Combining face-to-face sessions with ICTs for health promotion: Evidence from a field experiment with undergraduate students

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Abstract

This paper presents a field experiment in which students received intensive and high quality face-to-face sessions combined with Information and Communications Technologies (ICTs) that sought to foster healthy behavior. Students who were subject to the treatment (informative on-site sessions by experts and frequent reminders by several channels of social media) improved their knowledge on healthy habits relative to the control group. However, they were not able to translate it into healthier behavior, neither self-reported nor objectively measured by a physician. The patterns in the data appear most consistent with a model in which students have present-bias, lack of knowledge about the health production function, or are coping with complementary inputs, though it is possible to find other explanations.

Keywords: randomized trial; field experiment; healthy habits; human capital; information and communication technology.

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I. Introduction

Adolescence is a period of transition, marked by psychological, physical, and cognitive changes underpinned by biological factors (Fatusi and Hindin, 2010). Today's generation of young students is approaching adulthood in a world vastly different from previous generations: urbanization, electronic communication, and economic challenges have radically transformed the landscape. Healthy students learn better, and practitioners cautioned that no curriculum can compensate for deficiencies in student health status (Symons et al., 1997). Previous literature on the effectiveness of scalable and low cost interventions for promoting health within this young population is scarce, arises methodological concerns, and focuses nearly exclusively on mental health and sexual risks.

In an attempt to go beyond the simple provision of basic knowledge on standard healthy habits, the program 'Health & Academic Achievement' implemented at a university (Universidad de Montevideo) in a Latin American country (Uruguay), tries to promote students' healthy behavior – defined as regular physical activity, frequent fruit and vegetable intake, non-risky consumption of alcohol and non-smoking (Barreto, Passos, and Giatti, 2009). The program consists on four days of mandatory on-site sessions carried out by physicians specialized on drugs, physical activity and nutrition. They provided the students with theoretical and practical guidelines in order help them acquire healthier habits. The intervention also resorted to Information and Communication Technologies (ICTs) during the following months to enhance the content of the seminar. Participants received weekly reminders of the importance of exercise and following a nutritious diet through SMS messages, Social Media (Facebook) and banners on the students' intranet webpage at the university.

In order to avoid the biases of auto-selection (individuals more prone to healthy habits may be more inclined to take the course on health behavior), we evaluate the effects of this health intervention with a randomized controlled trial assigning students to a treatment or a control group and measuring the effects on knowledge acquired and habit formation.

We find that students who were subject to the intervention improved their knowledge on healthy behavior, measured through a test at the follow-up survey. However, we find no effect on students' behavior (measured through self-reported surveys and by biometric measurements collected by physicians). This latter finding is in line with several previous studies but not with many others. To better understand what mechanisms might lead to these mixed findings, we also contribute to the previous literature applying a model that comes from the field of human capital. In this model (Fryer, 2016), exerting effort to achieve healthier habits means the individual has to incur into costs. The magnitude of the effects of the health intervention depends on two features of the model: the responsiveness of effort to the change in beliefs, and the shape of the production technology around the pre-treatment equilibrium. We use this setup to frame our empirical results and explain why, in our experimental sample (and in several previous studies), beliefs changed, but effort did not. Our data is consistent with this model when students have high discount rates, suffer a lack of knowledge of the health production function, or are coping with complementary inputs. Higher discount rates prevent them from exerting the effort to achieve better health. The health production function implies that, for people with poor health, investments will be more sensitive to changes in the perceived return to health in comparison with healthier people (as Fryer suggests, the key idea is that there is more "low-hanging fruit" for people with poor health condition). Finally, if capital levels are so low that there is a very small return to effort, then students have little reason to work hard to develop healthier habits (effort and capital levels are complementary inputs of the health production function).

The rest of the paper is organized as follows: section II presents background literature, section III describes the program and explains the experiment's design, section IV presents the econometric model and results, section V presents the discussion, and VI the conclusion.

II. A brief review of related literature

The benefits of physical exercise and a nutritious diet on people's health and well-being have been extensively reported (e.g., Warburton, Nicol & Bredin, 2006; Reimers, Knapp & Reimers, 2012; Deslandes et al., 2009; McGuire, S., 2011). However, providing information on the benefits of exercise and the consequences of risky behavior seems to be not enough to modify the acquisition of healthier habits (e.g., Balsa, Gandelman & Lamé, 2014; Charness & Gneezy, 2009; Djuric et al., 2010; Hivert et al., 2007).

A growing body of research examines prevention strategies to achieve healthier habits, as well as the effects of informational treatments on health outcomes. Below, we describe each of these strategies in turn.

a. Prevention strategies to achieve healthier habits

Warburton, Nicol and Bredin (2006) provide evidence that physical activities play an important role in the primary and secondary prevention of chronic diseases such as *type 2* diabetes, cardiovascular disease, cancer, hypertension, obesity, depression and osteoporosis. Reimers, Knapp and Reimers (2012) synthesize previous studies on the relation of physical exercise and life expectancy and find a positive association. Lee et al. (2012) confirm these results by estimating the effects of physical inactivity on heart disease, type 2 diabetes, cancer and premature mortality. Deslandes et al. (2009) focus on the relation between mental health and physical activity, and find that physical activity is associated with an improvement on mental diseases such as depression, Alzheimer's and Parkinson's disease.

Preventing chronic diseases requires not only regular physical exercise but also having a nutritious diet (Physical Activity Guidelines Advisory Committee Report, 2008). The daily intake of fruits and vegetables is associated with a rise in happiness and mental health (Blanchflower, 2013), and a reduced risk of cardiovascular disease (McGuire, 2011).

b. Effects of informational treatments on health outcomes

Previous literature on providing information about the benefits of healthy habits shows mixed findings. Some studies find that programs that deliver health information impacts on risky behavior, but other studies do not. Balsa, Gandelman and Lamé (2014) provided information to adolescents through the Internet (website and e-mails) and SMS messages about the risks and consequences of substance abuse. They find that the intervention improved adolescents' knowledge about risks but there were no significant changes in behavior. Croom et al. (2009) evaluated an Information and Communication Technologies (ICTs) intervention to prevent alcohol abuse for entering freshmen prior to arrival on campus. The program was effective in achieving higher levels of accuracy in objective knowledge on healthy habits. However, the ICTs did not produce changes in substance-abusing behavior.

