervention significantly improved their physical and mental health status. Interestingly, the mechanisms through which these positive results were achieved were different for physical and mental health. In the case of physical health, FFW exerted a direct effect; but in the case of mental health, there was an indirect effect mediated through self-efficacy. More precisely, the indirect effect was mediated by psychological well-being self-efficacy. We have some ideas why FFW operated differently on physical and mental health in this trial.

To begin with, participants were specifically primed to focus mainly on a physical goal for this clinical trial. In addition, to achieve better outcomes in the physical health domain, it is important to take some direct action, such as eating more fruits and vegetables or walking more. In contrast, to enhance mental health, cognitive reframing and a great deal of reflection is required (Dacre Pool & Qualter, 2012). It is hard to improve mental health without engaging in some cognitive processes, such as challenging erroneous assumptions about oneself or making an effort to cope with negative emotions (Norcross, 2012). These tasks may require a higher level of self-efficacy beliefs than just walking 30 minutes a day, which is an obvious and achievable task. Improving one's perceptions of self-worth, on the other hand, is a more nuanced and gradual process. It is one that requires self-compassion and a great deal of psychological processing and insight. The very act of challenging one's assumptions both requires and improves self-efficacy at the same time (Maddux, 2009).

In line with prior literature, our findings accentuate the importance of measuring self-efficacy in these types of interventions (Dacre Pool & Qualter, 2012; Duranso, 2018; Schmitt et al., 2014; Stuifbergen et al., 2010). The useful role of self-efficacy in FFW and other preventive interventions has been demonstrated in earlier studies (Myers, Prilleltensky, Hill, & Feltz, 2017).

The fact that FFW improved physical and mental health in people with obesity is especially important, given that this is a population that experiences higher levels of risk. In line with our second hypothesis, self-efficacy at 30 days led to positive outcomes in both domains of health after 60 days. In a previous publication, it was also reported that FFW improved physical activity self-efficacy in this group (Myers, McMahon, Prilleltensky, et al., 2020). Taken as a whole, there is hope that improved self-efficacy, a key target of FFW, will indeed enhance the well-being of people with weight problems. FFW seems to increase a person's sense of competency and mastery. Indeed, the importance of self-efficacy to improve both physical and mental health cannot be overstated. In a systematic review of the literature that examined mediators for physical activity, Lewis and colleagues (2002) found that one of the most common was self-efficacy. Therefore, we recommend that developers of future interventions for people with obesity build into their program activities that enhance self-efficacy.

FFW is a methodic way to increase self-efficacy in participants by scaffolding their level of competence in the physical and psychological domains. Participants are presented with a variety of challenges that gradually develop their sense of mastery in these key aspects of wellness. The activities build competence in participants through a variety of means in line with Bandura's (1997) recommendations. People nurture their self-efficacy in FFW through enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological and/or

emotional states. Some of the challenges include video games, self-reflection exercises, and answering questions based on case studies where actors enact scenarios of competence.

Notably, this is the first time in which FFW outcomes are measured using the Optum™ SF-36v2 Health Survey, which is a highly reliable and widely accepted tool (Ware, 2000; Ware & Kosinski, 1996). In previous reports the main well-being outcome was the I COPPE scale (Prilleltensky et al., 2015). The fact that we obtained positive results using another well-established measure provides further evidence that FFW is indeed an effective health promotion program.

Thus far, FFW has been tried with a population of healthy adults and a population of adults with obesity. In both randomized controlled trials there were positive results in improving subjective well-being (Myers, Prilleltensky, Prilleltensky, et al., 2017), generating well-being actions (Myers, Dietz, et al., 2018), enhancing general and specific self-efficacy (Myers, Prilleltensky, Hill, & Feltz, 2017), and increasing physical activity (Myers, McMahon, et al., 2020). In this study we extend the results to enhanced physical and mental health status. In light of the fact that FFW teaches people how to use the BET I CAN skills to improve well-being in several domains of life, such as physical, psychological, interpersonal, and occupational, it is worth considering its expansion to other populations.

The fact that FFW is scalable and accessible (www.funforwellness.com) overcomes many of the barriers from usual forms of health care, such as high-cost and lack of access. In addition, there are no negative side effects usually associated with many biologic interventions.

