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## Inducing behavioral change: an experiment

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### ABSTRACT

To what extent can public policy affect the behavior of target populations without making far-reaching institutional or organizational changes? We investigate the efficacy of a policy instrument designed to increase people's adherence to physical exercise. Based on social norms theory, we developed a communication strategy consisting in the weekly delivery of two types of messages to people's cell-phones: one that informed them about their previous attendance to the gym, and another that encouraged them to exercise through a motivational phrase and image. We conducted a field experiment to test the efficacy of such strategy. Our results demonstrate that, for people who already developed the habit of exercising, descriptive messages did not induce them to improve their attendance to the gym given that they deemed they had exceeded their weekly exercise quota. On the contrary, motivational messages did improve attendance. Our research emphasizes that non-rational motivations can have important consequences on inducing healthy habits. It also claims that interventions such as the one we carried out is of practical importance for policy designers and implementation managers who, lacking the formal power to create radical changes, can nevertheless influence the behavior of target populations.

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Social norms; policy compliance; behavior change; field experiments; Mexico

## 1. Introduction

The attainment of health, wealth, and happiness has always been important for public policy, but their fulfillment strongly depends of the ability of governments to identify appropriate policy alternatives, select effective instruments and put them into practice successfully, as the literature on policy design has debated for a long time (Howlett 2019; Sidney 2017). For many years, rational choice theory has been a dominant approach in the field of policy analysis. Assuming that individuals are self-interested

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creatures seeking to maximize their own utility, capable of comparing the costs and benefits of alternative courses of action, such paradigm favored the use of incentives and market-type mechanisms as the primary policy tools to bring about socially desired outcomes, including sanctions, monetary incentives, conditional grants, information disclosure, among others (Schneider and Ingram 1990). Against the standard assumption of individual rational behavior, behavioral economics and experimental psychology have demonstrated that human choices are strongly influenced by cognitive bias, heuristics, and fallacies that very often preclude people from attaining those valuable goals, even if governments provide them with positive or negative incentives seeking to promote them (Kahneman 2011; Thaler and Sunstein 2008). As the principle that individuals are the best judges of their own wellbeing has been called into question, a new stream of policy tools have emerged based on the premise that people's choices are influenced by the decision-making context they face, and that they require an external intervention to prevent them being trapped by their own behavioral predispositions.

In this article, we investigate the efficacy of a concrete instrument designed to increase people's adherence to physical exercise in the context of a private university. Drawing on the perspective of social norms theory (Cialdini and Goldstein 2004), our intervention evaluates the efficacy of descriptive versus injunctive normative messages, the first of which express how people typically act, while the latter emphasizes what people tend to approve or disapprove. We conducted a field experiment to test the efficacy of a communication strategy consisting in the weekly delivery of two types of messages to people's cell-phones: one that informed them about their previous attendance level to the gym, and another that encouraged them to exercise through a motivational phrase. We carried it out in Mexico, a country with an extensive problem of physical sedentariness where chronic diseases have risen dramatically in the last decades (Figueroa-Lara, Gonzalez-Block, and Alarcon-Irigoyen 2016).

Although our study was conducted in a university setting, it has some practical implications for policy design. First, it illustrates how the promotion of healthy lifestyles is attainable through carefully crafted communicational mechanisms, which implies that policy formulators should be aware that the framing of messages has different consequences on people's behavior (Cialdini 2003). Specifically, our article shows that a communication strategy based exclusively on informing people about their previous performance can discourage them to increase their rate of attendance to the gym, while motivational messages are more likely to improve their adherence to physical exercise. Second, our work is an attempt to overcome one of the main challenges faced by policy designers and implementation managers: improving their policies and programs during implementation without having to change existing organizational or institutional settings, something that generally is beyond their formal powers (Favero, Meier, and O'Toole 2016; Gassner and Gofen 2018). Our article shows that a communication strategy such as the one we carried out for this research is an illustrative example of a "policy tactic", a minor adjustment within the implementation process or a small change in the design of an established policy that improves its likelihood to achieve its goals (omitted reference). Finally, our findings demonstrate the importance

of matching policy goals and means, as literature on policy design has underlined (Howlett and Mukherjee 2017).