Some studies report successful interventions that seem to be effective at inducing changes in health behavior. Zhong (2015) exploit a recent higher education expansion in China to identify the effects of education on health. Though this author does not find causal effects on drinking and smoking behaviors, the intervention seems to reduce the probability of suffering hypertension. In terms of using texts messages with informational or motivational purposes, Calzolari and Nardotto (2017) document the effects of sending reminders (on the possibility of exercising) to a sample of college students. They find that reminders induce users to increase gym attendance and their levels of physical exercise, and to maintain them for a prolonged period. Fjeldsoe, Marshall and Miller (2009) review four studies focused on preventive health and ten studies focused on clinical care that used tailored SMS to deliver information. Positive changes in outcomes arise in 13 of the 14 studies reviewed by the authors. A related finding is documented in Woolford et al. (2010). They send tailored information through text messages to adolescents enrolled in a weight-management program. Participants revealed that the messages were personally relevant and helped them to keep focused on weight management.

We provide a model (Fryer, 2016) that sheds light on the mechanisms that may explain these mixed results cited above.

III. Program and Experiment Design

Students majoring in several areas (Economics, Management, International Business Economics, Accountancy, Humanities, Communication and Engineering) took part in the 'Health & Academic Achievement' seminar in April of 2013. The instructors were physicians specialized on drugs, physical activity and nutrition.

The seminar provided students with concrete information on how healthy habits would contribute to improve academic performance. The seminar encouraged students to identify personal behaviors that could derive in chronical illnesses and to reflect on how these could be avoided. The instructors advised them to take preventive medical examinations in order to detect illnesses at a very early stage and to identify possible symptoms. Students were also instructed on the benefits of a healthy diet and properties of natural meals.

The seminar was held during four consecutive days, in on-site sessions of 110 minutes. Attendance was mandatory for each of the four days. Teaching assistants marked attendance only if the student stayed for the entire duration of the session.

As part of the seminar, the students received information on a weekly basis, related to healthy habits through phone message, social media, and through the students' personal intranet webpage at the university - during the four months after the end of the seminar. The content of the messages was related to what was taught at the seminar (e.g. "twelve people die per day for causes related to smoking", "seasonal fruits have a higher nutritional value than other fruits"; "oily fish contain high levels of omega 3: tuna, sardine, salmon, horse mackerel", "walking stimulates brain plasticity", "exercise diminishes depression and minimizes anxiety").

In the design of the ICT component of the intervention, we have selected messaging due to the promising effects on young individuals. Anstiss and Davies (2015) trialed a text message-based intervention package for use by young people to evaluate the potential efficacy of the text package as an intervention for depression and anxiety symptoms. Their findings support the potential efficacy of the text package, justify wider trials of the text package, and support the use of text message-based interventions as potentially effective therapies for young people. We have also included a Facebook component in the intervention because this social network has been widely used among young adults, and previous literature on health promotion presents this social network as a promising tool for health promotion (Zhang et al., 2015). Finally, we have included banners on the students' intranet webpage at the university because students visit this webpage frequently to seek for documents for their daily classes and homework.

In Table 1, we define a set of baseline characteristics and describe the sample of 68 students participating in the intervention. Students are 22 years old, on average; they have a mean grade of 6.8 out of 12[1]; and approximately 59% are female. Over 60% of the sample are not in the labor market. Although the seminar was open to students from several areas, over 76% of them are majoring in Accountancy, Management and Economics. Nearly 72% report that their economic well-being is good or very good. Regarding healthy habits, 21% are smokers. Nearly 76% drank alcohol in the last 30 days and 27% of the sample of students drinks alcohol from one to four times a week. On average, students eat vegetables 4.3 days a week and fruits 3.7 days a week, practice sports two hours and a half per week and remain sitting down or in a lying position more than 6 hours a day. In addition, 87% of the students perceive they have a good or very good health condition and over 80% of the sample made an appointment with a physician in the last 12 months.

[Insert Table 1]

[1] This mean grade, credits earned and the percentage of female students are similar to the averages at the University (mean grade: 6.7; credits earned: 158; percentage of female students: 52%).

We exploit the oversubscription to the program and design a randomized experiment to evaluate the intervention. This allocation rule ensures that the group of students participating in the health intervention—the treatment group— is similar at baseline to the group of students who are not drawn in the lottery —control group. Prior to randomization (and the surveys), we received the approval of the ethical review board of the university. We use a phase-in design, and emphasize that all candidates were able to attend the seminar (in the first phase or later). Hence, we prevent individuals of the control to feel offended to be a comparison group and individuals of the treatment to feel observed and react by altering their behavior (the so-called John Henry and Hawthorne effects - Duflo, Glennerster & Kremer, 2007).

In our field experiment, 68 students showed up for the seminar; 33 students were randomly assigned to the treatment group and 35 to the control group. Students in the health seminar automatically received a grading pass of seven -on a scale of 12- when they fulfilled the attendance requirement. In order to encourage students to show up at a later stage set to collect health indicators, we offered a grade of 12. At the follow-up stage, although the attendance of the control group was voluntary, it was highly recommended before the start of the intervention at the second semester.

[Diagram 1]

Before drawing the lottery, the research team collected administrative data of the pool of 68 students.

Randomization was executed to achieve balance between the treatment and control group in eight characteristics[2] . After randomization, but before the seminar started, we collected pre-treatment data on a wide array of students' characteristics such as smoking habits and attitudes towards alcohol, healthy habits and relation with their physician. In Table 2 we present summary statistics by treatment group. Given that only three of the 41 p-values estimated are smaller than 0.10, the randomization was effective at balancing the groups on observable variables[3].

[Insert Table 2]

The follow up questionnaire was implemented four months after the seminar. It was delivered through an online platform. Questions were very similar to the baseline ones, and we added an 18-question test to evaluate the acquisition of knowledge. Since answers to the follow-up survey were self-reported, we also hired a physician to collect health measures[4].

[2] Gender, region of the country –interior or capital of Uruguay-, major- economics, management or accountancy-, credits earned at college, grade average, scholarship at UM, year starting college and attending to one particular high-school – there is a large proportion of students at UM who had previously attended this high school- before attending college.

[3] We have administrative data for the 68 students on the experiment, but we were unable to collect some pre-treatment and follow-up data for some students.

[4] When students enrolled for the seminar they were told that, at the end-line evaluation, there was going to be a medical assessment of external health variables (pressure, height and weight).

IV. Econometric Model and Results

We evaluate the effects of the intervention on a wide array of outcomes. Ideally, we would like to estimate the following equation:

$$Y_i = a + b\,D_i + X_i{}'c + e_i \quad (1)$$

Where Y_i is the outcome of interest for student i (health indicators measured by physician, healthy behavior and improvement of information on healthy habits and behavior that could derive in chronical illnesses), D_i is the variable of interest: a dummy variable that takes the value 1 if student i takes part in the intervention, X_i is a matrix of student pre-treatment characteristics and e_i is the error term.