FFW was conceptualized as a health promotion intervention. As such, we recommend its use in a variety of settings. For example, doctors can recommend it to patients and colleges to students. Similarly, it can be used by the military for soldiers and by corporations for their

employees. The personal and economic costs of obesity and mental distress on individuals and society as a whole are just exorbitant (Mohney, 2018; WHO, 2018). It is imperative to develop and test more interventions such as FFW that are easily accessible, interactive, and effective.

Although the results of the current study are encouraging, there are some important limitations. The outcomes are based on self-report and we are working on a pilot to measure the impact of FFW on physiological measures. Another limitation is the demographic profile of our sample, which consisted mainly of individuals who identified as females (67.2%); White, non-Hispanic (74.1%); having completed at least a 4-year college degree (60.1%); married (65.2%); a full-time employee (62.6%); at least 40-years old (55.6%); and as residing in a household with an annual income of at least $70,000 (51.6%). This is a somewhat privileged group. In future studies it would be important to evaluate FFW with less privileged populations. Future research may also randomly assign different levels of access to BET I CAN challenges to better understand issues of dose for the FFW intervention. Finally, we should be aware of the limitations of interventions like this one that address mainly changes required within individuals. To promote health and wellness for all, it is important to work also at the systemic level, with policies addressing inequality and social determinants of health such as lack of universal health care (Prilleltensky, 2005; Prilleltensky, 2012; Prilleltensky & Prilleltensky, 2006).

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Table 1

Demographic Characteristics, Well-Being Self-Efficacy (WBSE) Scores, and Health Scores at Time 1 for Participants by Randomization Group

Variable	Usual Care		Fun For Wellness	
Female	66.1%		68.5%	
Black	16.1%		14.2%	
Hispanic	7.7%		6.9%	
Vocational or technical school	6.7%		7.6%	
Some college	18.8%		18.8%	
Undergraduate degree	42.3%		37.2%	
Graduate or professional degree	19.8%		20.5%	
Living with partner	6.0%		7.3%	
Married	66.1%		64.2%	
Single	15.2%		13.9%	
Part-time employment	11.9%		9.4%	
Full-time employment	60.7%		64.4%	
Retired	9.2%		9.8%	
	M	*SD*	*M*	*SD*
Age in years	43.35	11.12	44.02	11.04
Income	71986	50426	76016	91859
Physical WBSE (α = .77)	2.30	0.89	2.41	0.88
Psychological WBSE (α = .78)	2.46	0.91	2.42	0.97
Physical health status (α = .89)	48.01	9.49	48.49	9.02
Mental health status (α = .82)	42.90	9.61	43.15	9.71

Note. The reference group (e.g., male) for each demographic variable (e.g., gender) and subgroups comprising less than 5% of observations are not reported for spatial reasons. Missing data ranged from 0% to 2.85% across all of the variables in this table.

Table 2

Unstandardized Estimate of the Covariates from the Path Model

	Outcome			
Predictor	Physical well-being self-efficacy at Time 2	Psychological well-being self-efficacy at Time 2	Physical health status at Time 3	Mental health status at Time 3
Female	0.07(.08)	-0.06(.07)	0.37(.52)	0.52(.60)
Black	0.15(.10)	0.04(.09)	1.15(.73)	-1.60(.88)
Hispanic	0.17(.13)	0.24(.14)	-0.71(1.07)	-2.43(.93)**
Vocational or technical school	-0.04(.16)	0.31(.14)*	-0.32(1.01)	1.11(1.61)
Some college	-0.09(.12)	0.10(.14)	-2.01(.88)*	-0.98(1.10)
Undergraduate degree	-0.11(.12)	-0.18(.13)	0.07(.83)	-0.74(1.02)
Graduate or professional degree	-0.05(.14)	0.02(.14)	-1.26(.95)	-2.40(1.13)*
Living with partner	-0.30(.16)	0.03(.18)	0.68(1.33)	-2.66(1.63)
Married	-0.14(.11)	0.33(.11)**	2.82(.84)***	-0.51(1.04)
Single	-0.34(.14)*	-0.01(.14)	0.80(1.02)	-0.98(1.21)
Part-time employment	0.06(.12)	0.19(.13)	2.07(1.04)*	-0.17(1.17)
Full-time employment	0.01(.11)	0.11(.12)	1.85(.83)*	0.06(1.02)
Retired	-0.34(.15)*	0.14(.16)	-0.73(1.14)	0.68(1.41)
Age in years	-0.003(.004)	-0.002(.004)	-0.08(.03)**	0.06(.04)
Income in thousand dollars	.000(.000)	-0.001(.000)*	-0.008(.002)***	0.009(.002)***
Physical well-being self-efficacy at Time 1	0.60(.06)***	----	----	----
Psychological well-being self-efficacy at Time 1	----	0.60(.07)***	----	----
Physical health status at Time 1	0.01(.04)	----	0.82(.03)***	----
Mental health status at Time 1	----	0.02(.01)**	----	0.59(.05)***