## 2. The policy problem: assuring people's adherence to physical exercise

The promotion of healthy lifestyles – such as following a balanced diet, exercising regularly, quitting smoking or consuming alcohol moderately – is currently one of the main objectives for public policy around the world. In the specific case of physical activity, its advantages on human health – such as risk reductions for cardiovascular disease and diabetes – are widely acknowledged (HHS 2018). The World Health Organization (WHO) has developed a global strategy on diet, physical activity and health with advises for national (and even local) governments. The WHO global recommendation on physical activity for health for adults is 150 minutes of moderate-intensity activity (or equivalent) per week (World Health Organization 2018).

Although awareness about the benefits of exercising is growing (Cohen, Ardern, and Baker 2017), making people stick to a regular workout routine is a formidable challenge (Kelly and Barker 2016). For example, in the United States, adherence to the recommendation of 30 minutes per day of physical activity is less than 5% among adults (Troiano et al. 2008). In Mexico, 58% of adults report living a sedentary lifestyle, which means that they do not exercise at all during their free time (Instituto Nacional de Estadística y Geografía 2016). Non-adherence to physical activity can be explained by a myriad of demographic, health, social, environmental, and behavioral factors, including access to outdoors facilities, the level of safety in public spaces, the possibility of exercising with the company of other people, among many others (Allen and Morey 2010). Nevertheless, studies suggest that about 50% of adults who start a physical activity program will drop out within a few months (Marcus et al. 2000).

## 3. Approaches for policy design

Preventing a sedentary lifestyle – as well as promoting most human habits to prevent non-communicable diseases – is a behavioral challenge that requires a sound understanding of the contextual and cognitive factors that explain people's conduct, a condition that policy makers tend to overlook (Kelly and Barker 2016). Regarding the available knowledge about how governments can induce people to increase their levels of physical activity, a brief synthesis accounts for at least two dimensions: individual and environmental (Sherwood and Jefferey 2000). The individual dimension has to do with a wide array of factors that range from sex, age, race, personal motivations, person's exercise history, and stress levels, but it is frequently alleged that policy tools can rarely affect directly these dimensions. On the other hand, the environmental dimension is more likely to respond to changes in policy interventions. Environmental factors account for social support, time and access.

Recent policy reviews in *The Lancet* have pointed to the importance of an alternative set of approaches including campaigns and information, behavioral and social approaches, and environmental approaches “[.] to support for physical activity within communities and worksites, and school-based strategies that encompass physical

education [.]”(Heath et al. 2012, 2). In this sense, these three approaches group the majority of the policy efforts available to inform how to induce or promote long-lasting physical activity. A set of relevant key notions are included in that review that informs policy relevant aspects to this study in particular. First, although campaigns were initially categorized as ineffective, recent evidence suggests the emergence of short informational, instructional and motivational messages about physical activity at key communities’ sites have shown to be more effective than mass-media and general campaigns. Second, behavioral change may be induced using individually adapted strategies, such as goal setting, social support and behavioral reinforcing self-rewarding interventions. These are frequently delivered focusing on the individual via text messages, email, telephone, among others. Individual programs coupled with social support strategies are being developed around the world to cater community sites such as worksites, community centers, parks and educational facilities. Finally, other policy and environmental approaches unveil the importance of public infrastructure to promote active transportation such as bike lanes or sidewalks among other common physical and urban barriers that inhibit people to physically move.

During the last three decades of the past century, *subjective expected utility* became the predominant theoretical foundation to explain human behavior and to prescribe interventions for behavioral change in the health sphere (Marteau, Hollands, and Kelly 2015). The assumption of behavior as a reflective and conscious choice has promoted the use of information campaigns, incentives and sanctions as the leading type of policy instruments. Consider, for example, the use of monetary incentives to motivate people to exercise. The study by Charness and Gneezy demonstrate that economic inducements can be effective to stimulate the habit of exercising among sedentary people, but they require to be maintained for long periods, and they might destroy the intrinsic motivation to exercise among those who have already developed adherence to physical activity (Charness and Gneezy 2009; Royer, Stehr, and Sydnor 2015). The crowding out of existing intrinsic motivation is a controversial issue (Acland and Levy 2015) that policy makers need to consider as a potential cost of the intervention.