Two students who were assigned to the control group managed to receive treatment. Thus, the group who finally received treatment differs slightly from the group initially selected to be treated. The presence of non-compliers may be a threat when detecting the impact of the health intervention. A simple Ordinary Least Squares (OLS) may introduce bias into the impact estimates if selection into the treatment group is not random. Therefore, to address this issue, we use an Intention to Treat (ITT) approach (we employ the randomized assignment of students as an instrument for effective participation, and estimate the effects using instrumental variables). Our assumption is that the outcome is affected by the random assignment only through changes in the intervention take-up. We describe the first stage regression of the 2SLS model in equation (2):

$$D_i = d + f L_i + X_i{}'g + h_i \quad (2)$$

Where the variable D_i is a dummy variable that documents the take-up of the program, L_i is a dummy variable that takes the value 1 if the individual was randomly assigned to the health intervention, X_i is a matrix of student characteristics and h_i is the error term. Reduced form results, using the initial assignment – L_i – as the explanatory variable in equation (1), are available upon request.

a. Assessing the impact on acquired knowledge to foster healthy habits

In Table 3, we show results of the intervention on the acquisition of information related to healthy habits. Treatment and Control students took a test of 18 questions. The test takes the value 10 if all the questions were answered correctly. We present the results of the regression on the number of correct answers, on the value of the test, and on the value of the test adjusted by the difficulty of the questions[5]. Results indicate that the health intervention improved the test score in 1.27 points and in 1.31 points when

[5] We constructed a special index that takes into account the relative difficulty of the questions in the test. The formula assigned greater weight to those questions that were answered correctly less frequently by students. For each question i (of 18), we constructed a dummy variable d_i that takes the value of one if the student answered correctly and zero otherwise. The index is defined as follows: $\sum_i [1 - mean(d_i)] d_i / \sum_i [1 - mean(d_i)]$. We obtain a number between zero and one and multiply by 10. As a result, we obtain the test grade adjusting for difficulty of the questions.

controlling for difficulty – this represents approximately a 23% increase in the score compared to the control group. Being randomly assigned to the control group derives in answering 52% of the questions correctly when not considering difficulty and 37% when considering difficulty. Those assigned to the health intervention had a better performance in both cases. Figure 1 shows the difference in the cumulative distribution function of the test scores with and without adjustment for difficulty. Those randomly assigned to the health intervention outperform those assigned to the control group.

[Insert Table 3]

[Insert Figure 1]

We were unable to gather information for five students (four from the control group and one from the treatment group). We perform additional estimates controlling for baseline covariates that are unbalanced due to attrition, and they provide similar results (available upon request).

As a robustness check, we use the initial assignment – intention to treat status- as the explanatory variable in equation (1) instead of D_i. The results from these regressions are similar to the IV estimates and are available upon request.

b. Assessing the impact on self-reported health behavior and objective health indicators

As the on-site sessions of the intervention were carried out by physicians specialized on drugs, physical activity and nutrition, in Table 4 we report the effect of participating in the health intervention on these indicators. Columns (3), (4) and (5) show the impact on *risky consumption*, Columns (6), (7), and (8) on *physical activity*, and Columns (10), (11) and (12) on *nutrition*. We have also included the impact on two academic indicators from administrative data of the university, considering the possible relationship between information, health and academic achievements (So & Park, 2016). We find no significant differences between the two groups in 14 of the 16 outcome variables.

[Insert Table 4]

Attrition in the anthropometric data was a little higher than in the follow up survey, since students had to attend a doctors' appointment at the university. Some students were abroad, so it was not possible for them to attend, and others refused to participate at this stage. We perform additional estimates controlling for baseline covariates unbalanced due to attrition and results are similar to the ones in Table 4 (available upon request).

c. Assessing heterogeneity by risky behaviors at baseline

We explore the different effects of the intervention on participants that prior to the health seminar exercised less than 150 minutes (2.5 hours) a week and on those who exercised more than 150 minutes per week. We consider this threshold because it represents the minimum amount of time devoted to exercise advisable to prevent chronical diseases

(Physical Activity Guidelines Advisory Committee, 2008). The distribution of students is presented in Figure 2.

[Figure 2]

In Table 5, we present the results considering the interaction effects with the amount of exercise practiced prior to the Health Intervention. For this purpose, we consider the threshold of 2.5 hours per week. We estimate the following equation:

$$Y_i = a + b\, D_i + \mathrm{c}D_i * T_i + \mathrm{d}T_i + \, X_i{}'e + f_i \qquad (3)$$

Where Y_i is the outcome of interest for student i (health indicators measured by physician; healthy behaviors; and behaviors that could derive in chronical illnesses), D_i is a dummy variable that takes the value 1 if student i takes the health intervention, T_i is a dummy variable that takes the value 1 if the student i exercises less than 2.5 hours a week, $D_i * T_i$ is the interaction term, X_i is a matrix of student pre-treatment characteristics and f_i is the error term.

We instrument D_i and $D_i * T_i$ using the exogenous variables L_i (a dummy variable that takes the value 1 if the individual is randomly assigned to participate in the health intervention) and $L_i * T_i$.

Table 5 reports the estimates. The results suggest that being randomly assigned to the intervention does not seem to modify habits for those who exercised less than 2.5 hours per week (there are only some coefficients that seems to be significantly different from zero but most at 10 percent level: they will not survive conservative methods to adjust for multiple comparison bias – i.e. the Holm-Bonferroni method).

[Insert Table 5]

V. Discussion

The results of this health intervention show that students who were subject to the treatment improved their information on healthy habits but were not able to translate knowledge into a healthier behavior, neither reported nor objectively measured by a physician.

To better understand what mechanisms might lead to these conclusions, we apply a simple two-period model of human capital investment developed by Fryer (2016) and assess the conditions that might generate these facts. Consider the problem of a representative student choosing the optimal level of effort E to invest in her health. The production function for health achievement follows the production function A

$A = F\,(E,K)$

where K is an n-dimensional vector of personal and family "capital" levels that are fixed prior to the student's decision.

Fryer imposes the following restrictions: (a) F is twice continuously differentiable in all inputs, (b) production exhibits diminishing marginal returns to effort – i.e. $\frac{\partial F}{\partial E} > 0$ and $\frac{\partial^2 F}{\partial E^2} < 0$ - ; and (c) capital and effort are complements – i.e. $\frac{\partial^2 F}{\partial E \partial K_i} > 0$ where K_i is the i^{th} element of the vector *K*.

Let $V(A,r)$ denote the long-run perceived benefits of health achievement, where r is a parameter that measures the student's perceived return to health achievement. Fryer assumes that $\frac{\partial V}{\partial A} > 0$ and $\frac{\partial^2 V}{\partial A^2} < 0$. He also assumes that increases in r increase payoffs at all levels of A: $\frac{\partial V}{\partial r} > 0$.

