Behaviour Research and Therapy 101 (2018) 30–45

Contents lists available at ScienceDirect

Behaviour Research and Therapy

journal homepage: www.elsevier.com/locate/brat

Measuring self-efficacy, executive function, and temporal discounting in Kenya

Kristina Esopo[a,1], Daniel Mellow[b,1], Catherine Thomas[c,2], Hannah Uckat[d,2], Justin Abraham[e], Prachi Jain[f], Chaning Jang[b], Nicholas Otis[g], Michala Riis-Vestergaard[a], Amanda Starcev[b], Kate Orkin[b,d,3], Johannes Haushofer[a,b,h,*,3]

[a] Department of Psychology, Princeton University, USA
[b] Busara Center for Behavioral Economics, Nairobi, Kenya
[c] Department of Psychology, Stanford University, USA
[d] Department of Economics, University of Oxford, UK
[e] Department of Economics, University of California, San Diego, USA
[f] Department of Economics, Loyola Marymount University, USA
[g] Department of Public Health, University of California, Berkeley, USA
[h] Woodrow Wilson School for Public and International Affairs & Department of Economics, Princeton University, USA

ARTICLE INFO

Keywords:
Temporal discounting
Self-efficacy
Executive function
Measurement
Psychometrics

ABSTRACT

Developing countries have low adherence to medical regimens like water chlorination or antenatal and postnatal care, contributing to high infant and child mortality rates. We hypothesize that high levels of stress affect adherence through temporal discounting, self-efficacy, and executive control. Measurement of these constructs in developing countries requires adaptation of existing measures. In the current study, we adapt psychological scales and behavioral tasks, measuring each of these three constructs, for use among adults in Kenya. We translated and back-translated each measure to Kiswahili and conducted cognitive interviewing to establish cultural acceptability, refined existing behavioral tasks, and developed new ones. Then, in a laboratory session lasting 3 h, participants ($N = 511$) completed the adapted psychological inventories and behavioral tasks. We report the psychometric properties of these measures. We find relatively low reliability and poor correlational evidence between psychological scales and behavioral tasks measuring the same construct, highlighting the challenges of adapting measures across cultures, and suggesting that assays within the same domain may tap distinct underlying processes.

1. Introduction

The infant mortality rate, defined as the probability of dying before age 1, is 32 per 1000 live births worldwide, with 60% of these deaths occurring in the first 28 days of life (WHO, 2014). Despite improvement, the global maternal mortality rate remains at 210 per 100,000 live births (WHO, 2014). In developing countries such as Kenya, these figures are even higher, with an infant mortality rate of 55 per 1000 live births and a maternal mortality rate of 362 deaths per 100,000 live births (Kenya National Bureau of Statistics et al., 2014).

Two factors are thought to play an important role in accounting for these figures: contaminated drinking water (Carroli, Rooney, & Villar, 2001; McDonagh, 1996) and insufficient antenatal and postnatal care (ANC/PNC) takeup. Contaminated drinking water is the main cause of diarrheal diseases in developing countries and is estimated to cause 2100 child deaths every day worldwide (WHO, 2014). Chlorination of drinking water is a highly effective method to prevent diarrhea and is widely available at low cost in developing countries, such as Kenya. For instance, a bottle of WaterGuard to treat 1000l of water costs USD 0.26 PPP in Kenya, which is less than the typical household spends on sugar every day. Nevertheless, only about 5% of households chlorinate their drinking water (Kremer, Miguel, Mullainathan, Null, & Zwane, 2009). Similarly, the standard ANC/PNC regime for women in Kenya calls for two or more doses of SP/Fansidar, an anti-malarial medication;

* Corresponding author. Princeton University, Department of Psychology, 427 Peretsman Scully Hall, Princeton, NJ 08544, USA.
E-mail address: haushofer@princeton.edu (J. Haushofer).
[1] Contributed equally.
[2] Contributed equally.
[3] Contributed equally.

https://doi.org/10.1016/j.brat.2017.10.002
Received 9 March 2017; Received in revised form 3 October 2017; Accepted 4 October 2017
Available online 17 November 2017
0005-7967/

however, only 17% of pregnant women report adhering (Kenya National Bureau of Statistics et al., 2014). As a result, malaria infections are frequent and contribute to low birth weight and increased infant mortality.

Thus, adherence to water chlorination and ANC/PNC takeup is low in developing countries, despite significant benefits. Using a mechanisms-focused, experimental medicine approach to behavior change, we hypothesize that stressors related to poverty may contribute to low adherence by affecting three behaviors: *temporal discounting, self-efficacy, and executive control*. These targets are of interest because a) they are likely to be affected by stress, and b) they are likely to affect regimen adherence. The next section clarifies these links in more detail. In addition, these targets map neatly to models of decision-making in economics: in these models, the motives for behavior are fully characterized by preferences over outcomes, beliefs about oneself and the world, and the constraints one faces. Because temporal discounting is a preference, self-efficacy a belief measure, and executive control a constraint on decision-making, the three targets cover each of these three determinants of behavior in economic models.

In the broader context of the Science of Behavior Change (SOBC) framework, which aims to identify specific, malleable targets that are hypothesized to be relevant to behavior change, the goal of the current study is to identify, refine, and test the psychometric properties of a set of psychological scales and behavioral tasks that measure these targets. We subsequently use the results presented here to inform our selection of target measures in later phases of the project: testing the effects of stress on the three targets; developing interventions to engage the targets; and testing whether the engagement of these targets affects water chlorination and ANC/PNC regimen adherence.