A serious challenge to the subjective utility approach emerged at the outset of the new century, emphasizing the cognitive biases that characterize a person decision-making process (Kahneman 2011). Richard Thaler and Cass Sunstein’s famous book *Nudge* claims that individual choices are not free from context: human cognitive biases – such as default rules, framing effects, starting points – frequently prevent people from making wise choices regarding their own health, happiness or wealth. Therefore, people need the help of “choice architects” whose mission is to nudge them to choose what it is best for their interests (Thaler and Sunstein 2008). In the case of health-related behaviors, a growing number of scholars claim that the traditional policy instruments based on the reflective and conscious paradigm to cope with smoking, alcohol consumption, overeating and sedentary lifestyles have proven ineffective, while interventions that target the automatic, unreflective processes of human conduct are a promising tool for behavioral change (Marteau, Hollands, and Fletcher 2012). Some examples of these interventions include establishing bicycle hire schemes in cities; inviting people to make public commitments to quit smoking; placing healthy foods in

accessible places in lunchrooms, or changing the signup default rules to recruit organ donors (Quigley 2013).

Alternative streams of studies that engage in stimulating people to become physically active has involved the use of non-monetary incentives, but more specifically in the power of communication around policy relevant messages. The *regulatory focus theory*, among them, posits that “when people experience regulatory fit, the value they derive from their actions motivates behavior” (Latimer et al. 2008). The theory asserts that messages maximize their effectiveness only when they are tailored according to the regulatory orientation of each individual (Cesario, Corker, and Jelinek 2013).

In this same line of reasoning, another perspective that has gained acceptance among health policy scholars is the *social norms approach* to behavior, mainly developed from research on social psychology. Such view proclaims that social norms are important factors motivating people’s choices, and that they are useful to promote beneficial conduct (Cialdini and Goldstein 2004). A specific policy instrument based on this approach is the delivery of persuasive communications that appeal to certain ethical values and beliefs, and that are widely used to promote environmental protection, social justice or healthy habits, among many others. It rests on two key premises. First, that people tend to overestimate the prevalence of undesirable behaviors, a principle supported in decision-making prospect theory (Kahneman and Tversky 1979). Second, that “individuals use their perception of peer norms as a standard against which to compare their own behaviors” (Schultz et al. 2007). A distinction between two types of social norms, descriptive and injunctive, is required. Descriptive norms refer to what most people think, feel or do, whereas injunctive norms refer to what most people agree with. The former describes the behaviors people typically perform, while the latter place emphasis on the moral judgment based on what people tend to approve or disapprove. Policy relevant messages aspiring to promote socially desired outcomes should clearly distinguish the behavioral effects of these two types of norms because they tend to run in opposite directions. The basic claim of recent experimentation in social psychology goes directly to policy makers in avoiding the pervasive combination of injunctive and descriptive norms in the same message that could ultimately offset the desired behavioral outcome: while the injunctive segment of the message might deter people from doing immoral, unhealthy or harmful things, the descriptive portion may well persuade people to perform such undesirable actions (Cialdini 2003).

#### 4. The experiment

We present the results of an intervention designed to stimulate physical activity based on the delivery of text messages focused on individuals, which, as the previous section discussed, has been a more effective strategy compared to general campaigns. The intervention draws on some aspects the social norms approach to behavioral change previously discussed, specifically on differentiating the effects of descriptive versus injunctive messages on physical activity levels.

An experiment was conducted at ITESO, a private Jesuit university located in Guadalajara city, the most populated of western Mexico, during the first 12 weeks of the 2016 fall semester. By the time the experiment started, ITESO had almost 10

thousand students, 90% enrolled in undergraduate programs. The university has several fitness facilities, programs and activities, but only one in which access is controlled: the fitness center or gym. Open only to registered students, entrance to the center requires users to swipe their university ID card, thereby entering into an electronic registration system that allowed us to unobtrusively identify the day and time every user walked on the facility. The gym opens six days a week from early morning to late afternoon.