The student's problem can be summarized as:

$$\max_{E} \ \beta V(A,r) - C(E)$$

where $C(E)$ is the cost of effort and β is a standard discount factor. Fryer assumes that $C'(0)=0$ and $F'(0,K) > 0$ to ensure an interior solution.

The equilibrium level of effort is then defined by the value E* that solves:

$$\beta \frac{\partial V}{\partial E}(r) = \beta \frac{\partial V}{\partial A}(r) * \frac{\partial A}{\partial E} = C'(E^*)$$

In this framework, discount rates, uncertainty about the production function, and complementarities in production are potential mechanisms to generate a change in beliefs without change in health achievements.

a. High discount rates

If the benefits of the effort to acquire healthier habits occur primarily in the future, then excessive discounting could explain why in several previous studies changes in beliefs did not generate changes in behaviors. In other words, following the model of Fryer (2016), even if the information treatment causes students to foresee additional rewards for investing in their health, the payoff arrives so far in the future that it is not worth expending effort in the current period. In the framework of Fryer, this is equivalent to having β small enough such that $\frac{\partial E^*}{\partial r}$ is roughly zero.

b. Lack of knowledge of the production function

If students do not know the precise relationship between the vector of inputs and the corresponding output, then there may be little reason for them to increase effort in response to new information. In the framework of Fryer (2016), in a scenario where students only have a vague idea on how to increase achievement, the treatment changed beliefs so students put in more effort, but the effort was not effective at producing health achievements given their lack of knowledge on how to translate effort into output. This explanation may reconcile the set of studies that find positive impacts of ICTs on healthy behavior with those that find null effects. For instance, ICTs targeting people in poor health condition can produce large gains (these populations are investing extremely little in their health at baseline, leaving significant "low-hanging fruit" unclaimed). In other words, simple changes in effort – like just eating some vegetables or consulting a physician twice a year – can produce large gains in this context.

c. Complementary inputs

Another interpretation that may explain that changes in beliefs may not generate changes in behavior is that the health production function could have important complementarities that are out of the student's control. For instance, student effort may need to be coupled with effective medical care or other inputs in order to yield increased achievement. In term of the Fryer's model, if capital levels *K* are so low that there is a very small return to effort, then students have little reason to work hard to develop healthier habits.

The patterns in our data appear consistent with Fryer’s model, in which students have present-bias, lack knowledge on the educational production function, or are coping with complementary inputs.

We are not able to rule out other explanations to our findings. Investment in programs that provide information and remind individuals of the importance of exercise might be effective when bolstered with financial incentives to exercise (Charness and Gneezy, 2009). Another factor to consider is the complementarity between health investments in time. The formation of physical health capital could be modelled (Heckman, 2007) taking into account the pivotal importance of early investments in this area and the dynamic complementarity of investments – skills acquired at one stage raise the productivity of investment at later stages. If there were no previous health interventions or no remedial interventions in adolescence, the present health intervention should have been reinforced by upcoming health programs.

Physical activities may be affected by personal, social and environmental factors (Heath et al., 2012). Interventions that include those various levels – for instance, family support and peer effects – would be considered successful ways to increase physical activity (Bauman et al., 2012). Lavecchia, Liu and Oreopoulos (2014) suggest that one-on-one coaching is more intense than text-messages reminders which can be easily ignored. Lavecchia and colleagues recommend this approach because it could help to “get things done”, to reduce anxiety about making mistakes, to receive more detailed information and review, and to increase empowerment. Another possible explanation for our results is that most students rationally rate their health above the median (Benoît and Dubra, 2011). Health seminar students at Universidad de Montevideo acquired the information on the average risks of unhealthy behaviors but they thought these were not relevant or applied to them.

VI. Conclusion

In an attempt to go beyond the simple provision of basic knowledge on standard healthy habits, the program ‘Health & Academic Achievement’ was implemented to help undergraduate students to acquire healthy habits. The program includes intensive informative on-site sessions provided by highly qualified physicians, and Information and Communications Technologies (ICTs) (weekly reminders through SMS messages, social media and students’ personal web page). This is a potentially cost effective and quickly scalable strategy, not yet tested by a field experiment targeted at undergraduate students in Latin American countries. Two facts emerge: (1) students who were subject to the intervention improved their information on healthy behavior measured through a test at the follow-up, (2) there are no detectable changes in students' behavior measured through self-reported surveys and by biometric measurements collected by physicians at the follow-up.

The patterns in the data appear consistent with a model in which students have present-bias, lack knowledge about the educational production function, or are coping with complementary inputs.

The studied intervention combines face-to-face sessions with ICTs. For further research, new experiments may be designed in order to isolate the effect of the ICT component. It is particularly relevant due to the scalability and low cost of, for instance, an e-messaging program. The messages would seek to help individuals overcome behavioral biases by refocusing their attention toward the benefits of healthy habits, by decomposing complex tasks into simpler ones, and by reinforcing self-esteem and positive identities. Behavioral economic findings suggest that health ICTs interventions –such as e-messaging– are a promising tool.

Though the studied intervention was designed to be representative of ordinary undergraduate students, of normal academic months, and of normal courses that students usually take, further work may explore the impact of changing some features of the intervention. How sensitive are the results to the length of face-to-face intervention? Will increasing the number of months during which the students receive messages alter the results? There may be some seasonal aspects to consider as well (after a major exam or the end of a semester or the end of a year, some students may decide to make changes in their life-style; similarly, during the final's week, they may be involved in unhealthy behaviors like not having enough sleep, eating junk food etc.). It would be interesting to see if these groups respond differently to a set of incentives to adopt healthy habits. Further research may address these issues.