In the following, we briefly discuss how stress may affect each target, and how the targets may affect adherence.

1.1. Target 1: Temporal discounting

Our first candidate mechanism through which stress may affect adherence is temporal discounting, defined as the loss of value that rewards undergo as they are delayed into the future. A recent meta-analytic review by Fields, Lange, Ramos, Thamotharan, and Rassu (2014) found that discounting was related to stress with a moderate to large effect size. Indeed, our own work under SOBC-1 has shown that stress can focus individuals on the present in economic choice: after administration of 20 mg of hydrocortisone, which raises cortisol levels, subjects in our study showed increased temporal discounting, i.e. they were less willing to forgo smaller immediate rewards in favor of larger future rewards (Riis-Vestergaard et al., in press). Note, however, that we found no evidence that a physical stressor (i.e. the cold pressor task) and a social stressor (i.e. the Trier Social Stress Test) affect temporal discounting (Haushofer et al., 2013, 2015), raising the possibility that different types of stress may have different effects on discounting.

It is easy to see that an effect of stress on discounting may also negatively affect adherence, which requires incurring an immediate cost (e.g. traveling to a clinic, the discomfort of taking medications and their side effects) for a greater but delayed benefit (e.g. a healthy child). On this view, stress may decrease the attractiveness of the delayed benefit, or increase the disutility from the immediate cost, and thus reduce adherence (Fields, Ramos, & Reynolds, 2015). Indeed, in developed countries, high temporal discounting has been shown to be negatively associated with adherence to recommended screening regimes for cholesterol, breast, cervical, and prostate cancer and use of dental care, flu shots, and physical exercise (Bradford, 2010). Discounting is also positively associated with adherence-related adverse health behaviors, such as binge eating (Davis, Patte, Curtis, & Reid, 2010) and addiction and substance abuse (Andrade & Petry, 2012; Bickel & Marsch, 2001; Bickel et al., 2007; MacKillop et al., 2011; Reynolds, 2006; Rogers, Moeller, Swann, & Clark, 2010). In Kenya, time preferences have been shown to predict mortality among HIV-infected adults receiving antiretroviral therapy (ART); those with higher discount rates also had lower ART adherence, although the association was not statistically significant (Thirumurthy et al., 2015).

It is important to note that there are several context-dependent reasons why people may engage in discounting behavior, possibly reflecting environmental constraints in contexts of poverty. For example, Becker and Mulligan (1997) show that economic conditions, such as poverty, and environmental influences, such as mortality and risk, can endogenously lead to behavior that looks like impatience. Similarly, Carvalho, Meier, and Wang (2016) show that low-income participants have higher discount rates when making choices about monetary rewards before payday. Credit market imperfections may also explain behavior that resembles high discounting rates in developing countries (Banerjee, 2001; Holden, Shiferaw, & Wik, 1998; Pagiola, 1996; Shiferaw & Holden, 2001). Temporal discounting may also be partly driven by beliefs about environmental constraints and the likelihood of positive distal outcomes (Laajaj, 2012). In line with these arguments, we hypothesize that stress is a contextual factor that increases temporal discounting in developing countries.

1.2. Target 2: Self-efficacy

The second candidate mechanism is self-efficacy, defined as the belief that one can perform well in specific situations (Bandura, 1982). We hypothesize that stress may affect adherence and other health behaviors by decreasing an individual's perceived sense of control (i.e. personal mastery), and consequently lead to low self-efficacy.

Self-efficacy is linked to stress as an important determinant of individual responses to stressors (Bandura, 1988); numerous studies in Western contexts have demonstrated that those with high self-efficacy can cope better with stressors and trauma than those with low self-efficacy (Benight & Bandura, 2004; Perkins & Jenkins, 1998; Shnek et al., 1997; Shorey, Chan, Chong, & He, 2015; Tan-Kristanto & Kiropoulos, 2015). Self-efficacy has also been shown to be strongly related to adherence to medical regimens and other health behaviors. In a recent comprehensive meta-analysis of 207 studies on adherence to ART drugs for HIV, Langebeek et al. (2014) find that self-efficacy is the single strongest predictor of adherence, with an effect size more than 50% larger than the next-best predictor (substance abuse). In line with this finding, interventions targeted at improving self-efficacy have been shown to increase adherence to exercise regimens (Azizan, Justine, & Kuan, 2013; Barkley & Fahrenwald, 2013; Seghers, Van Hoecke, Schotte, Opdenacker, & Boen, 2014). In a recent study from a developing country context, Ghosal, Jana, Mani, Mitra, and Roy (2013) show that a training program for building “agency” (closely related to self-efficacy) among sex workers in India strongly increased self-efficacy and raised the likelihood of having undergone a health checkup in the last month by nine percentage points. We therefore build on previous work showing that self-efficacy is an integral part of behavior change by asking if low levels of self-efficacy are part of the mechanism through which stress lowers adherence to chlorination and ANC/PNC services in Kenya.

1.3. Target 3: Executive control

The final mechanism we consider is executive control. Executive control is a broad term commonly referring to the maintenance and execution of high-level plans and goals, and involves planning, cognitive flexibility, inhibitory control, and working memory processes. We combine these different concepts because deficits in these abilities may affect adherence and other health behaviors through a similar mechanism, namely a failure to make a plan or follow through on it. For instance, when faced with the task of attending a doctor's appointment, an individual might simply forget about it, be distracted by other tasks and therefore fail to attend, or fail to make a plan to go.