During the first three weeks of the 2016 fall semester, we assembled a sample of 173 persons who voluntarily agreed to participate in the experiment. In our sample, 48.5% of the cases were women and the average age was 21 with a standard deviation of 3.8. We asked participants to provide us with their WhatsApp number and a personal email, so they could receive a personal message every week through both channels. We told participants that the experiment had the purpose to improve the communication strategies of the university gym. To discourage attrition, we organized different raffle prizes – from food discounts in the university cafeteria to sports clothing – giving people the right to participate on the condition that they would not block our weekly communications and that they would respond to three surveys.

We randomly divided a sample of 173 individuals into three groups. The first two, with 58 members each, received either one of the following two treatments. Treatment 1 consisted in sending people a weekly message informing them about the number of days they had visited the gym the week before, for example “Last week you visited the gym twice”. Treatment 2 consisted in sending people a short motivational phrase that either praised or disapproved them, depending on their prior attendance. The control group consisted of 57 members (it had initially 58, but we had one dropout during the second week) who also received weekly messages with phrases unrelated to physical activity. [Table A1](#) in [Appendix I](#) describes the text of messages delivered to each group. Phrases, however, were not exactly the same every week in order to prevent tiring the recipients and the possibility of a block to our communications; such a possibility emerged as a recurrent issue in a focus groups carried out before the start of the experiment. The behavior of every participant was observed during 12 weeks, giving us 2076 observations. The intervention started on the fourth Monday of the 2016 fall semester. The two treatments were delivered between 8 am and 9am, and subsequently every Monday at the same time for the remaining nine weeks. We distributed the messages to each individual through three channels: cell phone Short Message Service (SMS), e-mail, and WhatsApp. The latter channel allowed us to verify, case by case, who did and who did not received (or read) our messages, an essential condition of our study. Of the 173 persons in our sample, only six did not read any messages during the 12-week period, which suggests that only they might have blocked our communications.

In order to have a baseline, we measured the number of visits each person paid to the gym during the first three weeks of the semester. Afterwards, daily visits were measured on a weekly basis. [Table 1](#) describes the average level of attendance for the three groups during the 12 weeks that the experiment lasted. Four observations are worth mentioning. First, despite the fact that we assigned people to each group on a random basis, attendance levels between groups differed during the baseline period (i.e. the first three weeks of the semester).<sup>1</sup> The average attendance levels at the baseline were 1.4 days for people in treatment 1, one day for people in treatment 2 and 0.7 days

**Table 1.** Descriptive statistics by type of treatment.

	Week	Control group				Treatment 1 (descriptive messages)				Treatment 2 (motivational messages)			
		Days attended	Std. Dev.	% of zeros		Days attended	Std. Dev.	% of zeros		Days attended	Std. Dev.	% of zeros	
Baseline (no treatments were applied)	1	1.00	1.29	35	1.36	1.41	40	0.97	1.30	53			
	2	1.15	1.39	29	1.50	1.54	38	1.21	1.28	45			
	3	1.03	1.39	36	1.43	1.72	48	0.93	1.25	53			
Treatments were applied	4	1.14	1.53	41	1.16	1.44	50	1.07	1.55	53			
	5	0.92	1.21	47	1.02	1.19	47	0.93	1.28	53			
	6	0.97	1.33	47	1.09	1.30	50	0.84	1.36	64			
	7	0.93	1.30	54	1.03	1.14	47	0.79	1.33	66			
	8	1.17	1.53	50	1.28	1.47	47	1.05	1.52	57			
	9	0.80	1.29	57	0.84	1.28	59	0.71	1.30	71			
	10	0.92	1.28	60	0.86	1.10	52	0.81	1.26	64			
	11	0.93	1.42	61	1.05	1.47	55	0.83	1.34	62			
	12	0.85	1.30	64	1.03	1.31	48	0.74	1.35	71			
	N			57			58			58			