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Diagram 1

Timeline of the Program and Data Collection

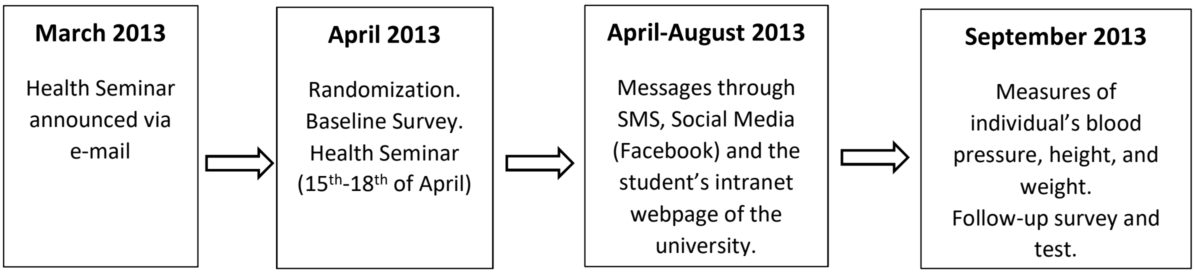


Table 1 – Description of Baseline Characteristics					
	(1) Mean	(2) S.D.	(3) Min	(4) Max	(5) # Obs.
Socio-Demographic Characteristics					
Age	21.908	2.902	18	31	67
Female	0.588	0.496	0	1	68
Capital of Uruguay	0.662	0.477	0	1	68
Good or very good economic well-being	0.721	0.452	0	1	68
Academic & Labor Environment					
Average Grade	6.800	2.685	0	10	68
Credits earned	148.059	99.605	0	339	68
Scholarship at Universidad de Montevideo (UM)	0.323	0.471	0	1	68
Majoring in Management	0.221	0.418	0	1	68
Majoring in Accountancy	0.397	0.493	0	1	68
Majoring in Economics	0.147	0.357	0	1	68
High School 1	0.074	0.263	0	1	68
High School 2	0.074	0.263	0	1	68
High School 3	0.074	0.263	0	1	68
Started college in 2009	0.147	0.357	0	1	68
Started college in 2010	0.088	0.286	0	1	68
Started college in 2011	0.265	0.444	0	1	68
Started college in 2012	0.250	0.436	0	1	68
Started college in 2013	0.103	0.306	0	1	68
Not working	0.612	0.491	0	1	67
Health Behavior & Household Environment					
Smoking					
Has smoke at least once in his/her life	0.478	0.503	0	1	67
Currently Smoking	0.438	0.504	0	1	32
Nobody smoke at home in the last 7 days	0.567	0.499	0	1	67
Alcohol					
Consumed alcohol in the last 12 months	0.940	0.239	0	1	67
In the last 12 months consumes alcohol from 1 to 3 times a month	0.508	0.504	0	1	63
In the last 12 months consumes alcohol from 1 to 4 times a week	0.270	0.477	0	1	63
Consumed alcohol in the last 30 days	0.761	0.430	0	1	67
Healthy Habits & Perceptions					
Days a week that eats vegetables	4.328	2.245	0	7	67
Days a week that eats fruits	3.672	2.128	0	7	67
Hours devoted to walk or ride a bike per day	0.876	0.837	0	5	67
Hours devoted to play sports per week	2.567	2.090	0	6	67
Hours staying in a sitting or lying position per day	6.570	3.422	1	13	67
Perceived fair health condition	0.075	0.265	0	1	67
Perceived good health condition	0.343	0.478	0	1	67
Perceived very good health condition	0.522	0.503	0	1	67
Perceived excellent health condition	0.060	0.239	0	1	67
Physician & Treatment					
Has controlled blood pressure at least once in his/her life	0.940	0.239	0	1	67
Ever being told to have high blood pressure	0.015	0.122	0	1	67
Has been measured the level of blood cholesterol at least once in his/her life	0.597	0.494	0	1	67
Weight (self-reported)	65.552	12.111	44	95	67
Has consulted a physician in the last 12 months	0.881	0.327	0	1	67
Has consulted a dentist in the last 12 months	0.761	0.430	0	1	67
Has been admitted to hospital in the last 12 months	0.075	0.265	0	1	67

Table 2 – Mean Comparison of Baseline Characteristics. Group Subject to Randomization

	(1) Treatment	(2) Control	(3) Difference	(4) Std.Error	(5) p-value	(6) # Obs.
Socio -Demographic Characteristics						
Age	22.094	21.727	-0.367	0.713	0.609	67
Female	0.576	0.600	0.024	0.121	0.842	68
Capital of Uruguay	0.697	0.629	-0.068	0.116	0.558	68
Good or very good economic well-being	0.727	0.714	-0.013	0.111	0.907	68
Academic and Labor Environment						
Average Grade	6.961	6.649	-0.312	0.655	0.635	68
Credits earned	167.758	129.486	-38.272	23.891	0.114	68
Scholarship at Universidad de Montevideo (UM)	0.303	0.343	0.040	0.115	0.730	68
Majoring in Economics	0.182	0.114	-0.068	0.087	0.439	68
Majoring in Accountancy	0.333	0.457	0.124	0.120	0.304	68
Majoring in Management	0.273	0.171	-0.101	0.101	0.321	68
High-School 1	0.061	0.086	0.025	0.064	0.697	68
High-School 2	0.121	0.029	-0.093	0.063	0.148	68
High-School 3	0.091	0.057	-0.034	0.064	0.600	68
Started college in 2009	0.182	0.114	-0.068	0.087	0.439	68
Started college in 2010	0.121	0.057	-0.064	0.069	0.359	68
Started college in 2011	0.242	0.286	0.043	0.109	0.691	68
Started college in 2012	0.182	0.314	0.132	0.105	0.213	68
Started college in 2013	0.091	0.114	0.023	0.075	0.756	68
Not Working	0.667	0.559	-0.108	0.120	0.373	67
Health Behavior & Environment						
Smoking						
Has smoked at least once in his/her life	0.576	0.382	-0.193	0.122	0.117	67
Currently Smoking	0.474	0.385	-0.089	0.184	0.631	32
Nobody smoke at home in the last 7 days	0.455	0.676	0.222	0.120	0.069	67
Alcohol						
Drank alcohol in the last 12 months	0.970	0.912	-0.058	0.058	0.324	67
In the last 12 months consumes alcohol from 1 to 3 times a month	0.406	0.613	0.207	0.125	0.104	63
In the last 12 months consumes alcohol from 1 to 4 times a week	0.313	0.226	-0.087	0.113	0.446	63
Consumed alcohol in the last 30 days	0.727	0.794	0.067	0.105	0.528	67
Healthy Habits & Perceptions						
Days a week that eats vegetables	4.121	4.529	0.408	0.551	0.461	67
Days a week that eats fruits	3.606	3.735	0.129	0.524	0.806	67
Hours devoted to walk or ride a bike per day	0.944	0.809	-0.136	0.205	0.511	67
Hours devoted to play sports per week	2.131	2.990	0.859	0.504	0.093	67
Hours staying in a sitting or lying position per day	6.929	6.221	-0.709	0.838	0.401	67
Perceived excellent health condition	0.091	0.029	-0.061	0.058	0.295	67
Perceived very good health condition	0.394	0.647	0.253	0.120	0.039	67
Perceived good health condition	0.424	0.265	-0.160	0.116	0.174	67
Perceived fair health condition	0.091	0.059	-0.032	0.065	0.624	67

Physician & Treatment						
Has controlled blood pressure at least once in his/her life	0.970	0.912	-0.058	0.058	0.324	67
Has been measured the level of blood cholesterol at least once in his/her life	0.636	0.559	-0.078	0.121	0.525	67
Ever being told to have high blood pressure	0.000	0.029	0.029	0.030	0.328	67
Weight (self-reported)	65.818	65.294	-0.524	2.981	0.861	67
Has consulted a physician in the last 12 months	0.818	0.941	0.123	0.079	0.124	67
Has consulted a dentist in the last 12 months	0.788	0.735	-0.053	0.106	0.620	67
Has been admitted to hospital in the last 12 months	0.061	0.088	0.028	0.065	0.673	67