Note. * $p < .05$, two-tailed. ** $p < .01$, two-tailed. *** $p < .001$, two-tailed.

Table 3

Unstandardized Estimate of each Focal Parameter from the Path Model by Hypothesis

Hypothesis 1: Fun For Wellness (FFW) → Well-Being Self-Efficacy				
Specific Path	β_1(*SE*)	[95% CI]	*d*	[95% CI]
FFW → Physical well-being self-efficacy at Time 2	-0.04(0.07)	[-0.17, 0.09]	-0.07	[-0.22, 0.08]
FFW → Psychological well-being self-efficacy at Time 2	0.14(0.07)*	[0.01, 0.27]	0.26	[0.11, 0.41]
Hypothesis 2: Well-Being Self-Efficacy → Health				
Specific Path	β_2(*SE*)	[95% CI]		
Physical well-being self-efficacy at Time 2 → Physical health status at Time 3	1.15(0.40)**	[0.36, 1.94]		
Psychological well-being self-efficacy at Time 2 → Mental health status at Time 3	3.13(0.58)***	[2.00, 4.26]		
Hypothesis 3: FFW → Health				
Specific Path	β_3(*SE*)	[95% CI]	*d*	[95% CI]
FFW → Physical health status at Time 3	1.33(0.48)**	[0.40, 2.27]	0.24	[0.09, 0.39]
FFW → Mental health status at Time 3	-0.22(0.57)	[-1.33, 0.89]	-0.04	[-0.19, 0.12]
Hypothesis 4: FFW → Well-Being Self-Efficacy → Health				
Specific Path	β_4(*SE*)	[95% CI]		
FFW → Physical well-being self-efficacy at Time 2 → Physical health status at Time 3	-0.05(0.08)	[-0.26, 0.10]		
FFW → Psychological well-being self-efficacy at Time 2 → Mental health status at Time 3	0.44(0.23)	[0.05, 0.94]†		

Note. d = Cohen's *d;* † = Bias corrected confidence interval did not include zero.

* $p < .05$, two-tailed. ** $p < .01$, two-tailed. *** $p < .001$, two-tailed.