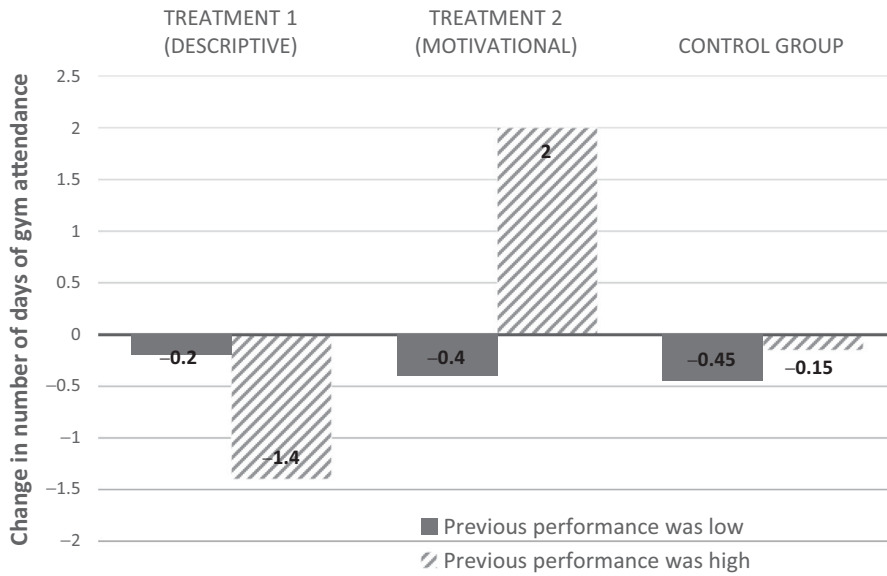
Frequency of zeros (out of the 1392 observations): 749 (53.8%)



for people in the control group. Since groups were not strictly comparable, we had to use a difference-in-difference estimation technique to determine average treatment effects. Second, the level of dispersion is very high for the three groups at every point in time, which can be verified by the fact that the standard deviation is larger than the mean. Third, every week a very substantial number of people did not attend the gym at all, which reached frequency levels as high as 71%. This changed both across time and between groups. Finally, there is a general downward tendency in attendance throughout the time, and no apparent structural change in behavior after the treatments started to be implemented. However, the following section presents a more detailed analysis that supports our claim that normative messages make a difference in behavior.

Drawing on the theory of social norms, we hypothesize that treatment 1 (descriptive messages) will create a “boomerang effect”: a description of how many days a person worked out at the gym might persuade them to go more often if they feel that they attended very few times. According to survey data collected from our sample, “very few times” represents three days or less per week. However, descriptive messages could have the opposite effect among people with higher turnout levels if they deem that they had exceeded their weekly quota (although each individual subjectively determines what such quota is). In contrast, motivational messages could act as injunctive norms as they always aim to encourage people in sustaining their effort to exercise. The expectation is, then, that motivational messages will increase attendance rates – or at least they will not decrease them – regardless of how many days a person attended the previous week.

To test the hypotheses outlined before we used a difference-in-difference (DD) model whose dependent variable is the number of days people attended the gym in each of the 12 weeks that our experiment lasted. Therefore, the minimum value this variable can take is 0 and its maximum is 6 (the facility opens Monday through Saturday). Since our dependent variable is a count of days – which typically follows a Poisson distribution (not a normal one) – and, as shown in [Table 1](#), its dispersion is very high, we chose to perform the estimations with the use of a negative binomial regression, a method commonly employed to analyze overly dispersed count data. Nevertheless, as will be shown afterward, the use of ordinary least squares (OLS) yielded very similar results. The model considers as independent variables two dichotomous variables identifying the people that received treatment 1 (T1) and treatment 2 (T2) (the reference category is the control group), and a dichotomous variable (Time) taking a value of 0 for the baseline period (weeks 1 through 3) and a value of 1 for weeks 4 through 12, when treatments were applied. It also introduces an additional dichotomous variable indicating whether the individual demonstrated high performance the week before (i.e. she/he showed up at the gym at least four days), and the multiplicative interaction between this and the remaining variables of the model. The purpose of the model is to capture the response of individuals to both treatments, making a distinction between those whose previous performance was high, and the rest. Finally, the model controls for the gender and age of participants. [Appendix II](#) describes the equation model with detail.



**Figure 1.** Predicted count of days from negative binomial regression results. *Source:* own elaboration based on the predicted margins of the negative binomial regression model.