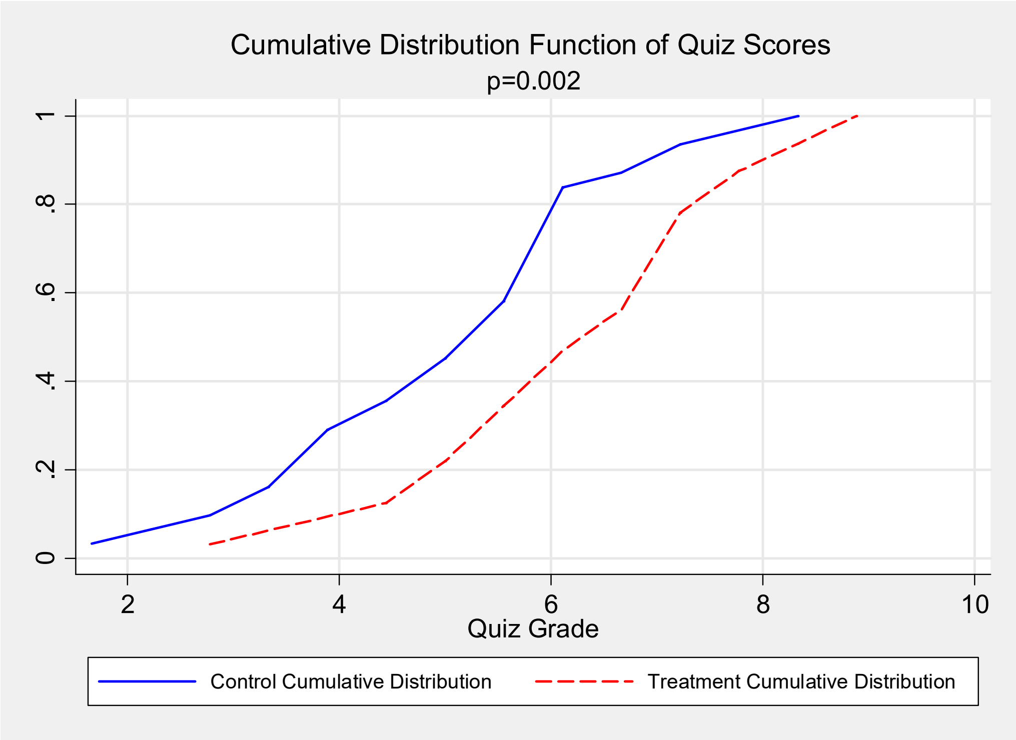
Table 3 – Effects of the health program on acquisition of health information

	(1) Number of correct answers	(2) Test of knowledge	(3) Test of knowledge (considering difficulty)
First Stage		0.925*** (0.000) [18.053]	
Participated in Health Intervention	2.293*** (0.002)	1.274*** (0.002)	1.310*** (0.002)
Age	-0.123 (0.311)	-0.069 (0.311)	-0.073 (0.293)
Female	0.384 (0.588)	0.213 (0.588)	0.204 (0.620)
Capital of Uruguay	0.853 (0.312)	0.474 (0.312)	0.243 (0.606)
Good or very good economic well-being	0.286 (0.732)	0.159 (0.732)	-0.071 (0.882)
r2	0.180	0.180	0.150
N	63	63	63

Summary Statistics on Acquisition of Health Knowledge

	Treatment		Control	
	Mean	S.D.	Mean	S.D.
	(4)	(5)	(6)	(7)
Number of correct questions	11.549	2.589	9.387	2.929
Test of Knowledge	6.441	1.438	5.215	1.627
Test Knowledge (considering difficulty)	4.980	1.549	3.748	1.639
N	32	32	31	31

Notes: 2SLS regression controlling for heteroscedasticity where variable 'Participated in Health Intervention' is instrumented by 'Randomly assigned to Health Intervention'. p-values in parentheses; * p<0.1, ** p<0.05, *** p<0.01. Coefficient from variable 'Randomly assigned to Health Intervention' in the First Stage -regression (2) -is displayed: p-values in parentheses and t-statistics in brackets. Similar results were obtained with OLS and ITT and 2SLS estimations, with and without controls and are available upon request. Controlling for baseline covariates unbalanced due to attrition provides similar results. The test had 18 questions related to healthy habits and risky behaviors. The test of knowledge was calculated by dividing the number of correct answers by the total number of questions and multiplying by 10. We constructed a special index that takes into account the relative difficulty of the questions in the test. The formula assigned greater weight to those questions that were answered correctly less frequently by students. For each question i (of 18), we constructed a dummy variable d_i that takes the value of one if the student answered correctly and zero otherwise. The index is defined as follows: $\sum_i [1 - mean(d_i)] d_i / \sum_i [1 - mean(d_i)]$. We obtain a number between zero and one and multiply by 10. As a result, we obtain the test of knowledge adjusting for difficulty of the questions. We also provide summary statistics by intention to treat variable of outcomes on acquisition of information.