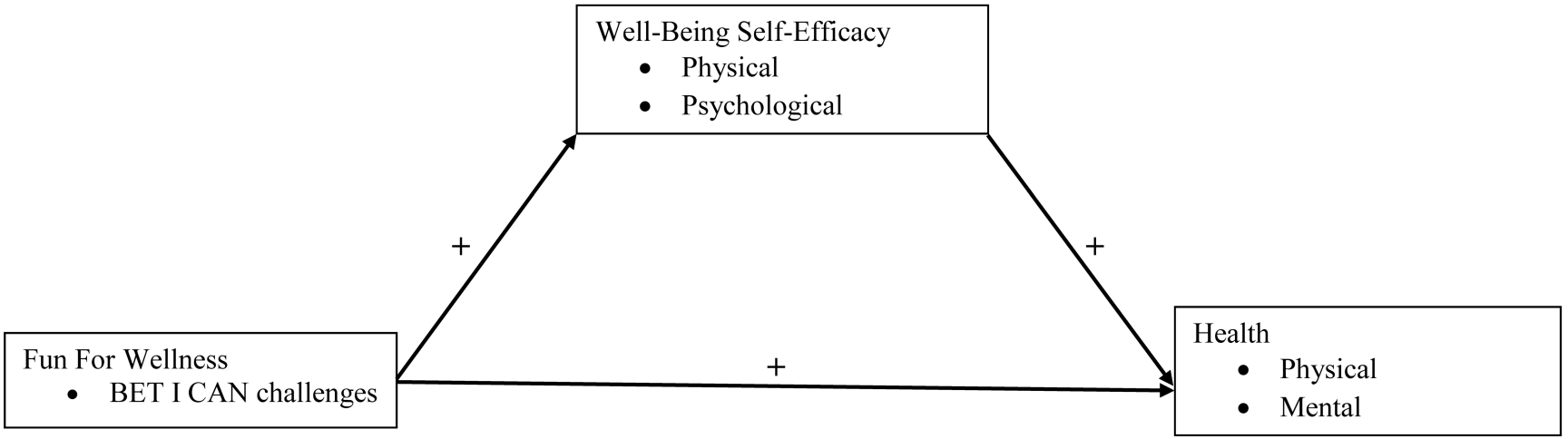

Figure 1. The Fun For Wellness conceptual model for the promotion of health.