## 5. Discussion of results

Table A2 in Appendix II reports regression results, which demonstrate our basic claim: only motivational messages encouraged people to increase their weekly attendance to the gym, while descriptive messages had the opposite effect.<sup>2</sup> Figure 1 provides a clearer explanation, since it presents the change in the predicted count of days before and after treatments were applied for each of the three groups in the experiment, and making a distinction between people whose prior performance was high and those whose prior performance was low. As predicted by social norms theory, the descriptive messages (T1) have a destructive power in attendance rates among individuals whose performance the week before was high. After being informed through an electronic message that they had attended the gym four or more times the week before, this segment decreased their attendance to the gym by 1.5 days on average in comparison to the control group: they had accomplished their exercise quota. Motivational messages (T2) had exactly the opposite effect: they encouraged people to increase their weekly attendance level by 1.5 days in comparison to the control group. In fact, the attendance gap between treatments 1 and 2 is equal to 3.6 days, which seems to us a remarkable difference, especially if we consider that the overall mean in days attended to the gym is slightly below one day per week. We must emphasize that this outcome is only restricted to people whose previous performance was high. For low performers, the effect of descriptive messages on attendance was negative, but not very different from the control group. In addition, motivational messages were not capable to reverse the tendency by exerting a moral pressure on low-performance people to improve their attendance rates.

The evidence provides support in favor of hypotheses. However, since results are only significant (in a statistical sense) among individuals with high prior attendance levels, we might suggest that the treatments were effective only when people have already developed the habit of physical activity. In this sense, motivational messages (T2) seem to serve to reinforce healthy lifestyles but not to create the habit of exercising, and descriptive messages (T1) makes high performing people feel they have reached their exercise quota, therefore diminishing the likelihood to keep attending to the gym.<sup>3</sup>

## 6. Conclusions and implications for policy

In this article, we argued that social norms theory provides a solid framework not only to understand people's behavior, but also to design policy interventions that induce behavioral change. The case of exercising is illustrative because, despite the fact that international agencies and national governments have developed diverse initiatives to encourage people to follow an active lifestyle, assuring compliance is always a complex challenge. Nevertheless, health-promoting organizations – such as sports centers, universities, or public and private firms – can utilize some concrete behavioral instruments to reach their goals, including those under the label of “behavior change wheel” (Heath et al. 2012; Michie et al. 2011; NICE 2014; Wang et al. 2017).

We developed a communication strategy based on the hypotheses that descriptive messages have a destructive effect on gym attendance when people saw themselves as having reached their weekly exercise quota. On the other hand, we assumed that motivational messages would improve attendance, no matter how often a person had visited the gym previously, to the extent that these messages act as a prescriptive device. Overall, the evidence confirmed our claim. During the periods of assessment, there was an overall downfall in gym attendance, implying that people lost motivation in doing exercise after time passed. However, the messages we sent to each group changed their trajectory, although in different ways. As predicted, we observed a boomerang effect among members who received treatment 1 (descriptive messages). For those whose prior performance was high, after being exposed to descriptive messages, they decided either to stop going to the gym or to reduce their attendance levels. We believe an “*I have reached my quota*” effect was occurring with this group. The drop is dramatic in terms of the weekly average days of attendance to the gym. With respect to those who outperformed their peers but received a motivational message, we found the opposite effect: this group was encouraged to attend more, increasing their weekly average attendance to the gym in two days more than the control group.

Our research has practical implications for policy. The most evident is that a simple communication strategy based on people's prior performance can be an effective method to promote healthy lifestyles. Nonetheless, policy designers should understand that the framing of messages has important consequences on behavior: while descriptive messages might deter compliance, motivational ones are more likely to induce it, as earlier studies (Schultz et al., 2007) have demonstrated. Recognizing these subtle differences, though, requires policy designers to open up their thinking to alternative theoretical perspectives, beyond the traditional views based on the premise of individual

rational calculation. Of course, our findings cannot be simply extrapolated to the broader population because the setting of our experiment was a well-equipped private university targeting students no older than 22. As we discussed in the theoretical section of this article, a myriad of factors affect the effectiveness of physical activation policies, such as individual characteristics, environmental factors, time and access (Sherwood and Jefferey, 2000; Heath et al. 2012). Therefore, all these additional factors should be carefully considered before any attempt to derive general conclusions and policy implications. Nevertheless, our results are in line with an important proposition in social psychology: that the composition of messages is a key component in assuring degrees of compliance.