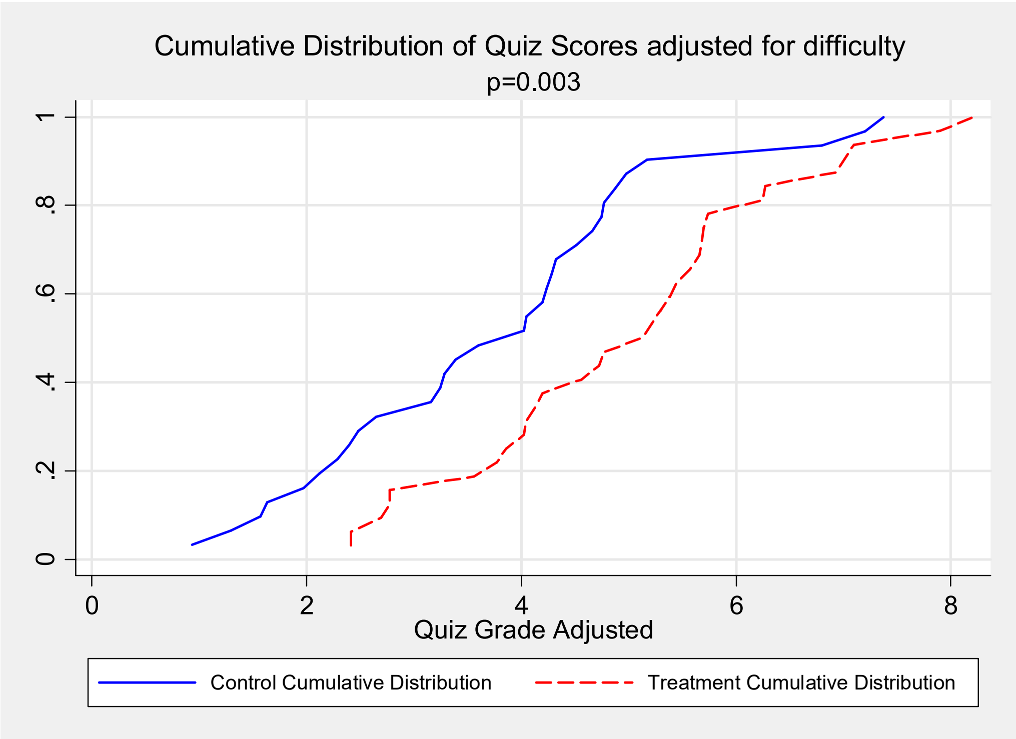


Figure 1

Figure 1. The test had 18 questions related to healthy habits and risky behaviors. The test of knowledge was calculated by dividing the number of correct answers by the total number of questions and multiplying by 10. We constructed a special index that takes into account the relative difficulty of the questions in the test. The formula assigned greater weight to those questions that were answered correctly less frequently by students. For each question i (of 18), we constructed a dummy variable d_i that takes the value of one if the student answered correctly and zero otherwise. The index is defined as follows: $\sum_i[1 - mean(d_i)]d_i / \sum_i[1 - mean(d_i)]$. We obtain a number between zero and one and multiply by 10. As a result, we obtain the test of knowledge adjusting for difficulty of the questions. Numbers above the charts are p-values testing the equality of means of the test scores for the treatment and control groups.

Table 4 - Effect of the Health Intervention on outcome variables																
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Academic performance		*Smoking & Alcohol*			*Healthy Habits, Perceptions & Objective Indicators*										
	Grade Average (9 months follow up)	Credits earned (9 months follow up)	Currently smoking	Nobody smoke at home in the last 7 days	Drank alcohol in the last 30 days	Hours devoted to play sports or exercise per week	Hours staying in a sitting or lying position per day	Hours devoted to walk or ride a bike per day	Perceived health (scale of self-reported health condition)	Days a week that eats vegetables	Days a week that eats fruits	Weight (kg) – measured by physician	SBP (mmhg) - measured by physician	DBP (mmhg) - measured by physician	Height (cm) - measured by physician	Body Mass Index – calculated by physician
First Stage	0.935***	0.935***	0.856***	0.925***	0.918***	0.925***	0.925***	0.925***	0.925***	0.925***	0.925***	0.924***	0.924***	0.924***	0.924***	0.924***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	[20.945]	[20.945]	[9.067]	[18.053]	[16.615]	[18.053]	[18.053]	[18.053]	[18.053]	[18.053]	[18.053]	[17.795]	[17.900]	[17.900]	[17.756]	[17.900]
Participated in Health Intervention	0.029	24.388	0.307*	-0.158	-0.092	-0.501	0.759	0.123	0.244	-0.825	-0.032	-1.916	5.872**	2.717	-1.292	-0.259
	(0.929)	(0.226)	(0.078)	(0.250)	(0.208)	(0.331)	(0.280)	(0.638)	(0.190)	(0.142)	(0.957)	(0.394)	(0.039)	(0.114)	(0.528)	(0.736)
Age	-0.142***	14.373***	-0.022	0.007	0.021**	-0.013	0.003	0.025	-0.038	0.110	-0.004	0.765**	0.078	0.405	0.511	0.137
	(0.002)	(0.002)	(0.333)	(0.746)	(0.035)	(0.887)	(0.980)	(0.528)	(0.205)	(0.143)	(0.965)	(0.025)	(0.830)	(0.112)	(0.153)	(0.368)
Female	0.682**	10.804	-0.052	0.048	-0.165***	-1.200**	-0.578	0.359	-0.133	0.801	-0.044	-15.406***	-4.333*	-4.066**	-12.849***	-1.698**
	(0.029)	(0.580)	(0.742)	(0.713)	(0.006)	(0.017)	(0.372)	(0.145)	(0.409)	(0.160)	(0.938)	(0.000)	(0.085)	(0.012)	(0.000)	(0.016)
Capital of Uruguay	0.226	37.899**	-0.296*	0.029	0.072	0.788	-0.071	0.027	-0.067	0.281	0.810	0.295	0.702	2.709	-0.019	0.309
	(0.505)	(0.033)	(0.088)	(0.832)	(0.336)	(0.146)	(0.919)	(0.919)	(0.719)	(0.623)	(0.190)	(0.886)	(0.808)	(0.128)	(0.991)	(0.639)
Good or very good economic well-being	0.539	27.348	0.034	0.025	0.093	0.111	0.688	-0.463	0.276	1.136*	0.540	-3.662	2.810	1.452	-2.518	-0.715
	(0.120)	(0.220)	(0.832)	(0.857)	(0.295)	(0.851)	(0.389)	(0.253)	(0.170)	(0.052)	(0.399)	(0.105)	(0.275)	(0.436)	(0.264)	(0.426)
r2	0.181	0.354	0.121	0.007	0.160	0.110	0.010	0.068	0.061	0.141	0.044	0.493	0.106	0.205	0.465	0.115
N	67	67	35	63	61	63	63	63	63	63	63	62	61	61	62	61.000

Notes: 2SLS regression controlling for heteroscedasticity where variable 'Participated in Health Intervention' is instrumented by 'Randomly assigned to Health Intervention'. *p*-values in parentheses; * p<0.1, ** p<0.05, *** p<0.01. Coefficient from variable 'Randomly assigned to Health Intervention' in the First Stage -regression (2) -is displayed: *p*-values in parentheses and t-statistics in brackets. Similar results were obtained with OLS, ITT and 2SLS estimations, with and without controls and are available upon request. Controlling for baseline covariates unbalanced due to attrition and for baseline outcome in each regression provides similar results. SBP acronym for Systolic Blood Pressure and DBP acronym for Diastolic Blood Pressure.