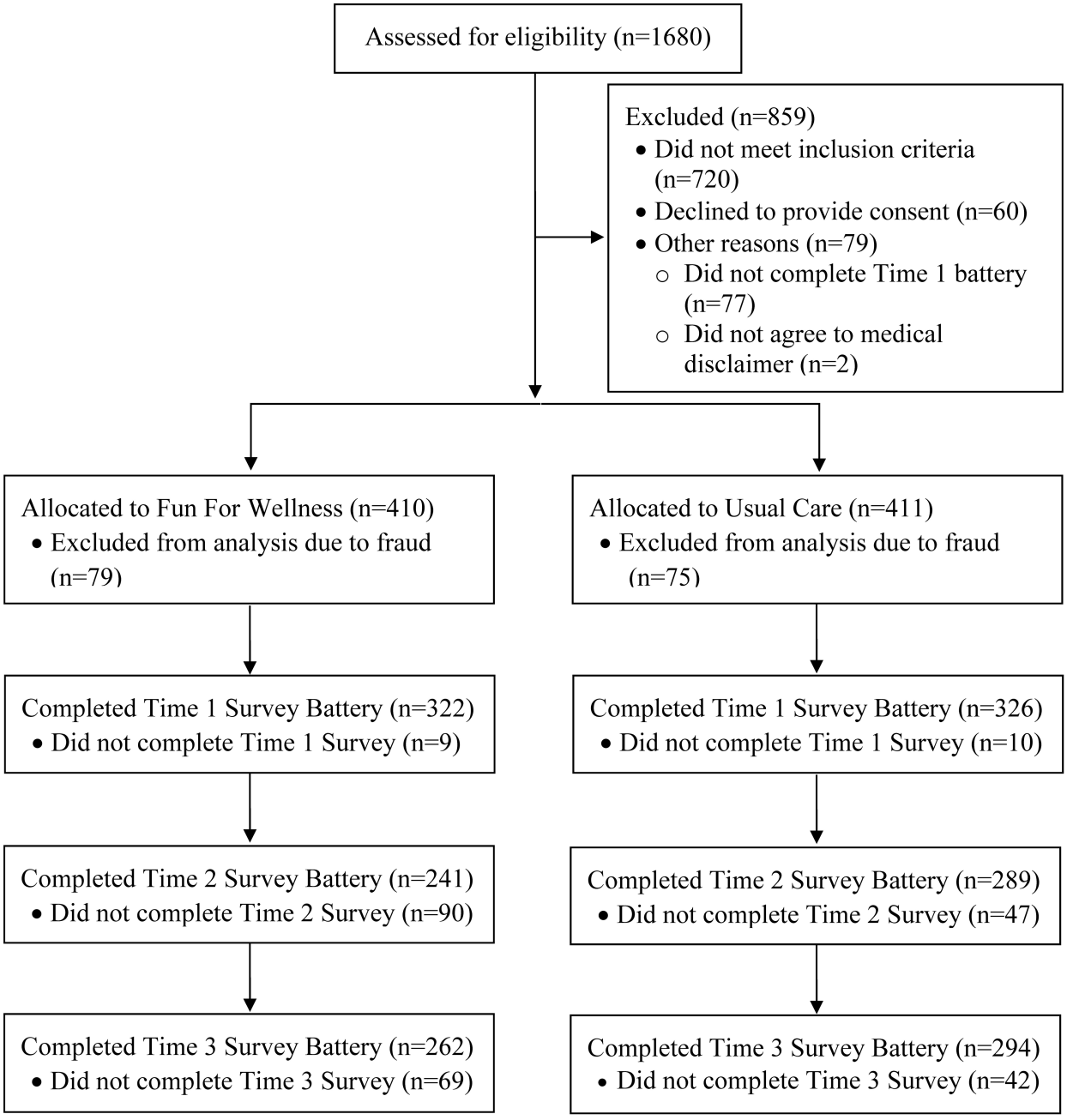

Figure 2. Participant flow from screening to randomization to retention over the three measurement occasions for the health data.

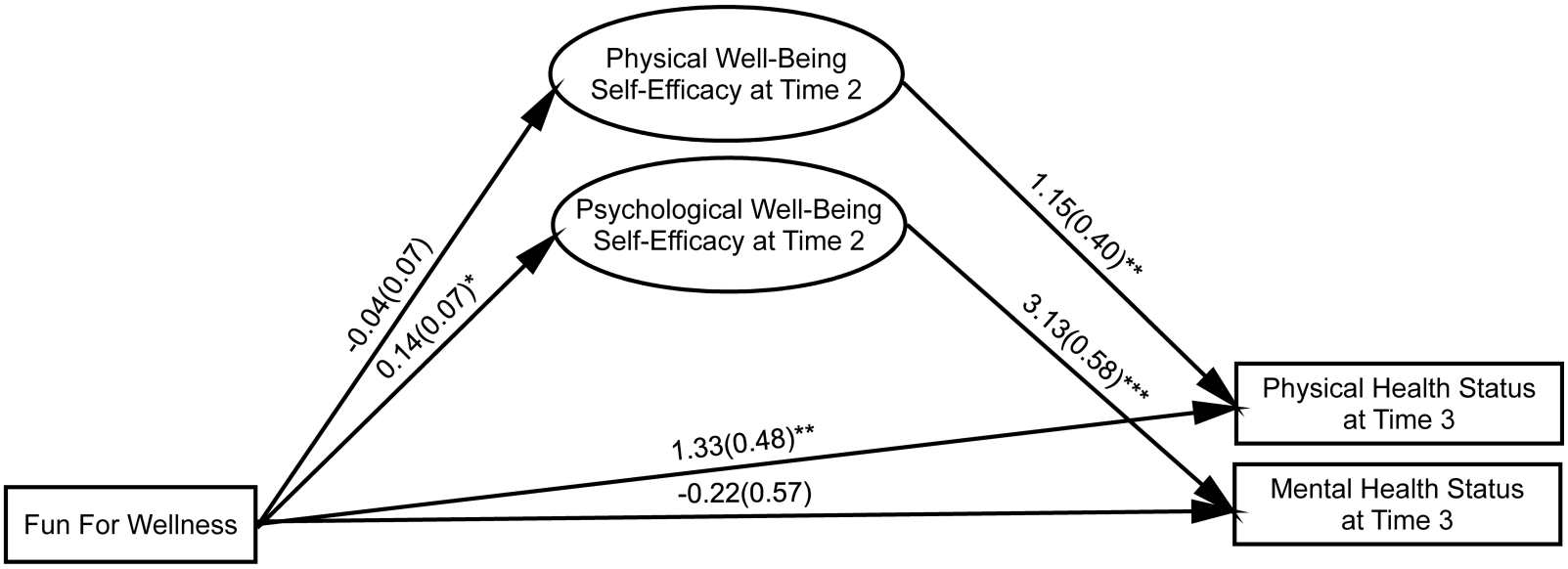

Figure 3. Key focal unstandardized parameter estimates from the path model for Hypothesis 1 through Hypothesis 3. Estimates for Hypothesis 4 are not directly provided because they are not parameter estimates per se but rather a function of existing parameter estimates. They are, however, listed at the bottom of Table 3. The 206 non-focal parameter estimates are not depicted to reduce clutter.