Another important implication has to do with the fact that behavioral change often requires only small-scale adjustments on how policies and programs interact with target populations, rather than a comprehensive institutional or organizational transformation. Of course, this is particularly relevant for those in charge to manage the implementation of public policies, since they generally lack the formal authority to produce largescale legal or political changes. Nevertheless, public managers have in fact the ability to adjust specific aspects in the implementation of programs in order to improve their effectiveness. A weekly motivational feedback to promote physical activity is an illustrative example of such an implementation tactic.

Finally, our results point to a major policy implication regarding governmental performance: “*the exercise of matching policy goals and means*” (Howlett and Mukherjee 2017;3). Policy formulation is a complex task involving a series of connected processes, frequently in asynchrony, one of which is instrument design. Among the many tools available to policy design (Hood 1983, 2007; Howlett 2005), policy messages exploit government’s *nodality* to change targets behavior in consonance to policy goals. In that sense, findings in our study are relevant to the overall governmental activities. It places an important place to messages intended to change peoples’ behavior unveiling the power of motivational messages vis a vis the effects of descriptive messages.

## Notes

1. A two-sample mean comparison t-test assessing the differences in attendance between each pair of groups at the baseline revealed that differences were statistically significant in all cases.
2. In addition to those derived from the negative binomial regression, it presents OLS estimates for comparative purposes, but we base our discussion on the former.
3. Readers should note that we could not observe physical activity outside the setting. This implies that a person not showing up at the gym does not necessarily mean she was physically inactive, as she could have exercised elsewhere. We conducted a survey a month after treatments started to be applied. Results revealed that people who exercise regularly (at least 10 days per month) tend to do it at the university gym (49% of the 133 respondents), while people who exercise more sporadically (six times a month or less) do it either at other sports facilities within the university (27%) or in another place (19%). This could be an explanation of why the results of the experiment failed to confirm the hypotheses among those whose prior performance was low (motivational messages could have stimulated sedentary people to exercise more, but outside the university gym, an outcome that would reinforce our main argument).

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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**Table A1.** Text of the weekly messages delivered to people receiving treatment 2 and in the control group.

Treatment 2			
Attended 0 or 1 time the previous week	Attended 2 or 3 times the previous week	Attender 4 or more times the previous week	Control group
If you have time for Facebook, you have time to exercise.	The difference between who you are and who you want to be is what you do.	Feel proud of how far you've come, have faith in how far you can go.	Have a great day.
The road to nowhere was paved with excuses.	The distance between dreams and reality is called discipline.	A champion is someone who gets up when others cannot.	Do not dream your life, live your dreams.
You want it? So strive to get it	The moment you want to quit is the one you must keep insisting on.	Facing challenges with strength, determination and confidence is what matters, and you have done it.	Whatever you decide to do, make sure it makes you happy.
Don't think about your limits, think about your possibilities.	Never throw in the towel. Use it to wipe off the sweat.	It is hard to beat a person who never gives up.	Don't get stuck in the past, don't dream about the future, focus on the present.
Eliminate "I can't" from your mind.	The difference between the impossible and the possible lies in a man's determination.	We are what we do repeatedly: excellence is a habit.	Difficult roads often lead you to beautiful destinations.
It will not be easy, but it will certainly be worth it.	If you are brave enough to start, you are strong enough to finish.	Exercise is a celebration of what your body can do.	Life is not a problem that seeks solution, it is a reality that seeks to be experienced.
Be stronger than your excuses.	Your only competition is yourself.	Action is the foundational key to all success.	Work until your idols become your rivals.
When the world tells you you can't, prove him wrong.	All our dreams can come true if we have the courage to pursue them	Wake up with determination. Go to bed with satisfaction.	Look into the sunlight and you won't see the shadow.
The voice in your head that says you can't is lying.	Don't wish for a good body, work for it.	Exercises not only changed your body, it changed your mind, your attitude and your mood.	Work hard and dream big.
Work on a new and better version of yourself.	Look in the mirror, that's your competition.	Be your own inspiration.	We were born to be real not perfect.
The only bad workout is the one that didn't happen.	Definition of a really good workout: when you hate doing it, but you love finishing it.	Congratulations on exercising your body every day.	The best way to predict the future is to create it.
You have a gym inside the university. There is no longer an excuse!	Each day will get easier.	Respect the training, honor the commitment. Cherish the results.	Stars can not shine without darkness.