Figure 2

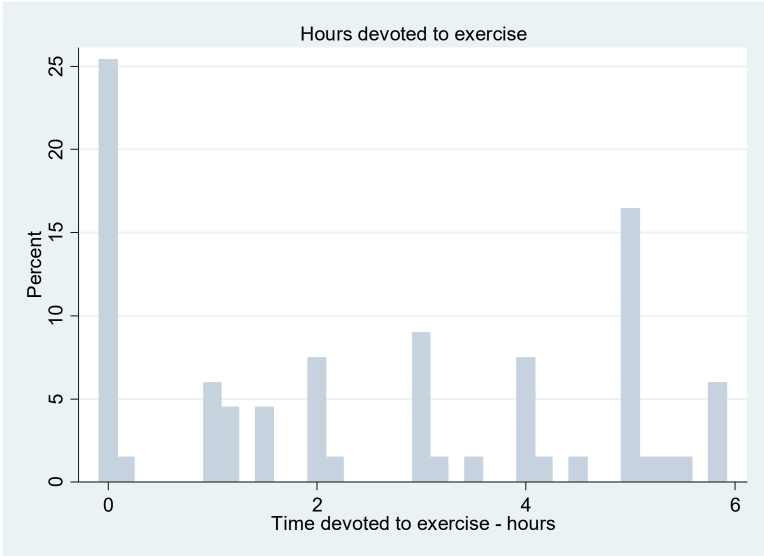


Figure 2. The figure shows the percentage of students according to time devoted to exercise (hours a week).

Table 5 - Effect of the Health Intervention on outcome variables considering interaction effects

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
		Academic performance		*Smoking & Alcohol*			*Healthy Habits, Perceptions & Objective Indicators*										
		Grade Average (9 months follow up)	Credits earned (9 months follow up)	Currently smoking	Nobody smoke at home in the last 7 days	Drank alcohol in the last 30 days	Hours devoted to play sports or exercise per week	Hours staying in a sitting or lying position per day	Hours devoted to walk or ride a bike per day	Perceived health (scale of self-reported health condition)	Days a week that eats vegetables	Days a week that eats fruits	Weight (kg)- measured by physician	SBP (mmhg) - measured by physician	DBP (mmhg) - measured by physician	Height (cm) - measured by physician	Body Mass Index – calculated by physician
First Stage – Participated in Health Intervention	(a)	0.942***	0.942***	0.914***	0.935***	0.935***	0.935***	0.935***	0.935***	0.935***	0.935***	0.935***	0.932***	0.932***	0.932***	0.932***	0.932***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
		[17.978]	[17.978]	[11.920]	[16.115]	[16.166]	[16.115]	[16.115]	[16.115]	[16.115]	[16.115]	[16.115]	[15.861]	[15.839]	[15.839]	[15.846]	[15.839]
	(b)	-0.015	-0.015	-0.206	-0.021	-0.039	-0.021	-0.021	-0.021	-0.021	-0.021	-0.021	-0.016	-0.015	-0.015	-0.016	-0.015
		(0.864)	(0.864)	(0.374)	(0.821)	(0.698)	(0.821)	(0.821)	(0.821)	(0.821)	(0.821)	(0.821)	(0.865)	(0.870)	(0.870)	(0.859)	(0.870)
		[-0.172]	[-0.172]	[-0.904]	[-0.227]	[-0.390]	[-0.227]	[-0.227]	[-0.227]	[-0.227]	[-0.227]	[-0.227]	[-0.171]	[-0.164]	[-0.164]	[-0.178]	[-0.164]
First Stage – Participated in Health Intervention* Exercised less than 2.5 hours per week	(a)	-0.003	-0.003	-0.014	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.006	-0.006	-0.006	-0.006	-0.006
		(0.642)	(0.642)	(0.527)	(0.633)	(0.632)	(0.633)	(0.633)	(0.633)	(0.633)	(0.633)	(0.633)	(0.524)	(0.525)	(0.525)	(0.522)	(0.525)
		[-0.467]	[-0.467]	[-0.641]	[-0.481]	[-0.481]	[-0.481]	[-0.481]	[-0.481]	[-0.481]	[-0.481]	[-0.481]	[-0.642]	[-0.640]	[-0.640]	[-0.644]	[-0.640]
	(b)	0.931***	0.931***	0.754***	0.924***	0.913***	0.924***	0.924***	0.924***	0.924***	0.924***	0.924***	0.926***	0.927***	0.927***	0.928***	0.927***
		(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
		[13.339]	[13.339]	[3.325]	[11.978]	[10.489]	[11.978]	[11.978]	[11.978]	[11.978]	[11.978]	[11.978]	[12.294]	[12.472]	[12.472]	[12.562]	[12.472]
Participated in Health Intervention		0.104	21.594	0.012	-0.356*	-0.179*	0.124	0.606	0.264	0.498**	-0.676	0.082	-2.360	8.625**	4.245*	-1.253	-0.740
		(0.831)	(0.379)	(0.951)	(0.051)	(0.079)	(0.815)	(0.480)	(0.544)	(0.014)	(0.374)	(0.919)	(0.478)	(0.038)	(0.052)	(0.696)	(0.372)
Participated in Health Intervention*Exercised less than 2.5 hours per week		-0.018	7.037	0.494	0.455*	0.190	-0.038	0.548	-0.015	-0.388	0.225	0.467	1.529	-5.672	-2.286	0.702	0.927
		(0.977)	(0.859)	(0.234)	(0.081)	(0.235)	(0.957)	(0.680)	(0.978)	(0.270)	(0.832)	(0.664)	(0.744)	(0.293)	(0.467)	(0.860)	(0.532)
Exercised less than 2.5 hours per week		-0.291	-7.153	-0.058	-0.392**	-0.121	-2.873***	-0.878	-0.629**	-0.073	-1.368*	-1.915**	-2.739	3.212	-1.428	-2.567	-0.329
		(0.531)	(0.792)	(0.877)	(0.032)	(0.231)	(0.000)	(0.378)	(0.023)	(0.774)	(0.075)	(0.023)	(0.407)	(0.328)	(0.524)	(0.351)	(0.765)
r2		0.190	0.355	0.212	0.077	0.182	0.582	0.021	0.149	0.114	0.220	0.182	0.500	0.142	0.239	0.475	0.124
N		67	67	35	63	61	63	63	63	63	63	63	62	61	61	62	61

Notes: 2SLS regression controlling for heteroscedasticity where variables 'Participated in Health Intervention' and the interaction term with "Exercised less than 2.5 hours" are instrumented by 'Randomly assigned to Health Intervention' and 'Randomly assigned to Health Intervention*Exercised less than 2.5 hours' . *p*-values in parentheses; * $p<0.1$, ** $p<0.05$, *** $p<0.01$. Coefficients from variable 'Randomly assigned to Health Intervention' (a) and 'Randomly assigned to Health Intervention*Exercised less than 2.5 hours' (b) in the First Stage regressions are displayed: *p*-values in parentheses and t-statistics in brackets. We control for age, gender, region of the country and economic well-being. Similar results were obtained with OLS, ITT and 2SLS estimations, with and without controls and are available upon request. Controlling for baseline covariates unbalanced due to attrition and for baseline outcome in each regression provides similar results. SBP acronym for Systolic Blood Pressure and DBP acronym for Diastolic Blood Pressure.