## Appendix I

## Appendix II

Difference-in-difference equation model to estimate the effect of treatments 1 and 2 on gym attendance

$$\begin{aligned}
 Y_{it} = & \delta_0 + \delta_1 T1_i + \delta_2 T2_i + \delta_3 TIME_{it} + \delta_4 TIME_{it} T1_i + \delta_5 TIME_{it} T2_i + \delta_6 HP_i + \delta_7 HP_{it} T1_i \\
 & + \delta_8 HP_{it} T2_i + \delta_9 TIME_{it} HP_{i,t-1} + \delta_{10} TIME_{it} HP_{i,t-1} T1_i + \delta_{11} TIME_{it} HP_{i,t-1} T2_i \\
 & + \delta_{12} GENDER_{it} + \delta_{13} AGE_{it} + \varepsilon_{it}
 \end{aligned} \tag{1}$$

where,

- $Y_{it}$  is the number of days the individual  $i$  attended the gym during week  $t$ ;
- $T1$  is a dummy variable taking a value of 1 if the individual  $i$  received a descriptive message, and 0 otherwise;
- $T2$  is a dummy variable taking a value of 1 if the individual  $i$  received a motivational message, and 0 otherwise;
- $TIME_{it}$  is a dummy variable taking a value of 0 for weeks 1 through 3, and 1 for weeks 4 through 12.
- $HP_{i,t-1}$  is a dummy variable taking a value of 1 if the individual attended the gym four or more days during week  $t-1$ , and 0 otherwise;
- $GENDER_{it}$  is a dummy variable taking a value of 1 if the individual is a female, and 0 otherwise;
- $AGE_{it}$  is the age of the individual.
- $\varepsilon_{it}$  is a stochastic error following a Poisson distribution.

If predictions based on social norms theory are accurate, we should observe the following: the confirmation of the “boomerang effect” of descriptive messages requires  $\delta_4 + \delta_{10} < 0$  for



people with high prior performance ( $HP_{i,t-1} = 1$ ) and  $\delta_4 < 0$  for people with lower prior performance. On the other hand, confirming the positive effect of motivational messages on the attendance of high performers requires  $\delta_5 + \delta_{11} > 0$ ; among low performance, it only

**Table A2.** Regression results of the experiment.

	Negative binomial regression	OLS
Constant	0.7621** (0.2947)	1.3503*** (0.172)
T1	0.5469** (0.2037)	0.4387* (0.1738)
T2	0.4601* (0.1929)	0.3819* (0.1568)
Time	0.1596 (0.1694)	0.1256 (0.1167)
T1 × Time	-0.3722 (0.2249)	-0.3074 (0.1911)
T2 × Time	-0.6678** (0.2203)	-0.5309** (0.1741)
$HP_{t-1}$	1.3738*** (0.2627)	2.0427*** (0.5629)
T1 × $HP_{t-1}$	-0.0258 (0.3208)	0.7764 (0.628)
T2 × $HP_{t-1}$	-0.7275 (0.3938)	-1.2329 (0.7364)
Time × $HP_{t-1}$	-0.0689 (0.2807)	0.1508 (0.5998)
Time × $HP_{t-1}$ × T1	-0.2591 (0.3505)	-1.3904* (0.7035)
Time × $HP_{t-1}$ × T2	1.2355** (0.4182)	2.1998** (0.7849)
Sex (female = 1)	-0.0169 (0.0641)	0.0027 (0.0563)
Age	-0.0566*** (0.0121)	-0.033*** (0.006)
Observations	1903	1903
$ln\alpha$	-0.2005 (0.1038)	
Alpha	0.8182 (0.085)	
R-squared		0.24
Wald $\chi^2(13)$	890	
Prob > $\chi^2$	0	

Robust standard errors in parentheses

\*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$

entails  $\delta_5 > 0$ .

## Appendix III